

KANNUR UNIVERSITY
(Abstract)

BSc. Statistics Programme - Revised Scheme & Syllabus of Core, Complementary and Open Courses under Choice Based Credit Semester System for Under Graduate Programme - implemented with effect from **2014 admission - Orders Issued.**

ACADEMIC BRANCH

No. Acad/C2/ 4500 /2014

Dated, Civil Station P.O, 17- 05-2014

Read: 1.U.O No. Acad/C2/2232/2014 dated 14-03-2014

2. Minutes of the meeting of the Board of Studies in Statistics (UG) held on 08-10-2013

3. Minutes of the meeting of the Faculty of Science held 25-03-2014

4. Letter dated 06-05-2014 from the Chairperson, BOS in Statistics (UG)

ORDER

1. The Revised Regulations for UG Programme under Choice based Credit Semester System were implemented in this University with effect from 2014 admission as per paper read (1) above.
2. As per paper read (2) above the Board of Studies in Statistics (UG) finalized the Scheme, Syllabus & model Question Papers for Core, Complementary & open courses of BSc Statistics programme to be implemented with effect from 2014 admission..
3. As per read (3) above the Faculty of Science held on 25-03-2014 approved Scheme, syllabus & model question papers for core/complementary & open courses of BSc Statistics programme to be implemented with effect from 2014 admission.
4. The Chairman, Board of Studies in Statistics (UG) vide paper read (4) above has submitted the finalized copy of Scheme, syllabus & Model question papers for core/complementary and open courses of BSc Statistics programme for implementation with effect from 2014 admission.
5. The Vice Chancellor, after examining the matter in detail, and in exercise of the powers of the Academic Council as per section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction to implement the revised scheme, syllabus & model question papers of BSc Statistics Programme with effect from 2014 admission.
6. Orders, are therefore issued implementing the revised scheme, syllabus & model question papers for core, complementary & open courses of BSc Statistics programme under CBCSS with effect from 2014 admission subject to report to Academic Council
7. Implemented revised Syllabus is appended.

SD/-
DEPUTY REGISTRAR (ACADEMIC)

FOR REGISTRAR

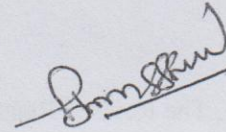
To

1. The Principals of Affiliated Colleges offering B.Sc Statistics Programme
2. The Examination Branch (through PA to CE)

Copy To:

1. The Chairperson, BOS Statistics (UG)
2. PS to VC/PA to PVC/PA to Registrar
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Approved/By Order



Section Officer

❖ For more details log on to www.kannur.university.ac.in

KANNUR UNIVERSITY
SCHEME & SYLLABUS FOR UNDERGRADUATE PROGRAMME
IN
S T A T I S T I C S
(CORE, COMPLEMENTARY AND OPEN COURSES)
CHOICE BASED CREDIT SEMESTER SYSTEM
(2014 ADMISSION ONWARDS)

PREFACE

The proposed revised syllabus is prepared in conformity with the National Educational Policy of **University Grants Commission** and the mission of Restructuring Undergraduate Education taken up by **The Kerala State Higher Education Council**.

The Board of Studies, Statistics (UG) of Kannur University conducted a Two day workshop sponsored by The Kerala State Higher Education Council in two spells- the first spell on 19-11-2013 and the second spell on 24-1-2014.

The restructured syllabus gives primacy to a transformation of rigid to flexible, from a set pattern to choice based structure, from sole summative evaluation to continuous assessment, from talk-and chalk to activity based imparting of knowledge. 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.

Aims and Objectives of the Programme

Aims:

In this programme, we aim to provide a solid foundation in all aspects of statistics and to show a broad spectrum of modern trends in statistics and to develop experimental, computational and application skills of students. The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of statistics by providing a more complete and logical framework in almost all areas of basic statistics. The Programme also aims

- (i) To provide education in statistics of the highest quality at the undergraduate level and produce graduates of the calibre sought by industries and public service as well as academic teachers and researchers of the future.
- (ii) To attract outstanding students from all backgrounds.
- (iii) To provide an intellectually stimulating environment in which the students have the opportunity to develop their skills and enthusiasms to the best of their potential.
- (iv) To maintain the highest academic standards in undergraduate teaching.
- (v) To impart the skills required to gather information from resources and use them.
- (vi) To equip the students in methodology related to statistics.

Objectives:

By the end of the second semester, the students should have

- (i) Attained a common level in elementary and basic principles of statistics and laid a strong foundation in mathematics and in Computer science for their future courses.

By the end of the fourth semester, the students should have

- (i) Been introduced to powerful tools for tackling a wide range of topics in Statistical methods and Distribution theories,
- (ii) Become familiar with additional relevant mathematical and computer techniques.

By the end of the sixth semester, the student should have

- (i) Covered a range of topics in almost all areas of Statistics including statistical inference, Sample survey, Design of experiments, Operation-Research, Statistical Quality control and other applied areas.
- (ii) Had expertise and independence in handling real life applications of statistics as demonstrated in their project work
- (iii) Developed their understanding of statistics as an important independent branch of scientific statistics having applications in all areas of learning.
- (iv) Further developed their experimental skills through a series of practical training imparted in the statistical lab, which is an integral part of the proposed new curriculum.

Sd/-

**Dr. P. V. Pushpaja,
Chairman, Board of Studies, Statistics (UG)**

KANNUR UNIVERSITY



COURSE STRUCTURE AND SYLLABUS

For

UNDERGRADUATE PROGRAMME

In

STATISTICS

CORE, COMPLEMENTARY

And

OPEN COURSES

Under

CHOICE BASED CREDIT AND SEMESTER SYSTEM

w. e. f. 2014 ADMISSION

KANNUR UNIVERSITY- 2014 ADMISSION

STATISTICS CORE COURSES

**WORK, CREDIT & MARK DISTRIBUTION
(2014 ADMISSION ONWARDS)**

Sem	Title of the course	Contact Hrs/week	Total Hrs/sem.	Credits	Exam Hours	Total Marks	External Marks	Internal Marks
I	Common Course (English)	5	85	4	3	50	40	10
I	Common Course (English)	4	72	3	3	50	40	10
I	Common Course (Additional Language)	4	72	4	3	50	40	10
I	Descriptive statistics	4	72	3	3	60	48	12
I	Complementary 1 (Mathematics)	4	72	3	3	50	40	10
I	Complementary 2 (Computer Science)	4	72	3	3	50	40	10
II	Common Course (English)	5	85	4	3	50	40	10
II	Common Course (English)	4	72	3	3	50	40	10
II	Common Course (Additional Language)	4	72	4	3	50	40	10
II	Probability theory	4	72	3	3	60	48	12
II	Complementary 1 (Mathematics)	4	72	3	3	50	40	10
II	Complementary 2(Computer Science)	4	72	3	3	50	40	10
III	Common Course (English)	5	85	4	3	50	40	10
III	Common Course (Additional Language)	5	85	4	3	50	40	10
III	Probability distributions	5	85	3	3	60	48	12
III	Complementary 1 (Mathematics)	5	85	3	3	50	40	10
III	Complementary 2(Computer Science)	5	85	3	3	50	40	10
IV	Common Course (English)	5	85	4	3	50	40	10
IV	Common Course (Additional Language)	5	85	4	3	50	40	10
IV	Statistical inference-I	5	85	4	3	60	48	12
IV	Complementary 1 (Mathematics)	5	85	3	3	50	40	10
IV	Complementary 2(Computer Science)	5	85	3	3	50	40	10
V	Statistical inference-II	4	72	4	3	60	48	12

V	Mathematical analysis-I	4	72	4	3	60	48	12
V	Statistics using R	4	72	4	3	60	48	12
V	Sampling techniques	4	72	4	3	60	48	12
V	Statistical quality control and operations research	4	72	4	3	60	48	12
V	Open course	2	36	2	2	25	20	5
VI	Mathematical analysis - II	4	72	4	3	60	48	12
VI	Time series, index numbers and vital statistics	5	85	4	3	60	48	12
VI	Design of experiments	5	85	4	3	60	48	12
VI	Actuarial statistics	5	85	4	3	60	48	12
VI	Practical using R	4	72	4	3	60	48	12
V & VI	Project	2 hrs each in sem. V & VI	72	0 credit in sem. V & 3credits in sem.VI	3	35	28	7
	Total			120		1800	1440	360

COURSE STRUCTURE UG PROGRAMME – STATISTICS (CORE)

CREDIT DISTRIBUTION FOR B.Sc. STATISTICS PROGRAMME

Semester	Common Courses		Core Course	Complementary Courses		Open Course	Total
	English	Additional Language	Statistics	Mathematics	Complementary course 2		
I	4+3	4	3	3	3	--	20
II	4+3	4	3	3	3	--	20
III	4	4	3	3	3	--	17
IV	4	4	4	3	3	--	18
V	--	--	4+4+4+4+4	--	--	2	22
VI	--	--	4+4+4+4+4+3	--	--	--	23
Total	22	16	56	12	12	2	120

SEMESTERWISE PROGRAMME DETAILS

SEMESTER I

Sl.No	Title of the Course	Contact hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	4	4	3
4	Core Course I	4	3	3
5	Complementary 1 (Course I)	4	3	3
6	Complementary 2 (Course I)	4	3	3

SEMESTER II

Sl.No	Title of the Course	Contact hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	4	4	3
4	Core Course 2	4	3	3
5	Complementary 1 (Course II)	4	3	3
6	Complementary 2 (Course II)	4	3	3

SEMESTER III

Sl.No	Title of the Course	Contact hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (Additional Language)	5	4	3
3	Core Course 3	5	3	3
4	Complementary 1 (Course III)	5	3	3
5	Complementary 2 (Course III)	5	3	3

SEMESTER IV

Sl.No	Title of the Course	Contact hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (Additional Language)	5	4	3
3	Core Course 4	5	4	3
4	Complementary 1 (Course IV)	5	3	3
5	Complementary 2 (Course IV)	5	3	3

SEMESTER V

Sl.No	Title of the Course	Contact hours/week	Credits	Exam hrs
1	Core Course 5	4	4	3
2	Core Course 6	5	4	3
3	Core Course 7	4	4	3
4	Core Course 8	4	4	3
5	Core Course 9	4	4	3
6	Open Course	2	2	2
7	Project	2	--	--

SEMESTER VI

Sl.No	Title of the Course	Contact hours/week	Credits	Exam hrs
1	Core Course 10	4	4	3
2	Core Course 11	5	4	3
3	Core Course 12	5	4	3
4	Core Course 13	5	4	3
5	Practical	4	4	3
6	Project	2	3	3

**STATISTICS CORE COURSES
WORK AND CREDIT DISTRIBUTION
(2014 ADMISSION ONWARDS)**

Sem	Course code	Title of the course	Contact Hrs/week	Total Hrs/sem.	Credits	Exam Hours	Total Marks	External Marks	Internal Marks
I	1B01STA	DESCRIPTIVE STATISTICS	4	72	3	3	60	48	12
II	2B02STA	PROBABILITY THEORY	4	72	3	3	60	48	12
III	3B03STA	PROBABILITY DISTRIBUTIONS	5	85	3	3	60	48	12
IV	4B04STA	STATISTICAL INFERENCE-I	5	85	4	3	60	48	12
V	5B05STA	STATISTICAL INFERENCE-II	4	72	4	3	60	48	12
V	5B06STA	MATHEMATICAL ANALYSIS- I	4	72	4	3	60	48	12
V	5B07STA	STATISTICS USING R	4	72	4	3	60	48	12
V	5B08STA	SAMPLING TECHNIQUES	4	72	4	3	60	48	12
V	5B09STA	STATISTICAL QUALITY CONTROL AND OPERATIONS RESEARCH	4	72	4	3	60	48	12
V	5D01STA	OPEN COURSE	2	36	2	2	25	20	5
VI	6B10STA	MATHEMATICAL ANALYSIS - II	4	72	4	3	60	48	12
VI	6B11STA	TIME SERIES, INDEX NUMBERS AND VITAL STATISTICS	5	85	4	3	60	48	12
VI	6B12STA	DESIGN OF EXPERIMENTS	5	85	4	3	60	48	12
VI	6B13STA	ACTUARIAL STATISTICS	5	85	4	3	60	48	12
VI	6B14STA	PRACTICALS USING R	4	72	4	3	60	48	12
V & VI	6B15STA	PROJECT	2 hrs each in sem. V & VI	72	0 credit in sem. V & 3credits in sem.VI	3	35	28	7
		Total			58		900	720	180

**STATISTICS OPEN COURSES
WORK AND CREDIT DISTRIBUTION**

Students of other Streams can choose *One Open Course from the following Three Courses*. All Statistics Departments (whether it is a Core department or Complementary department) can offer the course in semester V.

Scheme of Open courses

Sem	Course code	Title of the course	Contact hrs/week	Total hrs/sem	Credits	Exam hrs.	Max. Marks	External Marks	Internal Marks
V	5D01STA	Basics of Statistics	2	35	2	2	25	20	5
V	5D02STA	Sampling Techniques	2	35	2	2	25	20	5
V	5D03STA	Computer Oriented Data Analysis	2	35	2	2	25	20	5

**STATISTICS COMPLEMENTARY COURSES
FOR BSC. MATHEMATICS/COMPUTER SCIENCE
WORK AND CREDIT DISTRIBUTION**

**Scheme of Complementary (Statistics) for BSc.
Mathematics/Computer Science**

Sem	Course code	Title of the course	Contact hrs/week	Total hrs/sem	Credits	Exam hrs.	Max. Marks	External Marks	Internal Marks
I	1C01STA	Basic Statistics	4	72	3	3	50	40	10
II	2C02STA	Probability Theory and Random Variables	4	72	3	3	50	40	10
III	3C03STA	Standard Probability Distributions	5	85	3	3	50	40	10
IV	4C04STA	Statistical Inference	5	85	3	3	50	40	10
		Total			12		200	160	40

**STATISTICS COMPLEMENTARY COURSES
FOR BSC. GEOGRAPHY/PSYCHOLOGY
WORK AND CREDIT DISTRIBUTION**

Scheme of Complementary (Statistics) for BSc. Geography/Psychology

Sem	Course code	Title of the course	Contact hrs/week	Total Hrs/sem	Credits	Exam hrs.	Max. Marks	External Marks	Internal Marks
I	1C01STA(G&P)	Descriptive statistics	4	72	3	3	50	40	10
II	2C02STA(G&P)	Statistical methods	4	72	3	3	50	40	10
III	3C03STA(G&P)	Probability and Distribution theory	5	85	3	3	50	40	10
IV	4C04STA(G&P)	Statistical inference	5	85	3	3	50	40	10
		Total			12		200	160	40

**STATISTICS COURSE
FOR BA ECONOMICS
WORK AND CREDIT DISTRIBUTION**

This course is expected to provide students with an elementary introduction to statistical tools and mathematical concepts that are used in the study of Economics in UG level. This course will cover essential elementary topics in Statistics and Mathematics. The basic aim of the course is to develop skills in applying statistical techniques and mathematical concepts that are indispensable for the in-depth study of theoretical as well as empirical economics.

Scheme of Statistics courses for BA Economics

Se m	Course code	Title of the course	Contact hrs/week	Total Hrs/sem	Credits	Exam hrs.	Max. Marks	External Marks	Internal Marks
V	5 B07ECO	Basic tools for Economic analysis – I	6	108	4	3	50	40	10
VI	6B12ECO	Basic tools for Economic analysis – II	6	108	4	3	50	40	10
		Total			8		100	80	20

EVALUATION AND GRADING

The evaluation scheme for each course shall contain two parts; (a) Internal Assessment and (b) External Evaluation. 20% of the total marks shall be given to the internal assessment and the remaining 80% for the external evaluation. Evaluation (both Internal and External) is carried out using Mark System instead of direct grading. For each course in the semester letter grade, grade point and % of marks are introduced in 7- point Indirect Grading System. The indirect Grading System in 7 point scale is as below:

Seven Point Indirect Grading System

% of Marks	Grade	Interpretation	Grade Point Average (G)	Range of Grade Points	Class
90 and above	A+	Outstanding	6	5.5 – 6	First class with Distinction
80 to below 90	A	Excellent	5	4.5 - 5.49	
70 to below 80	B	Very good	4	3.5 - 4.49	First class
60 to below 70	C	Good	3	2.5 - 3.49	
50 to below 60	D	Satisfactory	2	1.5 - 2.49	Second class
40 to below 50	E	Pass / Adequate	1	0.5 - 1.49	Pass
Below 40	F	Failure	0	0 - 0.49	Fail

Course Evaluation

Assessment	Marks
Internal	20% of the total marks
External	80% of the total marks

EXTERNAL EVALUATION (END SEMESTER EVALUATION - ESE)

Details regarding the End Semester Evaluation of Core, Open, Practical, Project and Complementary Courses are given below:

1. Core Courses

- Maximum Marks for each course except Project/Open Course - 60 Marks
- Duration of examination - 3 Hrs.

Section	Mark for each question	Number of Questions		Total Marks	
		Total	Required	Aggregate	Maximum
A	1	6	6	6	6
B	2	9	7	18	14
C	4	6	4	24	16
D	6	4	2	24	12
Total	----	25	19	72	48

2. Open Course

- Maximum Marks for open course - 20 Marks
- Duration of examination - 2 Hrs.

Section	Mark for each question	Number of Questions		Total Marks	
		Total	Required	Aggregate	Maximum
A	1	6	6	6	6
B	2	6	4	12	8
C	6	2	1	12	6
Total	----	14	11	30	20

3. Practical

Guidelines

- Practical examination should be conducted using computers.
- Computer lab facilities should be provided by the college.
- The practical exams shall be done along with project evaluation.
- Practical Exam will be conducted Externally at the end of Sixth Semester by the University
- 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

There should be 12 questions, each question carries 6 marks and the candidate has to answer 8 questions. The module wise distribution of questions are given below

- Maximum Marks for Practical 48 Marks
- Duration of examination 3 Hrs.

Module	Number of Questions		Total Marks	
	Total	Required	Aggregate	Maximum
I	2	1	12	6
II	4	3	24	18
III	4	3	24	18
IV	2	1	12	6
Total	12	8	72	48

4. Project

Guidelines

- The project will start in Semester V and will end at the end of Semester VI.
- Project may be undertaken by a group of students. However, the project report shall be submitted by each student.
- 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.
- 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 project evaluation shall be done along with practical exams.
- 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.

External Evaluation of Project

Sl.No	Components	% of Marks allotted	Marks Allotted
1	Relevance of the Topic---Reference/ Bibliography	20	5.6
2	Presentation --Findings and Recommendations	30	8.4
3	Viva-Voce	50	14
Total		100	28

5. Complementary Courses

- Maximum Marks for each course - 40 Marks
- Duration of examination - 3 Hrs.
-

Section	Mark for each question	Number of Questions		Total Marks	
		Total	Required	Aggregate	Maximum
A	1	6	6	6	6
B	2	8	6	16	12
C	3	6	4	18	12
D	5	4	2	20	10
Total	----	24	18	60	40

INTERNAL ASSESSMENT (IA)

The internal assessment of theory courses, practical courses and project shall be based on different components. The components with percentage of marks are as follows:

1. Core/Complementary/Open Courses

Sl.No	Components	% of Marks allotted	Marks Allotted		
			Core courses	Complimentary Course	Open course
1	Attendance	25	3	2.5	1.25
2	Assignment/ Seminar/Viva -voce	25	3	2.5	1.25
3	Test paper	50	6	5	2.5
Total		100	12	10	5

(If a fraction appears in internal marks, nearest whole number is to be taken)

- **Assignment/ Seminar/ Viva-Voce:** For each theory course, each student is required to submit an assignment or to present a seminar or to attend a viva-voce based on any topic related to the course concerned. Assignment/ seminar/viva-voce shall be evaluated on the basis of student's performance.
- **Test paper:** For each theory course there shall be a minimum of two written tests and the average mark of the two tests is to be considered for Internal Mark. Each test paper may have duration of minimum one hour.
- **Attendance:** Attendance of each Course will be evaluated as below:

SN	% of Attendance	% of Marks allotted	Marks Allotted		
			Theory & Practical (Core)	Theory & Practical (Complementary)	Open course
1	Above 90	100	3	2.5	1.25
2	85 to 89	80	2.4	2	1
3	80 to 84	60	1.8	1.5	0.75
4	76 to 79	40	1.2	1	0.5
5	75	20	0.6	0.5	0.25

2. Practical

Sl.No	Components	% of Marks allotted	Marks Allotted
1	Record	50	6
2	Attendance	25	3
3	Test paper	25	3
Total			12

3. Project

Sl.No	Components	% of Marks allotted	Marks Allotted
1	Seminar Presentation/ Punctuality	20	1.5
2	Relevance of the Topic and content/ Use of Data	20	1.5

3	Scheme/Organization of Report/Layout	30	2
4	Viva-Voce	30	2
Total		100	7

General Course Structure of the B.Sc. Statistics Degree Programme

CORE COUSE I: DESCRIPTIVE STATISTICS

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

Module I: Origin and meaning of Statistics; History and development of Statistics; Definitions of Statistics-Statistics as Statistical data, Statistics as Statistical methods, Importance and Scope of Statistics in various streams of Science and other streams, Limitations of Statistics, Distrust of Statistics.

(10 Hrs)

Module II: Data Collection and Data Handling in Statistics – Information and data- Population, Census, Parameter, Sample, Sample Survey, Statistic, Different types of data-Quantitative, Qualitative, Geographical and Chronological, Interval, Nominal and Ordinal data; Continuous and discrete data; Methods of collection and editing of primary data; Designing of a questionnaire and a schedule; Sources and editing of secondary data; Classification and tabulation of data; Diagrammatic presentation- line diagram, bar diagrams and pie diagram; Graphical representation of frequency distribution by frequency polygon, frequency curve and ogives.

(20 Hrs)

Module III: 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.

Moments- raw and central moments and their inter-relationships.

Skewness and kurtosis - definition and measures of skewness and kurtosis

(20Hrs)

Module IV: Correlation and Regression- Scatter diagram, Karl Pearson's coefficient of correlation and its properties, Rank correlation, Spearman's rank correlation coefficient, repeated ranks, partial and Multiple correlation, partial and multiple correlation coefficients in terms of simple correlation coefficients (for three variables case only, without proof).

Curve fitting and principle of least squares – fitting of first degree, second degree, power curves and exponential curves.

Simple regression analysis- definition and fitting of regression equations, linear regression coefficients and its properties, coefficient of determination and interpretation, angle between the regression lines.

(22 Hrs)

Books for Study

1. Saxena. H. C.(1983): *Elementary Statistics*, S. Chand & Co.
2. Gupta S. C. and Kapoor, V. K.(2002): *Fundamentals of Mathematical Statistics*, Sultan Chand & Co. 3rd Edn.

Books for References

1. M. R. Spiegel (1961): Theory and problems of statistics- Schaum's outline series.
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:

Module I - 10 marks Module II - 12 marks Module III - 25 marks
Module IV- 25 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COUSE II: **PROBABILITY THEORY**

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2 B 02 STA	4	3	3

Module 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.

(20Hrs)

Module II: Random variables – Discrete and continuous random variables, Probability distribution and distribution function – definitions and properties, bivariate distributions, Joint, marginal and conditional distributions, independence of random variables, transformation of random variables.

(22Hrs)

Module 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, correlation coefficient, conditional mean and conditional variance and their properties.

(20Hrs)

Module IV: Generating functions – probability generating function, moment generating function, cumulant generating function, characteristic function and their properties.

(10 Hrs)

Books for Study

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

Books for Reference:

1. Goon A.M., Gupta M.K., Das Gupta.B. (1999): *Fundamentals of Statistics*, Vol.I and Vol. II, World Press, Calcutta.
2. Mood A.M, Graybill F.A and Boes D.C. (1974): *Introduction to the Theory of Statistics*, McGraw Hill.

Marks including choice:

Module I - 20 marks Module II - 20 marks Module III - 22 marks
Module IV- 10 marks **Total - 72 marks**

Pattern of Questions:

Part A: **Short answer** (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: **Short essay** (9 questions)

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

Part C: **Essay** (6 questions)

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

Part D: **Long essay** (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COURSE III: PROBABILITY DISTRIBUTIONS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3 B 03 STA	5	3	3

Module I: Discrete Distributions I: Definition, moments, generating functions (pgf, mgf, ch-fn and cumulant generating functions) and various characteristics of Degenerate distribution, Uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution.

(20 Hrs)

Module II: Discrete Distributions II: Definition, moments, generating functions (pgf, mgf, ch-fn and cumulant generating functions) and various characteristics of Geometric distribution, Hypergeometric distribution, Negative binomial distribution, Multinomial distribution.

(15 Hrs)

Module III: Continuous Distributions I: Definition, moments, generating functions (mgf, ch-fn 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).

(25Hrs)

Module IV : Continuous Distributions II: Definition, moments, generating functions (mgf, ch-fn and cumulant generating functions) and various characteristics of Exponential distribution, Gamma distribution, Beta distributions of first and second kinds, Cauchy distribution, Bivariate normal distribution (definition only).

(15 Hrs)

Module V: Inequalities and Convergence of random variables – Tchebychev's inequality. convergence in probability, weak law of large numbers, Bernoulli's weak law of large numbers. Central limit theorem (iid case, statement only).

(10 Hrs)

Books for Study:

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

Books for Reference:

1. Mukhopadhaya. P (1996). *Mathematical Statistics*, New Central Book Agency (P) Ltd., Calcutta.
2. Hogg, R. V and Craig, A. T (1970). *Introduction to Mathematical Statistics*, Amerind

Publishing Co. Pvt. Ltd.

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-* (Elsever)

Marks including choice:

Module I - 18 marks Module II - 12 marks Module III - 22 marks
Module IV - 12 marks Module V - 8 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

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 HRS
IV	4 B 04 STA	5	4	3

Module 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)

Module II: 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)

Module 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.

(15 Hrs)

Module 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, confidence intervals for parameters of one parameter exponential distribution and Poisson distribution in the large sample case.

(20 Hrs)

Books for study

Gupta, S. C and Kapoor, V. K (2002). Fundamentals of Mathematical Statistics, Amerind Publishing Co. Pvt. Ltd.

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..

Marks including choice:

Module I - 20 marks Module II - 22 marks Module III - 12 marks
Module IV - 18 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

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 HRS
V	5 B 05 STA	4	4	3

Module I: Statistical Hypotheses: Statistical hypothesis, 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.

(25 Hrs)

Module II: Small Sample Tests and Large Sample Tests: Definition, Tests based on t and normal distributions-means, difference of means, proportions, difference of proportions, standard deviation, equality of standard deviation, correlation coefficient.

(20 Hrs)

Module III: Tests based on Chi-square and F distributions: Tests for significance of variance, goodness of fit, independence of attributes and equality of variances.

(20 Hrs)

Module IV: Non parametric tests: Non- parametric test, 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.

(10 Hrs)

Books for Study:

1. S.C.Gupta &V.K.Kapoor (2002): *Fundamentals of Mathematical Statistics*, Sulthan Chand & Sons.
2. Mukhopadhaya. P (1996). *Mathematical Statistics*, New Central Book Agency (P) Ltd., Calcutta.

Books for Reference:

1. 100 Statistical Tests - Gopal.K.Kanji (SAGE Publishers)
2. Goon A. M, Gupta M. K and Das Gupta B (1986): *Fundamentals of Statistics Vol I*.

Marks including choice:

Module I - 22 marks

Module II - 20 marks

Module III - 18 marks

Module IV - 12 marks

Total - 72 marks

Pattern of Questions:

Part A: Short answer (6 questions)

- Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

- Answer any 4 questions (4 questions x 4marks each=16 marks)

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COURSE VI: MATHEMATICAL ANALYSIS –I

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

Module I: Sequence –Real sequences, limit of a sequence, Bolzano- Weirstrass theorem, limit inferior and superior, convergence and divergence, Cauchy’s Principle of convergence, algebra of sequences, important theorems, monotonic sequence.

(24Hrs)

Module 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.

(22Hrs)

Module 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.

(12Hrs)

Module IV: Differential Calculus: Derivatives, Darboux’s theorem, Rolle’s Theorem, mean value theorem, Taylor’s theorem.

(14Hrs)

Books for Study:

Books for Reference

1. Shanti Narayanan : Elements of Real Analysis
2. Shanti Narayanan : A course of Mathematical Analysis, Sulthan Chand & Sons l

Marks including choice:

Module I - 24 marks Module II - 22 marks Module III - 13 marks
Module IV - 13 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

- Answer any 4 questions (4 questions x 4marks each=16 marks)

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COURSE VII: STATISTICS USING R

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 B 07 STA	4	4	3

Module I: Introduction to R - 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; Measures of central tendency, Measures of dispersion, Measures of skewness and Kurtosis, Selection of representative samples.

(25 Hrs)

Module II: Probability distributions using R – Probability distributions, some special discrete distributions (Binomial, Poisson), Continuous probability distribution, some special continuous distributions (Normal, exponential); Methods for generating random variables – Introduction, Random generation of common probability distribution in R, the inverse transform method, transformation methods.

(15Hrs)

Module III: Correlation and Regression Analysis – Correlation, Inference procedures for correlation coefficient, Linear Regression, the coefficient of determination, Inference Procedures for simple linear model.

(10Hrs)

Module IV: Statistical Inference (R Commands and implementation only) Confidence intervals for mean, difference of means, variance and proportion, Hypothesis testing – the p-value – definition and interpretation, test 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 proportion, test of Goodness of fit, one way ANOVA.

(22Hrs)

Book for Study:

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

Books for References

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

Marks including choice:

Module I - 25 Marks Module II - 15 Marks Module III - 12 Marks

Module IV - 20 Marks **Total - 72Marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COUSE VIII: SAMPLING TECHNIQUES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 B 08 STA	4	4	3

Module I: Census and Sampling: Principal steps in sample survey, Sampling Vs Census, Sampling and non-sampling errors and Types of Sampling. Indian Census Operations - Origin and functions of Indian Census Operations. Origin and functions of - National Sample Survey Organisation(NSSO), Central Statistical Organization(CSO), Indian Statistical Institute (ISI) and Indian Council for Medical Researches (ICMR) etc., Role of these institutions in the planning and development processes.

(15 Hrs)

Module II: 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, SRS of attributes.

(15Hrs)

Module III: Stratified sampling- Method of selecting a stratified 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 sample with SRS.

(18 Hrs)

Module IV: Systematic sampling and Cluster 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). Cluster sampling – Cluster sampling with equal cluster size, estimation of population characteristics and variance of the estimators under cluster sampling with equal cluster size, Comparison of cluster sampling with SRS. PPS sampling- definition and methods of selection only.

(24Hrs)

Books for Study:

1. S.C. Gupta & V.K. Kapoor : Fundamentals of Applied statistics, Sulthan Chand & Sons
2. D.Singh and F.S.Chaudhary: Theory and Analysis of Sample survey, John Wiley and Sons

Books for Reference:

1. Murthy.M.N: Sampling Theory and Methods, Statistical Probability Society , Calcutta
2. Cochran.W.G: Sampling Techniques, Wiley Eastern Ltd
3. Desraj: Sampling Theory, Tata Mc Graw Hill

Marks including choice

Module I - 15 marks Module II - 20 marks Module III - 20 marks
Module IV- 17 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

- Answer any 4 questions (4 questions x 4marks each=16 marks)

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COURSE IX: Statistical Quality Control and Operations Research

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5 B 09 STA	4	4	3

Module I - 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)

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

(16 Hrs)

Module III: Statistical Quality Control-I: Process control, General Theory of Control Charts, Control Charts for variables – X bar Chart, R chart, σ chart; Control charts for attributes – p chart, np chart, c chart and modified control chart.

(20 Hrs)

Module 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*.

Marks including choice:

Module I - 20 marks Module II - 16 marks Module III - 20 marks
Module IV- 16 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COURSE X: MATHEMATICAL ANALYSIS- II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6 B 10 STA	4	4	3

Module 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.

(16Hrs)

Module II: Classes of Riemann integrable functions- Integrability of continuous and monotonic functions, Integration and differentiation (the primitive), first mean value theorem and fundamental theorem of integral calculus.

(15Hrs)

Module III: Vector Space- vector space, algebra of vectors, linear independence & dependence of vectors; 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)

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

(16 Hrs)

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

(10 Hrs)

Books for Study:

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

Books for Reference:

1. Biswas : Matrix Algebra
2. Apostol : Mathematical Analysis, Adison Wesley Publication Company Inc.
3. Devi Prasad : Elementary Linear Algebra, Narosa Publishing House, Chennai

Marks including choice:

Module I - 16 marks

Module II - 14 marks

Module_III - 14 marks

Module IV- 16 marks

Module V – 12 marks

Total - 72 marks

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COURSE XI: TIME SERIES, INDEX NUMBERS AND VITAL STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6 B 11 STA	5	4	3

Module I: Time series : Components of time series, additive and multiplicative models. Measurement of trend – semi average method, least square method – straight lines, parabola and exponential trend, moving average method. Measurement of seasonal variation-Method of simple average, ratio to trend, ratio to moving average and link relative methods.

(24 hrs)

Module II: Index numbers: Definition, simple and weighted index numbers, fixed base index number, Laspeyre's, Paasche's, Marshall – Edge worth 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.

(23 hrs)

Module III: 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.

Module IV: 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.

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

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

Marks including choice:

Module I - 20 marks Module II - 20 marks Module_III - 20 marks
Module IV- 12 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COUSE XII: **DESIGN OF EXPERIMENTS**

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6 B 12 STA	5	4	3

Module I: Linear Estimation and Analysis of variance- Linear parametric function, estimability, BLUE, Necessary and sufficient conditions for estimability of a linear parametric function, linear hypothesis, Gauss Markov's theorem and simple problems.

(17 Hrs)

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

(26Hrs)

Module III: Experimental Design: Comparative and absolute experiments, treatments, experimental units, yield and experimental error; Principles of Experimentation-Randomization, Replication and Local control; Completely Randomized Design-Analysis, advantages and disadvantages; Randomized Block design-Analysis, estimation of missing observations, advantages and disadvantages; Latin Square design - Analysis, estimation of missing observations, advantages and disadvantages. Relative efficiencies of CRD, RBD and LSD; Greaco-Latin square design (definition only).

(32 Hrs)

Module IV: Factorial experiments- Definition and use of factorial Experiments. Main effects and interaction effects. Analysis of 2^2 Factorial experiment.

(10 Hrs)

Book for Study:

S.C. Gupta & V.K. Kapoor : Fundamentals of Applied statistics, Sulthan Chand & Sons

Books for Reference:

1. M.N. Das & N. Giri : Design of experiments, Wiley Eastern Ltd
2. D.D. Joshy : Linear Estimation and Design of experiments, Wiley Eastern Ltd
3. Federer : Experimental Design, Oxford & JBH Publications

Marks including choice:

Module I - 15 marks

Module II - 22 marks

Module III - 28 marks

Module IV- 7 marks

Total - 72 marks

Pattern of Questions:

Part A: Short answer (6 questions)

- Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

- Answer any 4 questions (4 questions x 4marks each=16 marks)

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COUSE XIII: ACTUARIAL STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6 B 13 STA	5	4	3

Module-I: Utility theory: insurance and utility theory, models for individual claims and their sums, survival function, curate future lifetime, force of mortality.

The basic deterministic model: cash flows, discount functions, calculating the discount function, interest and discount rates, values and actuarial equivalence, regular pattern cash flows, Balances and reserves, recursion formulas, time shifting and splitting identity, change of discount function, internal rates of return, forward prices and term structure, standard notations and terminology.

The Life table: Basic definitions, probabilities, constructing life table from the values of q_x , Life expectancy, choice of life tables, standard notations and terminology.

(20)

Module-II: Life annuities: Introduction, calculating annuity premiums, the interest and

survivorship discount function, guaranteed payments, deferred annuities with annual premiums, some practical considerations, standard notations and terminology,

Life insurance : Introduction, calculating life insurance premiums, types of life insurance, combined insurance-annuity benefits, insurance viewed as annuities, a general insurance-annuity identity, standard notations and terminology.

Insurance and annuity reserves: Reserves, general pattern of reserves, recursion, detailed analysis of an insurance or annuity contract, interest and mortality bases for reserves, non-forfeiture values, policies involving a 'return of the reserve',

premium difference and paid up formulas, universal life and variable annuities, standard notations and terminology.

(25)

Module-III : Fractional durations: Introduction, cash-flows discounted with interest only, life annuities paid monthly, immediate annuities, approximation and computation, fractional period premiums and reserves, reserves at fractional durations.

Continuous payments: Continuous annuities, the force of discount, the constant interest case, continuous life annuities, the force of mortality, insurance payable at the moment of death, premiums and reserves, the general insurance-annuity identity in the continuous case, some examples of exact calculation, standard actuarial notations and terminology.

Select mortality: Introduction, select and ultimate tables, changes in formulas, projections in annuity tables,

(20)

Module-IV: Multiple-life contracts: Introduction, the joint-life status, joint life annuities and insurances, last survivor annuities and insurances, moment of death insurance, the general two life annuity contract, the general two life insurance contract, contingent insurances, duration problems, application to annuity credit risk, standard notations and terminology.

Multiple decrement theory: Introduction, the basic model, insurances, determining the model from the force of decrement, the analogy with joint-life statuses, associated single decrement tables.

Expenses: Introduction, effect on reserves, realistic reserve and balance calculations.

(20)

Books for Study

1. S. David Promislow, *Fundamentals of Actuarial Mathematics*, John Wiley & Sons, Ltd

Books for reference

1. Mark S Dorfman, Introduction to Risk Management and Insurance, Prentice Hall
2. C.D.Daykin, T. Pentikainen et al, Practical Risk Theory of Acturries, Chapman and Hill

Marks including choice:

Module I - 18 marks Module II - 18 marks Module_III - 18 marks

Module IV- 18 marks **Total - 72 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

- **Answer all the 6 questions** (6 questions x 1 mark each=6 marks)

Part B: Short essay (9 questions)

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

Part C: Essay (6 questions)

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

Part D: Long essay (4 questions)

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

Total marks including choice: 72

Maximum marks of the course: 48

CORE COUSE XIV: (COMPUTER PRACTICAL) : **PRACTICALS USING R**

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6 B 14 STA	4	4	3

Module I : Data Exploration, Box plot, PP Plot, qq Plot, test for normality; Measures of central tendency and Dispersion-Mean, Median, Mode, Partition values, Variance, Skewness and Kurtosis

(12 Hrs)

Module II: Point Estimation, Confidence Interval, Test based on one and two samples, Non- Parametric tests

(24Hrs)

Module III: Sampling Techniques, Estimation of population characteristic and standard error;

Design of Experiments, ANOVA (one way) ; Control Charts

(18Hrs)

Module IV: Time series, Fitting and plotting; Index Numbers and Correlation and regression

(18Hrs)

Marks including choice:

Module I - 12 Marks

Module II – 24 Marks

Module III –24 Marks

Module IV –12 Marks

Total – 72 Marks

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
- 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
- The practical exams shall be done along with project evaluation.

Pattern of Questions

Module	No. of Questions with 6 Marks each	No. of Questions to be Answered
I	2	1
II	4	3
III	4	3
IV	2	1
Total	12	48

Internal Evaluation

Components	% of Marks
Record	50%
Attendance	25%
Test paper	25%

CORE COUSE XV: **PROJECT**

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

Guidelines for Project

- The project will start in Semester V and will end at the end of Semester VI.
- Project may be undertaken by a group of students. However, the project report shall be submitted by each student.
- 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.
- 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
- The project evaluation shall be done along with practical exams.
- 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
<ul style="list-style-type: none"> • Relevance of the Topic, • Statement of Objectives, • Methodology (Reference/ Bibliography) 	20%
<ul style="list-style-type: none"> • Presentation, • Quality of Analysis/Use of Statistical tools, • Findings and recommendations 	30%
<ul style="list-style-type: none"> • 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

Sd/-

Dr. P. V. Pushpaja,
Chairman, BOS Statistics (UG)

1: BASIC STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDITS	EXAM HRS.
1	1 C 01 STA	4	3	3

Module I: Statistical Methods: 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, non-probability, restricted and non-restricted sampling, judgment and mixed sampling,[SRSWOR,SRSWR, stratified and systematic sampling methods(definition only).

(10 hrs.)

Module II: Measures of Central Tendency: Definition and properties of various measures of central tendency - AM, Median, Mode, GM, HM and weighted averages; Partition Values – Quartiles, Deciles, Percentiles; Dispersion : Definition and properties of various measures of dispersion– Range, QD, MD, SD, CV and other 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.)

Module III: Correlation and Regression Analysis: Method of Least Square - Scatter Diagram, Fitting of linear, quadratic and exponential curves, principle of least squares; Regression Analysis - linear regression, fitting of regression lines, regression coefficients and their properties; Correlation Analysis - Definition and properties of correlation coefficient, rank correlation coefficient (with and without ties), definitions of partial and multiple correlation coefficients(trivariate case only).

(20 hrs.)

Module IV: Time Series and Index Numbers: Time series - Meaning, need, components and models of time series, estimation of linear trend by 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. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sulthan Chand & Sons
 2. S. C. Gupta & V. K. Kapoor: Fundamentals of Applied Statistics, Sulthan Chand & Sons
- Books for References:

Books for Reference:

1. R. P. Hooda : Statistics for Business & Economics, MACMILLAN Business books
2. S. P. Gupta & M. P. Gupta: Business Statistics, Sulthan Chand & Sons

Marks including choice:

Module I - 8 marks

Module II- 25 marks

Module III- 15 marks

Module IV- 12 marks

Total - 60 marks

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions x 2 marks each=12 marks)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

COMPLEMENTARY COURSE FOR BSc MATHEMATICS/COMPUTER SCIENCE II

2: PROBABILITY THEORY AND RANDOM VARIABLES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS.
II	2 C 02 STA	4	3	3

Module I: Probability Theory– Random Experiments, sample space, events, classical definition and frequency approach to probability, Class of sets, sigma field, axiomatic definition of probability, probability space, addition theorem.

(20 hrs)

Module II: Conditional probability-Conditional probability, multiplication theorem, independence of events, Bayes' theorem and its applications.

(15 hrs)

Module III: Random variables- Discrete and continuous type random variables, probability distribution of a random variable, distribution function-definition and properties, transformation of random variables discrete and continuous type.

(20 hrs)

Module IV: Bivariate random variables- Definitions, joint probability distributions, marginal and conditional distributions, independence of random variables.

Book for Study:

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

Books for References

1. J.N.Kapoor & H.C. Saxena : Mathematical Statistics, Sulthan Chand & Sons
2. Sheldon .M .Ross : A First course in Probability, McMillion Publishing co.
3. T.K. Chandra & D.Chatterjee : A First course in Probability, Narosa Publishing House

Marks including choice:

Module I - 20 Marks	Module II - 15 Marks	Module III – 15 Marks
Module IV – 10 Marks	Total -	60 Marks

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions x 2 marks each=12 marks)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

3: STANDARD PROBABILITY DISTRIBUTIONS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS.
III	3 C 03 STA	5	3	3

Module I: Mathematical Expectation –Definition and properties of mathematical expectation, addition and multiplication theorem on expectation and 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, correlation coefficient between random variables; Generating functions – Moment generating function, definition and properties, cumulant generating function and characteristic function.

(30 Hrs)

Module II: Discrete Distributions : Definition, moments, mgf, cgf, properties and different characteristics of Discrete Uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution and Geometric distribution

(20 Hrs)

Module III: Continuous Distributions – Definition, moments, mgf, cgf, properties and different characteristics of Uniform distribution, Normal distribution, Standard normal distribution, Exponential distribution, Gamma distribution with one and two parameters and Beta distributions I and II kind

(20Hrs)

Module IV: Tchebycheff's inequality and Law of large numbers – Tchebycheff's inequality and its applications, convergence in probability, Weak law of large numbers, Bernoulli's law of large numbers, central limit theorem (Statement only) for iid random variables

(15 Hrs)

Book for Study

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

Book for Reference

Sheldon.M.Ross : Introductory Statistics, Elsevier Academic Press

Marks including choice:

Module I - 20 marks

Module II- 10 marks

Module III- 20 marks

Module IV- 10 marks

Total - 60 marks

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions x 2 marks each=12 marks)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

COMPLEMENTARY COURSE FOR BSc MATHEMATICS/COMPUTER SCIENCE- IV

4: STATISTICAL INFERENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS.
IV	4 C 04 STA	5	3	3

Module I : Sampling Distributions - Definition, standard error, sampling distribution of mean and variance, chi-square, Student's t and F distributions, the interrelations between t, F and chi-square statistics.

(15 Hrs)

Module II: Theory of Estimation - Point estimation, desirable properties of a good estimator, methods of estimation – method of MLE, method of moments.

Interval estimation: Confidence interval for mean, proportion, variance, difference of means, difference of proportions.

(30 Hrs)

Module III: Testing of Hypothesis – Statistical hypothesis, simple and composite hypothesis, Null and alternative hypothesis, types of errors, critical region, size and power of test, most powerful test, Neymann – Pearson Lemma (without proof).

(15 Hours)

Module IV: Large and small sample tests – Test for mean, proportion, equality of means, paired t-test, equality of proportions, test for variance and equality of variance, Chi-square test for goodness of fit, test of independence of attributes.

(24 Hours)

Book for Study

S. C. Gupta and V.K.Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons

Books for Reference:

1. S.M. Ross : Introductory Statistics, Elsevier
2. Hoog, Tanis and Rao : Probability and Statistical Inference, Pearson
3. Surendran and Saxena : Statistical Inference, Sulthan Chand and Sons

Marks including Choice:

Module I – 12

Module II – 20

Module III -12

Module IV -16

Total - 60 Marks.

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions)

Total marks including choice – 60

Maximum marks of the course- 40

COMPLEMENTARY COURSE FOR BSC GEOGRAPHY/ PSYCHOLOGY-1

1: DESCRIPTIVE STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
1	1 C 01 STA(G&P)	4	3	3

Module I: Data Presentation: Collection of data, primary and secondary data; Numerical presentation – Row 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)

Module II: Measures of central tendency: Basic concepts, various measures -mean, median, mode, geometric mean, harmonic mean, weighted average, partition values and simple numerical problems.

(16 Hrs)

Module III: Measures of dispersion and moments- Absolute and relative measures of dispersion- range, mean deviation quartile deviation, standard deviation, coefficient of variation, Lorenz curve and simple numerical problems; Moments- Raw moments , central moments, relation between moments; Skewness and Kurtosis-Definition and various measures and simple numerical problems.

(20 Hrs)

Module IV: 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.C Gupta and V.K . Kapoor: *Fundamentals of Mathematical Statistics*, Sulthan Chand and Sons
2. S.C Gupta and V.K . Kapoor: *Fundamentals of Applied Statistics*, Sulthan Chand and Sons

Books for References:

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:

Module I- 15 marks

Module II- 15 marks

Module III- 15marks

Module IV- 15 marks

Total - 60 marks

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions x 2 marks each=12 marks)

Part C- Essay (6 questions)

□ Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

□ Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 4

COMPLEMENTARY COURSE FOR BSC GEOGRAPHY/ PSYCHOLOGY-11

2: STATISTICAL METHODS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
II	2 C 02 STA (G&P)	4	3	3

Module I: Fitting of curves of the form linear, quadratic, power and exponential curves; Correlation analysis- concept of correlation , method of studying correlation, scatter diagram, Karl Pearsons correlation coefficient, Spearman's rank correlation coefficient; Regression analysis- linear regression, regression equations (concept only).

(22 Hrs)

Module II: Index numbers : Meaning and use of index numbers, simple and weighted index numbers, Laspeyer's , Paache's , Marshall-Edgeworth and Fisher's index numbers, Test for good index number , chain base and fixed base index number, construction of cost of living index number.

(20 Hrs)

Module III: Time Series Analysis: 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), concept of seasonal and cyclic variation.

(20 Hrs)

Module IV: Vital Statistics- Sources of vital statistics , rates and ratios, various measures of mortality and fertility.

(10 Hrs)

Books for Study

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

Books for References:

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:

Module I - 20 marks

Module II- 15 marks

Module III- 15 marks

Module IV- 10 marks

Total - 60 marks

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions x 2 marks each=12 marks)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

COMPLEMENTARY COURSE FOR BSC GEOGRAPHY/ PSYCHOLOGY-III

3: PROBABILITY AND DISTRIBUTION THEORY

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

Module 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.

(25Hrs)

Module 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.

(20Hrs)

Module 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)

Module IV: Sampling distributions: distribution of sample mean, chi square, student's t and Snedecor's F-distributions-definition, applications and interrelation between them.

(15Hrs)

Books for Study

1. S.C Gupta and V.K . Kapoor: *Fundamentals of Mathematical Statistics*, Sulthan Chand and Sons
2. Murrau R Spiegel: *Theory and problems of statistics*, Schaums Outline series

Books for References:

1. John E Freund, Roanld E Walpole: *Mathematical Statistics* 4th Edition, Prentice Hall India Pvt Ltd.
2. David Ebdon, Basil Blackwell: *Statistics in Geography-A practical approach*, Oxford.

Marks including choice:

Module I - 15marks Module II- 15 marks Module III- 20 marks
 Module IV- 10 marks **Total - 60 marks**

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions x 2 marks each=12 marks)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

COMPLEMENTARY COURSE FOR BSC GEOGRAPHY/ PSYCHOLOGY-IV

4: STATISTICAL INFERENCE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
IV	4 C 04 STA (G&P)	5	3	3

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

(25 Hrs)

Module II: Testing of hypothesis: Null and alternative hypothesis, simple and composite hypothesis, two types of errors; size and power of a test, most powerful test and uniformly most powerful test, Neymann-Pearson lemma.

(15 hrs)

Module 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.

(25 Hrs)

Module 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.

(20 Hrs)

Books for Study

1. S.C Gupta and V.K . Kapoor: *Fundamentals of Mathematical Statistics*, Sulthan Chand and Sons
2. S.C Gupta and V.K . Kapoor: *Fundamentals of Applied Statistics*, Sulthan Chand and Sons

Books for References:

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

Marks including choice:

Module I - 18 marks

Module II- 15 marks

Module III- 17 marks

Module IV- 10 marks

Total - 60marks

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (8 questions)

Answer any 6 questions (6 questions x 2 marks each=12 marks)

Part C- Essay (6 questions)

□ Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

□ Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

CORE COURSE FOR BA ECONOMICS-I

Basic Tools for Economic Analysis-I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
V	5B07ECO	6	4	3

Module I: Elementary Mathematics : Number system, laws of indices, logarithm, arithmetic and

geometric series, compound growth rate. Equations: Single and system of linear equations, quadratic equations and their solution. Examples from economics – market equilibrium.

(35 hours)

Module II: Elementary set theory : Set theory: Concept, types, operations, Cartesian product,

relations and functions, Graphs, application in Economics. Cost, revenue, total product, average cost, demand and supply curves.

(20 hours)

Module III: Description of Data : Collection of data: Data types, Nature of Data – Population,

Sample, Types of sampling. Classification of data: Tables, Frequency distributions. Presentation of data: Histograms, polygon, frequency curves, bar and pie diagrams. Analysis and interpretation of data: Measures of central value, dispersion, partition values, skewness, kurtosis, Lorenz curve, Gini coefficient.

(35 hours)

Module IV: Basic Probability: Meaning and approaches, definition of probability, addition

theorem, conditional probability, independence of events and multiplication theorem, simple examples

(18 hours)

Books for Study

1. Allen R.G.D. (1956): Mathematical Analysis for Economists, McMillan
2. Gupta S.P.(2008): Statistical Methods, Sultan Chand, New Delhi

Books for Reference

1. David Bowers (1991): Statistics for Economics and Business, McMillan
2. Monga G.S. (2000): Mathematics and Statistics for Economics, Vikas Publishing House, New Delhi
3. Srinath Baruah (2001): Basic Mathematics and its applications in Economics, McMillan

Marks including choice:

Module I - 17 marks Module II- 12 marks Module III- 18 marks
 Module IV- 13marks **Total - 60marks**

Pattern of Questions:

Part A: Short answer (4 questions)

Answer all the 4 questions (4 questions x 1 mark each=4 marks)

Part B - Short essay (10 questions)

Answer any 7 questions (7 questions x 2 marks each=14 marks)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

CORE COURSE FOR BA ECONOMICS-II

Basic Tools for Economic Analysis-II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HOURS
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VI	6BI2ECO	6	4	3
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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.

(25 hours)

Module II: Differential calculus: Limit and continuity (definition only), differentiation of single variable function: rules, second order derivatives, sign and magnitude of derivatives and its interpretation –concept of slope, maxima and minima of unbounded functions.

Differentiation of two variable functions: partial derivatives of first and second order, Application in utility function, production and cost function, Cobb-Douglas production function.

(25 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.

(30 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, uses of index numbers.

(28 hours)

Books for Study

1. Allen R.G.D. (1956): Mathematical Analysis for Economists, McMillan
2. Gupta S.P.(2008): Statistical Methods, Sultan Chand, New Delhi

Books for Reference

1. David Bowers (1991): Statistics for Economics and Business, McMillan
2. Monga G.S. (2000): Mathematics and Statistics for Economics, Vikas Publishing House, New Delhi

Marks including choice:

Module I - 12 marks Module II- 12 marks Module III- 18 marks
 Module IV- 18marks **Total - 60marks**

Pattern of Questions:

Part A: Short answer (4 questions)

Answer all the 4 questions (4 questions x 1 mark each=4 marks)

Part B - Short essay (10 questions)

Answer any 7 questions (7 questions x 2 marks each=14 marks)

Part C- Essay (6 questions)

Answer any 4 questions (4 questions x 3 marks each=12 marks)

Part D - Long essay (4 questions)

Answer any 2 questions (2 questions x 5 each=10 marks)

Total marks including choice – 60

Maximum marks of the course- 40

STATISTICS OPEN COURSES

OPEN COURSE I: BASICS OF STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS.
V	5 D 01 STA	2	2	2

Module I: Statistics-Introduction-origin & growth of Statistics-function of Statistics-Scope of Statistics-Statistical Methods, Organising a Statistical Survey, Introduction, planning the survey, executing the Survey. **(10 Hrs)**

Module II: Classification and Tabulation of data-Meaning and objective of Classification-Types of classification-Tabulation of data, frequency distribution. **(13 Hrs)**

Module III: Descriptive Statistics: - Measures of central tendency, Measures of dispersion(Absolute & relative measures). **(12 Hrs)**

Books for Study

1. G.V Shenay, Madan Pant : Statistical methods in business and social sciences, Macmillan India Ltd.
Books for References
2. Blalock H.M and Blalck: Methodology in Social research, Mc Graw-Hill
3. D.N Elhance, Veena Elhance and B.M Agarwall: Fundamentals of statistics, Kitab Mahal publications.

Marks including Choice:

Module I - 10 marks Module II - 10 marks Module III -10 marks **Total - 30 Marks.**

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (6 questions)

Answer any 4 questions (4 questions x 2 marks each=8 marks)

Part C - Long essay (2 questions)

Answer any 1 question (1 questions x 6 =6 marks)

Total marks including choice – 30

Maximum marks of the course- 20

OPEN COURSE II : SAMPLING TECHNIQUES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS.
V	5 D 02 STA	2	2	2

Module I 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- Judgement, probability and mixed sampling.
(12 Hrs)

Module II 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).
(15 Hrs)

Moduel III Directorate of Indian Census Operation, National Sample Survey Organisation, Central Statistical Organisation, Indian Statistical Institute, Indian Council for Medical Research etc - their role in planning and development processes of the nation.
(8 Hrs)

Book 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 Sons

Marks including Choice:

Module I – 10 marks Module II – 15 marks Module III -5 marks **Total - 30 Marks.**

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (6 questions)

Answer any 4 questions (4 questions x 2 marks each=8 marks)

Part C - Long essay (2 questions)

Answer any 1 question (1 questions x 6 =6 marks)

Total marks including choice – 30

Maximum marks of the course- 20

OPEN COURSE III : COMPUTER ORIENTED DATA ANALYSIS

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

Module I: **Statistical Investigation:** Definition- statistics, statistical data, population. Functions, scope and limitations of statistics. Census and Sample survey – concept, compare and contrast. Sampling Methods – Simple, Stratified and Systematic Random Sampling. Primary and Secondary Data – definition, sources, limitations and comparison. Preparation of Questionnaire, structured and unstructured questionnaire. **(12 hrs.)**

Module II: **Presentation of Data:** Classification – Definition, types of classification, formation of frequency distribution. Tabulation – Definition, parts of a table, types of tables - simple, complex and general purpose tables. Diagrams and Graphs – Bar Diagrams- simple, subdivided, multiple, percentage and deviation bar diagrams. Pie Diagram, Pictograms and Cartograms (Concept only), Histogram, frequency polygon and frequency curve. Presentation of Data Using SPSS/Excel. **(13 hrs.)**

Module III: **Summary Measures of Data :** Computation of AM, Median, Mode and Standard Deviation. Computation of these measures using SPSS/Excel. **(10 hrs.)**

Marks including Choice:

Module I – 10 marks Module II -12 marks Module III -8 marks **Total - 30 Marks.**

Pattern of Questions:

Part A: Short answer (6 questions)

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

Part B - Short essay (6 questions)

Answer any 4 questions (4 questions x 2 marks each=8 marks)

Part C - Long essay (2 questions)

Answer any 1 question (1 questions x 6 =6 marks)

Total marks including choice – 30

Maximum marks of the course- 20

Sd/-

Dr. P. V. Pushpaja,

Chairman, Board of Studies, Statistics (UG)

MODEL QUESTION PAPER

FIRST SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course : **Statistics**

Paper: 1B01STA DESCRIPTIVE STATISTICS

(Use of calculators and Statistical tables are permitted)

Time: 3 hrs

Max. Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define Statistics as statistical methods
2. What is statistical enquiry?
3. Describe chronological data.
4. Define population and give an example.
5. What are deciles?
6. What is the relation between Arithmetic mean, Geometric mean and Harmonic mean?

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Describe the term multiplicity of causes.
8. "Statistics is the science of counting". Comment?
9. Distinguish between census study and sample survey method.
10. Describe different types of data.
11. What is the importance of diagrammatic representation?
12. What are the different measures of central tendency?
13. Define dispersion and mention its uses.
14. Define correlation and mention any two properties of dispersion.
15. Describe the regression coefficients?

Part C- Essay

Answer any 4 questions (4 x 4marks=16 marks)

16. Give the origin and scope of Statistics?
17. Represent the following data by a suitable diagram

Items	:	Food	Clothing	Recreation	Education	Rent	Others
Expenditure in Rs.	:	120	32	18	16	20	25

18. What are the properties to be satisfied by a good average? On the basis of these, which is the best average?
19. Write short notes on the following
 (i) Variance (ii) Coefficient of variation (iii) Skewness (iv) Kurtosis
20. Derive the regression line of X on Y based on n observations from the bi-variate data on X and Y? Why there are two regression lines?
21. Explain partial and multiple correlations? And give the expressions multiple and partial correlation coefficients in terms of simple correlation coefficients? Also give the range for the multiple and partial correlation coefficients?

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Fit a curve of the second degree to the following data:
- | | | | | | | | | | | |
|------------|---|------|------|------|------|------|------|------|------|------|
| Year | : | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Production | : | 17 | 20 | 19 | 26 | 24 | 40 | 35 | 35 | 55 |
- Also estimate the production for 2010?
23. Compute arithmetic mean, median and mode from the following data and verify the relation between them?
- | | | | | | | | | | | | |
|-----------|---|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Class | : | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | 90-100 |
| Frequency | : | 2 | 4 | 10 | 15 | 22 | 18 | 12 | 8 | 5 | 4 |
24. From the prices of shares of A and B below, find out which is more stable in value
- | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| A: | 35 | 54 | 52 | 53 | 56 | 58 | 52 | 50 | 51 | 49 |
| B: | 108 | 107 | 105 | 105 | 106 | 107 | 104 | 103 | 104 | 101 |
25. The following data gives the age(X) and Blood Pressure(Y) of 8 persons
- | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|
| X: | 52 | 63 | 45 | 36 | 72 | 65 | 47 | 25 |
| Y: | 62 | 53 | 51 | 25 | 79 | 43 | 60 | 33 |
- Obtain the regression lines of X on Y and Y on X and hence find the expected B.P of a person having 50 years old.

MODEL QUESTION PAPER

SECOND SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course: **Statistics**

Paper : 2B02STA **PROBABILITY THEORY**

(Use of calculators and Statistical tables are permitted)

Time: 3 hrs

Max. Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define random experiment.
2. What is law of statistical regularity?
3. Define distribution function.
4. Describe independence of random variables.
5. Define mathematical expectation of a random variable.
6. State the multiplication theorem on expectation.

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Let A and B be two events such that $P(A)= 0.4$, $P(B)= 0.7$, $P(AB)= 0.3$. Calculate $P(AB^1)$.
8. Give the axiomatic definition of probability.
9. A random variable X has the pdf $f(x)=1/4$, $-2<x<2$ and zero otherwise. Find $P(|X|>1)$.
10. Let X be a random variable with pdf $f(x)=2x$, $0<x<1$ and zero otherwise. Find the pdf of $Y= 3X+1$.
11. Establish with the help of an example that the expectation of a random variable need not always exist.
12. Distinguish between correlation and regression.
13. Define characteristics function and mention two of its properties.
14. Prove that the moment generating function of the sum of two independent random variables is the product of their individual moment generating functions.
15. Define probability generating function of a discrete random variable. Give the relationship between the pgf and mgf.

Part C- Essay

Answer any 4 questions (4 x 4marks =16 marks)

16. Distinguish between pair-wise independence and mutual independence of events. Establish with the help of an example that pair-wise independence doesn't imply mutual independence.
17. If A, B and C are three events, show that (i). $P(A \cup B | C) = P(A/C) + P(B/C) - P(A \cap B/C)$
(ii). $P(A \cap B \cap C) \geq P(A) + P(B) - 2$
18. Let $f(x,y) = 8xy$, $0 < x < y < 1$ and zero otherwise, find the marginal distributions of X and Y.
19. Find the distribution function of the random variable having the pdf
- $$f(x) = \begin{cases} x & \text{for } 0 \leq x < 1 \\ 2-x & \text{for } 1 \leq x < 2 \\ 0 & \text{otherwise} \end{cases}$$
20. If X and Y are independent random variables, show that $V(aX + bY) = a^2V(X) + b^2V(Y)$.
21. Find the moment generating function of the random variable with probability function $P(x) = 1/2^x$, $x = 1, 2, 3, \dots$ and zero otherwise. Hence find its mean and variance

Part D - Long essay

Answer any 2 questions (2 x 6 marks =12 marks)

22. (i). State and prove Bayes' theorem.
(ii). A machine part is produced by three factories A, B and C. Their proportional production is 25%, 35% and 40% respectively. Also the defective percentages are 5, 4 and 3 respectively. A part is chosen at random and is found to be defective. Find the probability that the selected part belongs to factory B
23. A continuous random variable X has a density function $f(x) = Ax^2$, $0 \leq x \leq 10$. Determine the value of A and find (a). $P(2 < X < 5)$, (b). $P(X < 3 | X > -1)$.
24. Let (X,Y) be a random variable taking values -1, 0, 1 and having joint probability distribution given by

x		-1	0	1
Y	-1	0	0.1	0.1
	0	0.2	0.2	0.2
	1	0	0.1	0.1

Find the correlation between X and Y.

25. Distinguish between raw and central moments. Establish the relation between them.

MODEL QUESTION PAPER

THIRD SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course : **Statistics**

Paper : 3B03STA PROBABILITY DISTRIBUTIONS

(Use of calculators and Statistical tables are permitted)

Time: 3 hrs

Max. Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Describe degenerate distribution.
2. Find the mean of discrete uniform distribution.
3. Define negative binomial distribution.
4. Define multinomial distribution.
5. Find the quartile deviation of normal distribution.
6. Define the area property of normal distribution.

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Find the mean and variance of Bernoulli distribution.
8. Find the pgf of binomial distribution.
9. Describe the additive property of Poisson distribution.
10. What are the main features of normal distribution?
11. Find the characteristics function of standard normal distribution.
12. Describe lognormal distribution.
13. Define beta distribution of second kind and find its mean.
14. A random variable X has the pdf $f(x)=e^{-x}$, for $x>0$ and zero otherwise. Show that Chebychev's inequality gives $P(|X|>2)<1/4$.
15. State and prove central limit theorem.

Part C- Essay

Answer any 4 questions (4 x 4marks =16 marks)

16. Find the mode of Poisson distribution.
17. Find the mean and variance of hyper geometric distribution.
18. Derive the mgf of exponential distribution and hence find its mean and variance.
19. If X has a uniform distribution over $[0,1]$, find the distribution of $Y = -2\log X$.
20. Derive the expression for even order central moments of normal distribution.
21. State and prove Bernoulli's law of large numbers.

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Derive the recurrence relation of central moments of binomial distribution. Hence find its first three central moments.
23. State and establish the lack of memory property of Geometric distribution.
24. For a normal distribution with parameters μ and σ , derive the mean deviation about mean.
25. Define one parameter gamma distribution. Derive its mgf and hence establish its additive property.

MODEL QUESTION PAPER
THIRD SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME
Core Course : **Statistics**
Paper : 4B04STA STATISTICAL INFERENCE –I

(Use of calculators and Statistical tables are permitted)

Time: 3 hrs

Max. Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark = 6 marks)

1. Define Fisher's 't' statistic.
2. Write down the density function of F-distribution with (n_1, n_2) degrees of freedom.
3. Define the terms (a) Estimator (b) Parameter
4. Distinguish between point estimation and interval estimation.
5. State the factorization theorem for sufficient statistics.
6. State Rao-Blackwell theorem.

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. A sample of size 16 is taken from $N(50,400)$. What is the probability that the sample mean is at least 60.
8. Find the moment generating function of chi-square distribution.
9. State and prove the additive property of chi-square distribution.
10. Find the mean of F-distribution.
11. Define an unbiased estimator. Show by an example that unbiased estimator need not be unique.
12. "A consistent estimator is unbiased". Comment.
13. State the invariance property of maximum likelihood estimator. If X has a Poisson distribution with

mean λ , find the maximum likelihood estimator of λ ?

14. A sample of 20 observations from a normal population was taken. The sample mean is 60 and sample variance is 15. Find the 95% confidence interval for the mean μ .
15. Obtain 100(1- α)% confidence interval for the parameter σ^2 of the normal distribution $N(\mu, \sigma^2)$.

Part C- Essay

Answer any 4 questions (4 x 4marks=16 marks)

16. Define student's t statistic and derive its distribution.
17. Show that the sample variance is always a biased estimator of the population variance. Hence find an unbiased estimator of the population variance.
18. Define a consistent estimator. State and prove the sufficient condition for consistency of an estimator.
19. Let X_1, X_2, \dots, X_n be a random sample from a rectangular distribution with parameters a and b. Obtain the mle of a, b.
20. Define MVB estimator. Obtain the MVB estimator for λ in a Poisson distribution.
21. Explain the method of finding 100(1- α)% confidence interval for the difference of proportions.

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Derive the inter relationship between normal, chi-square, t and F.
23. Specifying regularity conditions state and prove Cramer-Rao inequality.
24. Find the moment estimators of μ, σ^2 for a log-normal distribution.
25. (a) Explain the method of finding 100(1- α)% confidence interval for the difference between means of two normal population when the variances are equal and unknown.
(b) In 100 tosses of a coin head turns up 65 times. Obtain 99% confidence interval for the proportion of heads. Also calculate range of limits.

MODEL QUESTION PAPER

FIFTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course : **Statistics**

Paper : 5B05STA STATISTICAL INFERENCE -II

(Use of calculators and Statistical tables are permitted)

Time: 3 hrs

Max. Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Distinguish between simple and composite hypotheses.
2. Distinguish between type I and type II errors.
3. Describe p-value.
4. Define critical region.
5. What are the assumptions of non-parametric tests.
6. Define runs.

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Distinguish between most powerful and uniformly most powerful tests.
8. If $x > 1$ is the critical region for testing $H_0 : \theta = 2$ Vs $H_1 : \theta = 1$ based on a single observation from the population with $f(x, \theta) = \theta e^{-\theta x}$, for $X > 0$. Find the power of the test.
9. Describe F-test for equality of variances.
10. Give the test statistics and test criterion for testing the equality of two population proportions.
11. Describe U-test.
12. Describe the test for significance of correlation coefficient.
13. Describe the test for significance of variance of a normal population.
14. Make a comparison between parametric and nonparametric tests.
15. Describe median test.

Part C- Essay

Answer any 4 questions (4 x 4marks =16 marks)

16. State and prove Neymann-Pearson lemma.
17. Find the most powerful test for testing $H_0: \lambda=\lambda_0$ Vs $H_1: \lambda=\lambda_1$, based on sample observations from Poisson distribution.
18. Describe the test procedure for testing the significance of population proportion.
19. Describe the test statistics for testing $H_0: \theta=\theta_0$ Vs $H_1: \theta=\theta_1$, where θ is the mean of normal population with unknown variance, based on (i). Large samples (ii). Small sample.
20. Describe the chi-square test for goodness of fit.
21. Based on random samples from two independent normal populations, it was observed that the sample standard deviations are respectively 0.01 and 0.015. Examine whether the population standard deviations are same or not.

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Find the MP test for testing $H_0: \theta=\theta_0$ Vs $H_1: \theta=\theta_1$ based on a sample of size n from $f(x, \theta) = \theta x^{\theta-1}$, for $0 < x < 1$ and zero otherwise.
23. Describe the test procedure for testing the equality of means of two independent normal populations.
24. Describe the test for independence of attributes.
25. Distinguish between sign test and signed rank test.

MODEL QUESTION PAPER

FIFTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course: **Statistics**

Paper: 5B06STA **MATHEMATICAL ANALYSIS I**

(Use of calculators and Statistical tables are permitted)

Time: Three Hrs

Maximum Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define bounded sequence with an example
2. Examine the convergence of the sequence $\{a_n\}$, where $a_n = (3n+4) / (2n-1)$
3. Test the convergence of the alternating series $1 - 1/2 + 1/3 - 1/4 + \dots$
4. Is the function $f(x) = |x|$ is continuous at $x=2$?
5. A function f is define on \mathbb{R} by $f(x) = x$, $0 \leq x < 1$ and $f(x) = 1$, if $x \geq 1$, examine whether the derivative $f'(1)$ exists or not.
6. Expand the function e^x as Maclaurin's infinite series

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. What do you mean by limit inferior and limit superior of a sequence? Give an example. State the monotonic property of the sequences.
8. Show that if $\lim_{x \rightarrow a} f(x)$ exist, then it is unique.
9. If $\lim a_n = a$ and $a_n \geq 0$ for all n , prove that $a \geq 0$
10. State and prove a necessary condition for convergence of an infinite series.
11. Examine whether the series $\sum_{n=2}^{\infty} \frac{1}{\log n}$ is convergent or not
12. Define absolute convergence and conditional convergence with an example
13. Prove that a function which is derivable at a point is necessarily continuous
14. Show that $\sin x$ is uniformly continuous on $[0, \infty)$
15. If a function $f(x)$ satisfies the conditions of mean value theorem and derivative of $f(x)$ is zero in a finite interval, show that the function is constant.

Part C (Essay)

Answer any 4 questions (4 x 4 marks =16 marks)

16. Define limit point of a sequence. Given an example. Show that every bounded sequence has a limit point. Give an example to show that an unbounded sequence may exist with a limit point.
17. (i) Show that a monotonic sequence which is bounded is convergent.
(ii) Investigate the convergence of a geometric series
18. Show that the positive term series $\sum 1/n^p$ converges for $p > 1$ and diverges when $p \leq 1$
19. (i) Show that sum of two continuous functions is continuous.
(ii) If a function is continuous in a closed interval, then prove that it is bounded therein.
20. State and prove Rolle's theorem on differential calculus. Explain how to deduce Lagrange's mean value theorem from Rolle's theorem
21. (i) Show that $\frac{\tan x}{x} > \frac{x}{\sin x}$ for $0 < x < \pi/2$
(ii) Stating Darboux's theorem, deduce intermediate value theorem for derivatives

Part D (Long Essay)

Answer any 2 questions (2 x 6 marks =12 marks)

22. (i) State and prove Cauchy's general principle of convergence for sequences.
(ii) Show that the sequence $\{S_n\}$, where $S_n = 1 + 1/3 + 1/5 + \dots + 1/(2n+1)$ cannot converge
23. (i) State and prove D'Alembert's Ratio test for convergence of an infinite series
(ii) Examine the convergence of $1/(1+x) + 1/(1+2x^2) + 1/(1+3x^3) + 1/(1+4x^4) + \dots$ for $x > 0$.
24. (i) Explain various types of discontinuities of functions. Find the kind of discontinuity of the function $f(x) = (x - |x|) / x$ when $x \neq 0$ and $f(x) = 2$ when $x = 0$.
(ii) Show that the function $f(x) = \sin(1/x)$ for $x \neq 0$ and $f(x) = 0$ for $x = 0$ is not uniformly continuous on $[0, \infty)$.
25. (i) State and prove Taylor's theorem and hence deduce Taylor's series
(ii) Using Taylor's theorem, prove that $\cos x \geq 1 - (x^2/2)$ for all real x

MODEL QUESTION PAPER
FIFTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME
Core Course : **Statistics**

Paper: 5B07STA : Statistics Using R

Time: 3 Hours

Max Marks : 48

(Use of calculators and Statistical tables are permitted)

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. What is the R-command for the output [1] 20 20 20 20 ?
2. What is the R-command to find the combination $\binom{6}{2}$?
3. How do you simulate 100 standard normal random variables and put in y ?
4. If A and B are matrices of the same order, how to find the product A*B using R-command?
5. If p-value is 0.2653 in an output, what will be your inference?
6. If X follows a binomial distribution with parameters n = 10 and p = 0.25, write down the R- command to find P(X = 3).

Part B - Short essay

Answer any 7 questions (7 x 2 marks=14 marks)

Describe the output of the following R-commands:

7. S = sort(x, decreasing = T); S
8. seq(5,29, length = 7)
9. qchisq(0.95,2)
10. sample(1:6,10,replace = T)
11. curve(dnorm(x), from -3 to 3)
12. xt = table(x); which(xt == max(xt))
13. seq(10, 25, by = 3)
14. M = matrix(c(1,3,5,0,-1,-3,7,8,9), ncol = 3, by row = 3); M
15. t.test(x, y, paired = T)

Part C- Essay

Answer any 4 questions (4 x 4marks =16 marks)

16. Briefly describe history of development of R.
17. Explain the plots to check normality of data in R.
18. Explain the utility of data.frame() and scan() functions.
19. If X follows a Poisson distribution with mean 1.5, write R- program to obtain a table of Poisson probabilities.
20. Distinguish between the functions plot () and curve ().
21. Write down R-command to determine correlation coefficient, regression lines X on Y and Y on X for the following data.

X: 28 26 32 31 37 30 36 34 39 40

Y: 75 74 82 81 90 88 85 92 92 95

Part D - Long essay

Answer any 2 questions (2 x 6 =12 marks)

22. Weight measured for 20 persons in a study is 73, 48, 53, 65, 70, 58, 64, 89, 96, 57, 81, 64, 76, 84, 73, 59, 61, 73, 92, 67 (kgs). Prepare R-program to (a) determine the mean, median and variance (b) box and whisker plot
23. Following table shows the frequency distribution of daily emission (in tons) of sulfur dioxide from an industrial plant:

Class	: 4-7.9	8-11.9	12-15.9	16-19.9	20-23.9	24-27.9	28-31.9
Frequency	: 3	10	14	25	17	9	2

Prepare R-program to determine the three Quartiles.

24. Prepare R-program for ‘ Regression Analysis’. List the additional information obtained when summary() function is used.
25. Prepare R-program for one way ANOVA. Describe the points in its output.

MODEL QUESTION PAPER

FIFTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course : **Statistics**

Paper : 5B08STA SAMPLING TECHNIQUES

(Use of calculators and Statistical tables are permitted)

Time-3 hours

max.marks:48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Give two situations where method of sampling is used.
2. Define simple random sampling.
3. Define population correction factor.
4. What are the situations under which stratified random sampling is more preferred than SRS.
5. Define PPS sampling.
6. Describe proportional allocation.

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Explain different types of sampling.
8. Write short note on ISI.
9. Show that the probability of drawing any unit at any draw is same as that it being selected at the first draw.
10. Find an unbiased estimator of population total in SRSWR ?
11. Describe a method of selecting a simple random sample.
12. Find the variance of the estimate of the population mean in stratified random sampling?
13. Describe cluster sampling and obtain the unbiased estimator of population mean under cluster sampling

14. Distinguish between linear and circular systematic sampling.
15. Explain any one method of drawing a PPS sample.

Part C- Essay

Answer any 4 questions (4 x 4marks=16 marks)

16. Distinguish between sampling and non sampling errors. What are the measures used to control these errors.
17. Describe the method of allocation in SRS
18. Show that sample mean square is an unbiased estimator of population mean square in SRSWOR.
19. Establish the Neymann's optimum allocation in stratified random sampling.
20. Compare the estimate of population mean under SRS and stratified random sampling under proportional allocation.
21. Find mean and variance of sample mean under cluster sampling.

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Discuss the principal steps in large scale sample survey.
23. Find the variance of sample mean under SRSWOR
24. Discuss the role of NSSO, CSO and ICMR in planning and development process of the nation.
25. If there is a linear trend in the population, then make a comparison between the variances under SRS, systematic sampling and stratified sampling.

MODEL QUESTION PAPER

FIFTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course: **Statistics**

Paper : 5B09STA **Statistical Quality control and Operations Research**

(Use of calculators and Statistical tables are permitted)

Time : 3 Hours

Max. Marks : 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. What are slack and surplus variables?
2. Define (i) basic solution (ii) feasible solution and (iii) basic feasible solution.
3. What are rational subgroups?
4. Distinguish between defect and defective
5. Define product control.
6. What do you mean by quality of a lot?

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Define dual of an LPP. With the help of an example, show that dual of a dual is primal.
8. Explain the basic characteristics of LPP.
9. What is an assignment problem? Represent an assignment problem as an LPP
10. Describe 3σ control limits
11. Explain chance and assignable causes of variations.
12. Derive the control limits of c chart.
13. Distinguish between control chart for variables and control chart for attributes.
14. Define (i) AQL and (ii) LTPD.
15. Explain double sampling plan

Part C- Essay

Answer any 4 questions (4 x 4marks=16 marks)

16. Describe the graphical method of solving LPP. Solve the following LPP by graphical method

Maximize $Z = 2x_1 + x_2$, Subject to the constraints

$x_1 - x_2 \leq 10, x_1 \leq 20, x_1 \geq 0$ and $x_2 \geq 0$

17. (i) Show that in a transportation problem, there exists a feasible solution if and only if the problem is balanced.
(ii) Write the canonical and standard form of LPP
18. Explain transportation problem. Find the initial basic feasible solution to the following transportation problem using Vogel's Approximation Method. The cost matrix is given below

	D1	D2	D3	D4	Supply
S1	20	25	28	31	200
S2	32	28	32	41	240
S3	18	35	24	32	100
Demand	150	40	180	170	

18. Write short notes on (i) modified control chart and (ii) np chart.
19. Define (i) Producers Risk (ii) Consumers Risk (iii) ASN and (iv) ATI. Write the expression for ASN and ATI in double sampling plan.
20. Describe single sampling plan. Find the expression for OC curve in single sampling plan

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Using simplex method, solve the following LPP

$$\text{Maximize } Z = 4x_1 + 5x_2 + 9x_3 + 11x_4 \quad \text{subject to the constraints}$$

$$x_1 + x_2 + x_3 + x_4 \leq 15, \quad 7x_1 + 5x_2 + 3x_3 + 2x_4 \leq 120,$$

$$3x_1 + 5x_2 + 10x_3 + 15x_4 \leq 100, \quad x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, \text{ and } x_4 \geq 0$$

23. A company is faced with the problem of assigning 4 machines to 6 different jobs (one machine to one job only). The profits are estimated as follows:

Job	Machine			
	A	B	C	D
1	3	6	2	6
2	7	1	4	4
3	3	8	5	8
4	6	4	3	7
5	5	2	4	3
6	5	7	6	4

Solve the problem to maximize the total profits.

24. What is a control chart? Explain the steps involved in the construction of control charts for mean and range.
25. The following are the figures of defectives in 22 lots each containing 2,000 rubber belts:

425, 430, 216, 341, 564, 654, 342, 243, 354, 34, 453, 234, 435, 423, 123, 324, 143, 234, 254, 234, 423, 234.

Draw control chart for fraction defective and comment on the state of control of the processes.

MODEL QUESTION PAPER

SIXTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course: **Statistics**

Paper: 6B10STA MATHEMATICAL ANALYSIS- II

(Use of calculators and Statistical tables are permitted)

Time: Three hrs

Maximum Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Give an example of a bounded function which is not integrable
2. Show that a constant function is integrable
3. Define (i) Limit point (ii) limit of a function and (iii) continuity with respect to functions of two variables,
4. Show that any vector can be expressed as a linear combination of basic unit vectors
5. Define (i) null vector (ii) transpose of a vector (iii) length of a vector and (iv) addition of vectors
6. Show that $\Gamma n = (n-1) \Gamma(n-1)$

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Show that integrability of sum of integrable functions is integrable.
8. Using Riemann integral as a limit of sum, compute $\int_{-1}^1 |X| dx$
9. State and prove first mean value theorem of integral calculus
10. Show that the function $f(x, y) = (xy)^{1/2}$ is not differentiable at the origin
11. Define extreme value of a function $f(x, y)$. State the sufficient condition for $f(a, b)$ is an extreme value of $f(x, y)$
12. Show that linear independence in a system of vectors is not altered by non zero scalar multiplication
13. Examine whether the vectors $U=(1,1,1)$, $V(1,0,-1)$ and $W=(1,-2,1)$ form an orthogonal system
14. Test the convergence of $\int_0^1 dx/\sqrt{(1-x^3)}$
15. Define different forms of beta function and show that it is symmetric

Part C- Essay

Answer any 4 questions (4 x 4marks=16 marks)

16. If a function f is integrable on $[a, b]$, prove that (i) $|f|$ is integrable on $[a, b]$ and (ii) f^2 is integrable on $[a, b]$
17. (i) Prove that the lower Riemann sum with respect to a partition cannot exceed the sum with respect to the refinement of partition.
(ii) Show that the function $f(x) = [x]$, denote the greatest integer not greater than x , is integrable on $[0, 3]$.
18. (i) State and prove fundamental theorem of integral calculus
(ii) The function $f(x)$ is defined in the interval $[0, 1]$ by the condition that if r is an integer $f(x) = 2rx$ when $1/(r+1) < x \leq 1/r$. Show that $f(x)$ is integrable over $[0, 1]$ and find the value of the definite integral.
19. (i) Show that for the function $f(x, y) = xy/(x^2+y^2)$ for $(x, y) \neq (0,0)$ and $f(x, y) = 0$ for $(x, y) = (0, 0)$, both the partial derivatives exist at the origin, but the function is not continuous there.
(ii) Find the maxima and minima of the function $f(x, y) = x^3+y^3 - 3x+12y+20$.
20. (i) Define linear independence and dependence of vectors. Check the linear independence of the vectors $V_1 = (1, 2, 1)$, $V_2 = (1, -1, 1)$, $V_3 = (3, 3, 3)$.
(ii) Show that every set of mutually orthogonal non null vectors are linearly independent.
21. (i) Establish the relation between beta and gamma integrals
(ii) Test the convergence of $\int_0^{\pi/2} \frac{\sin x}{x^3} dx$

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Explain Riemann integral and its existence. State and prove the necessary and sufficient condition for Riemann integrability of a bounded function in terms of lower and upper Riemann Sums.
23. (i) Establish the integrability of continuous function. Is the monotonic function is integrable?
(ii) Show that beta function $B(m, n)$ is convergent if both m and n are positive
24. (i) Explain the Lagrange's method of multipliers. Find the minimum value of $x^2 + y^2$ subject to the constraint $x^2 + 8xy + 7y^2 = 225$ using Lagrange's method
(ii) Expand the function $f(x, y) = x^2y + 3y - 2$ in powers of $x-1$ and $y+2$
25. (i) Define eigen values and eigen vectors of a matrix. Find the eigen values and eigen vectors of the matrix
- $$\begin{matrix} & \begin{matrix} 1 & 0 & -1 \\ 2 & 1 & 3 \\ 3 & 1 & 4 \end{matrix} \end{matrix}$$
- (ii) State Cayely-Hamilton theorem. Find the inverse of the matrix given above in question 25(i) by Cayely-Hamilton theorem

MODEL QUESTION PAPER

FIFTH SEMESTER B.Sc STATISTICS(CCSS) PROGRAMME

Core Course : **Statistics**

Paper: 6 B 11 STA TIME SERIES, INDEX NUMBERS AND VITAL STATISTICS

(Use of calculators and Statistical tables are permitted)

Time: Three hrs

Maximum Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define time series. Point out its utility.
2. What are additive and multiplicative models in time series analysis?
3. Distinguish between simple and weighted index numbers
4. What are price and quantity index numbers?
5. What do you mean by vital statistics? Mention the official sources of vital statistics
6. Define force of mortality

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. Explain the moving average method of measuring trend in a time series
8. Describe the simple average method of measuring seasonal variation
9. Define Laspeyre's and Paasche's Index numbers. What are the types of bias appears in them?
10. Write short notes on chain base index number
11. Point out the uses and limitations of index numbers
12. Define (i) crude death rate and (ii) standardized death rate. In what way standardized death rate superior to crude death rate.
13. Define life table. What are the uses of life table?
14. Explain Makehams graduation formula
15. Distinguish between gross and net reproduction rates

Part C- Essay

Answer any 4 questions (4 x 4marks=16 marks)

16. Explain different components of time series.
17. Estimate linear trend from the following data by the method of least squares

Year: 1987 1988 1989 2000 2001 2002 2003

Production: 80 90 92 83 94 99 92
 ('000 qtls)

18. Define cost of living index numbers. Explain the construction of cost of living index numbers.
19. Explain the tests to be satisfied by a good index number. Examine whether Laspeyres and Paasche's index numbers satisfy these tests
20. Define population projection. Explain how logistic curve is useful to study the growth of the population
21. Distinguish between complete and curate expectation of life. With usual notation prove that $e_x^0 \approx e_x + 0.5$

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. Calculate seasonal variation by e ratio to trend method for the following data

Year	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
1979	30	40	36	34
1980	34	52	50	44
1981	40	58	54	48
1982	52	76	68	62
1983	80	92	80	82

23. Calculate Fishers and Marshall Edgeworth index numbers from the following data and hence show that Fishers index number is an ideal index number

Commodity	Base year		Current year	
	Price	Quantity	Price	Quantity
A	2	8	4	6
B	5	10	6	5
C	4	14	5	10
D	2	19	2	13

24. Distinguish between complete and abridged life tables. Describe the components of complete and abridged life tables. Explain the construction of complete life table
25. Explain various measures of fertility. Compare their merits and demerits.

MODEL QUESTION PAPER
SIXTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME
Core Course : **Statistics**
Paper : 6B12 STA -DESIGN OF EXPERIMENTS

(Use of calculators and Statistical tables are permitted)

Time -3 hours

max.mark.48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Explain Gauss Markov's setup.
2. Define critical difference.
3. State mathematical model used in two way classification, explain each factor.
- 4 Distinguish between comparative and absolute experiments.
5. Define ANOVA.
6. Describe what is meant by factorial experiments.

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. State and prove the necessary and sufficient condition for estimability of a linear parametric function.
8. Explain linear hypotheses.
9. Describe ANCOVA.
10. Explain one-way classified data.
11. Define main effects and interaction effects in a 2^2 factorial experiment.
12. Explain the role of critical difference in ANOVA.
13. Define Greco- Latin square design.
14. What are the advantages and disadvantages of CRD?.
15. What are the assumptions used in ANOVA? Write down the layout of a LSD.

Part C- Essay

Answer any 4 questions (4 x 4marks =16 marks)

16. Prove that in one-way classified data, the error variance is an unbiased estimator of population variance
17. Explain the principles of experimentation.
18. Define a randomized block design. Describe the model and hypotheses in RBD. Also give its ANOVA table.
19. Describe the analysis of a CRD.
20. Explain the procedure of estimating the missing observation in LSD
21. Compare the efficiency of RBD with LSD

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. State and prove Gauss Markov's theorem
23. Explain the analysis of a two way classified data.
24. Describe the analysis of LSD.
25. Describe one-way ANCOVA.

MODEL QUESTION PAPER

SIXTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Core Course: **Statistics**

Paper: 6B13STA **ACTUARIAL STATISTICS**

(Use of calculators and Statistical tables are permitted)

Time: 3 hrs

Max. Marks: 48

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define the term mortality?
2. Give the relationship between balances and reserves?
3. Give the relation between l_{x+1} , l_x and d_x ?
4. Define guaranteed payments?
5. What is term insurance?
6. What is joint-life status?

Part B - Short essay

Answer any 7 questions (7 x 2 marks =14 marks)

7. What is meant by discount functions?
8. What is life expectancy?
9. What is meant by force of mortality?
10. Define interest and survivorship discount function?
11. Explain about recursions?
12. How insurance can be viewed as annuity?
13. Explain about deferred insurance and varying benefit insurance?
14. Explain what is meant by reserves?
15. What is universal life?

Part C- Essay

Answer any 4 questions (4 x 4marks =16 marks)

16. Explain analytical law of mortality? What is life table and give its importance?
17. What is curate life expectancy and complete life expectancy? Give their expressions in terms of l_x ?
18. Explain about various types of life insurances?
19. Explain about various life annuities?
20. What is expense and what is its effect on reserves?
21. What is multiple decrement table?

Part D - Long essay

Answer any 2 questions (2 x 6 marks=12 marks)

22. What is utility theory and explain its importance in insurance?
23. What is select mortality? Explain about select and ultimate tables?
24. Explain various multiple decrement models? Why decrement is used in insurance?
25. Given that ${}_1p_{70}=0.9$, ${}_2p_{70}=0.8$, ${}_3p_{70}=0.7$. The interest rate is 20% for the first year and 25% for the second year. Find the present value of the benefits on a 2-year term insurance policy sold to two lives (70) and (71) that provides benefits upon the first death, payable at the end of the year of death. The amount of the death benefit is 1000 if the first death occurs in the first year, and 2000 if it occurs in the second year.

MODEL QUESTION PAPER

First Sem. B.Sc. Degree Examination

Complementary Course: Statistics (Mathematics/Computer Science)

Paper: 1C01STA – Basic Statistics

Time: 3 Hrs

Maximum: 40 marks

(Use of calculators and Statistical tables are permitted.)

Part A: Short answer

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

1. Which average is most suitable for index numbers.
2. When is the sum of squares of deviations of a set of observations has the smallest value.
3. Define raw and central moments.
4. What is the relation between mean, median and mode for a positive skewed data.
5. State the relationship between correlation and regression coefficients.
6. Name various components of time series.

Part B: Short essay

Answer any 6 questions (6 questions x 2 mark each=12 marks)

7. What are the advantages of sampling over census
8. Explain probability sampling
9. For the following less than frequency distribution of income per month, find the median
Income less than(Rs.): 1500 1250 1000 750 500 250
No of Persons : 100 80 70 55 32 12
10. Derive an expression for the 4th central moment in terms of raw moments
11. Calculate M.D from mean for the following data
Classes : 2 - 4 4 - 6 6 - 8 8 - 10
Frequency : 2 5 4 1
12. Explain percentiles
13. Explain partial and multiple correlation coefficients
14. Explain the estimation of linear trend by least square method

Part C: Essay

Answer any 4 questions (4 questions x 3 mark each=12 marks)

15. Explain simple, stratified and systematic sampling
16. Explain various measures of skewness
17. Explain kurtosis
18. Goals scored by two teams A and B in a football season were as follows:
No. of goals scored in a match: 0 1 2 3 4
No. of matches A: 27 9 8 5 4
 B: 17 9 6 5 3
Find which team may be considered more consistent
19. Derive an expression for the rank correlation coefficient
20. Explain why Fisher's IN is called an ideal IN

Part A: Long Essay

Answer any 2 questions (2 questions x 5 mark each=10 marks)

21. Find Q_1 , Q_3 , D_7 , P_{20} and also the quartile deviation
Marks : 0-10 10-20 20-30 30-40 40-50 50-60 60-70 70-80
No. of students: 3 9 12 20 8 6 6 5
22. The first four moments of a distribution about $X=4$ are 1,4,10 and 45. Find the first four central moments and moment measures of skewness and kurtosis
23. a) Explain positive and negative correlation
 b) Show that the correlation coefficient lies between -1 and +1
24. Find Laaspeyer's, Paashe's and Fisher's Index Numbers from the following data and show that Fisher's IN satisfies time reversal test and factor reversal test while the other two IN do not satisfy these tests.

	Base Year		Current Year	
	Price	Quantity	Price	Quantity
Rice	10	100	14.5	90
Wheat	7.4	110	13.7	100
Jowar	6.1	50	12.7	30

Model Question Paper
COMPLEMENTARY COURSE IN
STATISTICS
(For Mathematics/ Computer Science)
3C03 STA - Standard Distributions

Time: 3 Hours _____ Max.Marks: 40

PART - A

(Answer all questions. Each question carries 1 mark.)

1. Define expectation of a random variable.
2. Define conditional variance.
3. Define geometric distribution
4. Give the relation connecting beta distributions of I kind and II kind.
5. What do you mean by standard uniform distribution?
6. Define convergence in probability.

PART - B

(Answer any six questions. Each question carries 2 marks.)

7. A random variable X has the following probability mass function

$$P(X = k) = \frac{(-1)^k 2^k}{k} = \frac{1}{2^k}$$

Examine the existence of $E(X)$.

8. Define characteristic function of a random variable. State its important properties.
9. Give the physical conditions in which binomial distribution can be applied.
10. For a Poisson distribution with unit mean, show that the mean deviation about mean is $\frac{2}{e}$ times the standard deviation.
11. Find the moment generating function of an exponential distribution and hence find its mean and variance.
12. State any five properties of normal distribution.
13. Derive the expression for mean deviation about mean for a normal distribution.

14. State and prove Bernoulli's weak law of large numbers.

PART - C

(Answer any four questions. Each question carries 3 marks.)

15. A continuous random variable X has the density function

$$f(x) = 2(1 - x), 0 < x < 1$$

. Find $E(3X^2 + 6X)$.

16. If X follows a Poisson distribution such that $P(X = 1) = P(X = 2)$, find $P(X = 4)$.
17. A random variable X has the density function $f(x) = e^{-x}$, $x \geq 0$. Show that Chebychev's inequality gives $P\{|X - 1| > 2\} < \frac{1}{4}$ while the actual probability is e^{-3} .
18. A balanced die is tossed 600 times. Find the lower bound for the probability of getting 80 to 120 sixes.

PART - D

(Answer any two questions. Each question carries 5 marks.)

19. Establish the following relationships.
- (a) $E[E(X|Y)] = E(X)$
- (b) $E[V(X|Y)] + V[E(X|Y)] = V(X)$
20. Derive the recurrence relation for the central moments of binomial distribution. Hence find its first four central moments.
21. Derive the expression for the even order central moments of a normal distribution.
22. State and prove Chebychev's inequality.

MODEL QUESTION PAPER

Fourth Sem. B.Sc. Degree Examination

Complementary Course: Statistics (Mathematics/Computer Science)

Paper: 4C04STA - Statistical Inference

Time: 3 Hrs

Maximum: 40 marks

(Use of calculators and Statistical tables are permitted.)

Part A: Short answer

Answer all the 6 questions (6 questions x 1 mark each=6 marks)

1. Define statistic.
2. Define statistical inference.
3. Write the m.g.f. of the mean of a random sample of size n taken from $N(\mu, \sigma)$.
4. Define consistency.
5. What are the sufficient conditions for a consistent estimator?
6. Define confidence coefficient.

Part B - Short essay

Answer any 6 questions (6 questions x 2 marks each=12 marks)

7. Find the mean of a random variable following chi square distribution with n degrees of freedom.
8. Prove that the ratio of the squares of two independent standard normal random variables is an F-random variable with (1,1) d.f.
9. A random sample of size n x_1, x_2, \dots, x_n is taken from a normal population $N(\mu, 1)$. Show that, $t = \frac{1}{n} \sum x_i^2$ is an unbiased estimator of $\mu^2 + 1$.
10. For a Poisson random variable with parameter λ , show that sample mean is the sufficient estimator for λ .
11. Obtain the MLE of a and b using n random samples taken from a rectangular population over the interval $[a-b, a+b]$.
12. Explain the method of moments.
13. Define type I and type II errors in testing of hypothesis.

14. Differentiate between simple and composite hypothesis.

Part C - Essay

Answer any 4 questions (4 questions x 3 marks each=12 marks)

15. State and prove the reproductive property of chi-square distribution
16. If S^2 is the variance of a random sample of size 10 taken from a normal population $N(\mu, 5)$. Find suitable values for a and b , so as $P(a < S^2 < b) = 0.95$.
17. A random sample of size 25 is taken from a normal population $N(\mu, 9)$. Determine a 95% confidence interval for μ .
18. Let p be the probability that a coin will fall head in a single toss in order to test $H_0 : p = \frac{1}{3}$ against $H_1 : p = \frac{3}{4}$. The coin is tossed 5 times and H_0 is rejected if more than 2 heads obtained. Find the size and power of the test.
19. A random sample of 10 boys had the following IQs 70,120,110,101,88,83,95,98,107,100. Do the data supports the assumption of a population mean I.Q. of 100?
20. Explain the method of chi-square test of independence of attributes.

Part D - Long essay

Answer any 2 questions (2 questions x 5 marks each=10 marks)

21. Write a short note on confidence interval. Derive confidence interval for the mean of a normal population when S.D. is known. In a sample of 532 individuals selected at random from a population, 89 have been found to have Rh-ve blood. Find an interval estimate of the proportion of individuals in the population with Rh-ve blood with 95% confidence.
22. State Neyman-Pearson Lemma. Use the lemma to find a most powerful test with significance level α for testing $H_0 : \mu = \mu_0$ against, $H_1 : \mu = \mu_1 (\mu_1 > \mu_0)$ using the random sample x_1, x_2, \dots, x_n drawn from $N(\mu, 3)$
23. Explain the uses of t-distribution and F-distribution in testing of hypothesis. Two independent groups of 10 children were tested to find how many digits they could repeat from memory after hearing them once. The results are as follows: Group A: 8 6 5 7 6 8 7 4 5 6
Group B: 10 6 7 8 6 9 7 6 7 7
Is the difference between the mean scores of the two groups significant?

24. Explain any two tests using chi-square distribution. The theory predicts the proportion of beans in the four groups A, B, C, and D should be 9:3:3:1. In an experiment among 1600 beans, the members in the four groups were 882,313,287 and 118. Does the experimental result support the theory?

MODEL QUESTION PAPER

First Sem. B.Sc. (CCSS) Degree Examination

Complementary Course: Statistics (Geography/Psychology)

Paper: 1C01STA (G&P) - **DESCRIPTIVE STATISTICS**

Time: 3 Hrs

Maximum: 40 marks

(Use of calculators and Statistical tables are permitted.)

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define primary data
2. Name two graphs to represent grouped frequency distribution
3. Write an example of a situation where harmonic mean is used
4. Write an expression for finding relative measure of dispersion
5. What do you mean by a sampling frame?
6. Define probability sampling.

Part B - Short essay

Answer any 6 questions (6 x 2 marks =12 marks)

7. What are the advantages of diagrammatic representation?
8. Explain in brief a pie chart
9. Compare AM, GM and HM
10. Explain partition values
11. Discuss the merits of standard deviation in measuring dispersion
12. What are the advantages of sampling over census?
13. Explain non- sampling errors
14. What are the uses of Lorenz Curve?

Part C - Essay

Answer any 4 questions (4 x 3 marks=12 marks)

15. Explain bar diagrams

16. Calculate median from the following data

Profits	:	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of companies:		4	12	24	36	20	16	8	5

17. Calculate mean deviation about mean of the following data

No. of units	:	20	40	60	80	100
No. of consumers :		9	18	27	32	45

18. Derive an expression for the central moments in terms of raw moments

19. Explain kurtosis

20. Explain various steps in data presentation

Part D – Long Essay

Answer any 2 questions (2 x 5 marks =10 marks)

21. Draw a histogram and frequency polygon

Class	:	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency:		7	10	20	13	17	10	14	9

22. Calculate all the quartiles, D_2 and P_{56}

X:	1	2	4	6	7	9	10
f(x):	20	23	17	10	5	3	1

23. The runs scored by two batsmen in 5 innings are given below. Find who is the more consistent batsman?

A:	25	50	45	30	70
B:	10	70	50	20	95

24. Explain simple, systematic and stratified random sampling methods.

MODEL QUESTION PAPER

Second Sem. B.Sc. (CCSS) Degree Examination

Complementary Course: Statistics (Geography/Psychology)

Paper: 2C02STA (G&P)- STATISTICAL METHODS

Time: 3 Hrs

Maximum: 40 marks

(Use of calculators and Statistical tables are permitted.)

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. What is a scatter diagram?
2. Write down the normal equations to fit the line $y = ax + b$.
3. Define correlation.
4. What is price relative?
5. Describe time series data.
6. Define Age Specific Death Rate.

Part B - Short essay

Answer any 6 questions (6 x 2 marks =12 marks)

7. Distinguish between positive and negative correlation
8. Describe the two regression lines.
9. Define cyclical variation.
10. Give the formula for Pasche's index number.
11. What are the uses of index numbers?
12. Describe chain base index number.
13. What do you mean by vital statistics?
14. Two regression coefficients are 1.5 and 0.2. Find the correlation coefficient r .

Part C - Essay

Answer any 4 questions (4 x 3 marks =12 marks)

15. Distinguish between simple and weighted index numbers with examples.
16. Explain the method for fitting a curve of the form $y = ab^x$.

17. Calculate Spearman's rank correlation coefficient for the following data

Marks in geo:	1	2	3	4	5	6	7	8	9	10
Marks in eco:	4	8	2	3	5	7	9	10	11	8

18. Explain cost of living index number.

19. Give two methods for the measurement of secular trend in a time series data.

20. Distinguish between crude death rate and standardised death rate.

Part D – Long Essay

Answer any 2 questions (2 x 5 marks =10 marks)

21. Explain the various components of time series

22. What are the different tests to be satisfied by a good index number? Show that Fisher's index number satisfies all of them.

23. From the following data given below find the regression line of X on Y. What is the suggested value of X when Y=6?

X:	2	3	4	5	6
Y:	3	5	4	8	9

24. Compute the Karl Pearsons correlation coefficient for the following data.

X:	60	48	36	52	41	58	13
Y:	75	51	39	55	49	62	17

MODEL QUESTION PAPER

Fourth Sem. B.Sc.(CCSS) Degree Examination

Complementary Course: Statistics (Geography/Psychology)

3C03STA: (G&P) PROBABILITY AND DISTRIBUTION THEORY

Time:3 hrs.

Max. Marks: 40

(Use of calculators and statistical tables are permitted.)

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Give the classical definition of Probability.
2. Distinguish between mutually exclusive events and independent events.
3. Define distribution function of a random variable.
4. Define characteristic function.
5. Define expectation of a random variable.
6. Establish the additive property of two independent binomial random variables.

Part B - Short essay

Answer any 6 questions (6 x 2 marks =12 marks)

7. There are 5 men and 6 women. Find the probability of selecting 5 of which
(a) Exactly 2 are women. (b) At least 2 women.
8. A discrete random variable X has the following probability distribution.ⁱ

X :	-1	0	1	2
f(x):	1/8	1/4	1/8	1/2

Find E(x).

9. If A and B are two events, then prove that $P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$
10. If X follows $N(20, 5)$, find $P(16 \leq X \leq 22)$.
11. Find the mean of Binomial distribution.
12. State and prove the additive property of Binomial distribution.
13. Derive the sampling distribution of sample mean.
14. Explain the uses of Chi-square distribution.

Part C - Essay

Answer any 4 questions (4 x 3 marks =12 marks)

15. State and prove addition theorem of Probability
16. If A and B are independent, Show that (a) A^1 and B are independent. (b) A and B^1 are independent (c) A^1 and B^1 are independent.
17. A random variable X has the following density function, find the distribution functions of X.

$$f(x) = \begin{cases} x/2 & \text{if } 0 \leq x < 1 \\ 1/2 & \text{if } 1 \leq x < 2 \\ 1/2(3-x) & \text{if } 2 \leq x < 3 \end{cases}$$

18. Find the m.g.f of Poisson distribution. Hence find its mean and variance.
19. Define chi-square, t and F-distributions
20. Discuss the inter-relationships among normal, chi-square, student's t and distributions.

Part D – Long Essay

Answer any 2 questions (2 x 5 marks =10 marks)

21. State and prove Bayes' theorem.
22. A random variable X has the following p.m.f.

X:	0	1	2	3	4	5	6	7
P(x):	0	k	2k	2k	3k	k^2	$2k^2$	$2k^2+k$

Find (a) k (b) $P(X < 6)$ (c) $P(X \geq 6)$ (d) $P(0 < X < 5)$ (e) $P(X > 7)$

23. Define Exponential distribution. State and prove lack of memory property of exponential distribution.
24. Fit a Binomial distribution for the following data.

x :	0	1	2	3	4
f(x) :	3	5	9	8	5

MODEL QUESTION PAPER

Fourth Sem. B.Sc. (CCSS) Degree Examination

Complementary Course: Statistics (Geography/Psychology)

Paper: 4C04STA (G&P)- Statistical Inference

Time: 3 Hrs

Maximum: 40 marks

(Use of calculators and Statistical tables are permitted.)

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define sufficient estimator.
2. Explain confidence coefficients.
3. Describe point estimation.
4. Define ANOVA.
5. Define critical difference.
6. Define experimental error.

Part B - Short essay

Answer any 6 questions (6 x 2 marks =12 marks)

7. Illustrate with an example that unbiased estimator is not unique.
8. Distinguish between point estimation and interval estimation.
9. A sample of size 1 is taken from a Poisson distribution with parameter θ . To test $H_0: \theta = \theta_0$ Vs $H_1: \theta = \theta_1$, find the most powerful test.
10. Distinguish between most powerful and uniformly most powerful tests.
11. Explain the procedure of testing the significance of population proportion based on large sample.
12. Explain chi square test for goodness of fit.
13. Define linear hypothesis.
14. Describe the assumptions in ANOVA.

Part C - Essay

Answer any 4 questions (4 x 3 marks each=12 marks)

15. Define sufficient statistics. Find the sufficient estimator of θ based on sample observations from $f(x, \theta) = (1/\theta)e^{-(x/\theta)}$, for $x > 0$ and zero otherwise.
16. Obtain the $100(1-\alpha)\%$ confidence interval for the population proportion.
17. Let p be the probability that a coin will fall head in a single toss, to test $H_0 : p = \frac{1}{3}$ against $H_1 : p = \frac{3}{4}$ the coin is tossed 5 times and H_0 is rejected if more than 2 heads obtained. Find the size and power of the test
18. A machinist is making engine parts with diameters of 0.7. A random sample of 10 shows a mean of 0.75 with a standard deviation of 0.04. Examine whether the work meet the specification.
19. Explain the method of chi-square test for significance of variance.
20. Describe the test procedure to conduct ANOVA.

Part D – Long Essay

Answer any 2 questions (2 x 5 marks =10 marks)

21. Write a short note on confidence interval. Obtain $100(1-\alpha)\%$ confidence interval for the difference of means of two normal populations when the variances are same.
22. State Neymaan-Pearson Lemma. Use the lemma to find a most powerful test with significance level α for testing $H_0 : \mu = \mu_0$ against, $H_1 : \mu = \mu_1 (\mu_1 > \mu_0)$ using the random sample of size n drawn from $N(\mu, 3)$
23. Explain the procedure for testing the equality of proportions of two distinct populations.
24. Explain any two tests using chi-square distribution. The theory predicts the proportion of beans in the four groups A, B, C, and D should be 9:3:3:1. In an experiment among 1600 beans, the members in the four groups were 882,313,287 and 118. Does the experimental result support the theory?

MODEL QUESTION PAPER

SEMESTER B.Sc STATISTICS(CCSS) PROGRAMME

Open Course : **Statistics**

Paper : **5 D 01 STA BASICS OF STATISTICS**

Time: 2 hrs

Max. Marks: 20

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Distinguish between population and sample?
2. What are the objectives of classification?
3. Define median. Find median of the following data?
20, 30, 25, 15, 18, 36, 48, 50, 60, 70, 34
4. What are the relative measures of dispersion?
5. What are the different measures of central tendency?
6. Describe what is meant by tabulation?

Part B - Short Essay

Answer any 4 questions (4 x 2 marks =8 marks)

7. What are the functions of statistics?
8. Describe frequency distribution?
9. Write short notes on the following
(i) Quartile deviation (ii) Coefficient of variation
10. What are the properties to be satisfied by a good average? On the basis of these, which is the best average?
11. Describe manifold classification with the help of an example.
12. Describe different methods of data collection.

Part C - Essay

Answer any 6 questions (1 x 6 marks=6 marks)

13. What are the principal steps in the planning and execution of a sample survey?
14. Compute arithmetic mean, median and mode from the following data and verify the relation between them?

Class	: 0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	: 2	4	10	15	22	18	12	8	5	4

MODEL QUESTION PAPER

FIFTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME

Open Course: **Statistics**

Paper: 5D02STA SAMPLING TECHNIQUES

(Use of calculators and Statistical tables are permitted)

Time: 2 hrs

Max. Marks: 20

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Define sampling error. What are the sources of sampling error?
2. Describe different methods of sampling.
3. Distinguish between SRSWR and SRSWOR.
4. What are the functions of CSO?
5. When and where ISI start functioning?
6. What is the role of ICMR in the development of nation?

Part B - Short essay

Answer any 4 questions (4 x 2 marks =8 marks)

7. Distinguish between primary and secondary data.
8. Describe different methods of selecting a simple random sample.
9. Describe stratified random sampling and mention its applications.
10. Distinguish between linear and circular systematic sampling.
11. Describe multistage sampling.
12. What are the functions of NSSO?

Part C- Essay

Answer any 1 question (1 x 6marks =6 marks)

13. Explain the principal steps to conduct a well executed sample survey.
14. Explain different methods of allocations in stratified sampling.

MODEL QUESTION PAPER
FIFTH SEMESTER B.Sc STATISTICS (CCSS) PROGRAMME
Open Course: **Statistics**
Paper: 5D03STA **Computer Oriented Data Analysis**

(Use of calculators and Statistical tables are permitted)

Time: 2 hrs

Max. Marks: 20

Part A: Short answer

Answer all the 6 questions (6 x 1 mark =6 marks)

1. Explain what do you mean by simple random sampling?
2. Define frequency distribution?
3. Name EXCEL function used for mean and standard deviation for a raw data.
4. Distinguish between census and sample survey methods for collection of data.
5. Explain the role of stratifying factor.
6. What do you mean by a questionnaire?

Part B - Short essay

Answer any 4 questions (4 x 2 marks =8 marks)

7. Mention different types of classification. What are the objectives of classification?
8. Explain the important merits and demerits of Arithmetic Mean as an average
9. Name SPSS menu and Sub Menus used for finding mean, median, mode and standard deviation for a frequency distribution
10. Distinguish between subdivided and multiple bar diagrams.
11. Explain the functions of statistics?
12. Distinguish between primary and secondary data. How will you collect primary data?

Part C- Essay

Answer any 1 question (1 x 6 marks =6 marks)

13. Define mean and standard deviation for a frequency distribution. Find the mean, median, mode and standard deviation from the following frequency distribution

Life in hours	0-15	15-30	30-45	45-60	60-75	75-90
No of units	14	29	41	46	33	17

14. Explain how SPSS and EXCEL are useful in statistical data analysis. What are the advantages of one over the other?