



Re-Accredited by NAAC with 'A Grade' Affiliated to Mahatma Gandhi University Centre of Excellence under Govt. of Kerala Identified by UGC as College with Potential for Excellence

POST GRADUATE AND RESEARCH **DEPARTMENT OF STATISTICS**



Under Graduate Curriculum and Syllabus (Choice Based Credit Semester System)

Complementary Course

For 2020 Admission Onwards



MAHARAJA'S COLLEGE ERNAKULAM

(A Government Autonomous College affiliated to Mahatma Gandhi University)

CURRICULUM AND SYLLABUS - 2020 ADMISSION ONWARDS

Syllabus of various Undergraduate Courses offered by Department of Statistics

(Statistics department do not offer any Undergraduate Programme separately)

PREFACE

The meeting of the Board of Studies of the Dept. of Statistics, Maharaja's College held on 23.9.2019 at the Dept. Staff Room at 11.00 am recommended refinements in the existing syllabus (2016 syllabus) of the courses for the BSc Mathematics, BSc Physics and BA Economics and BA Economics (Hons.). Recommendations were to address the content, to correct the sequential ordering of the topics to improve course structure.

The following members were present for the meeting.

- 1. Dr. James Kurian, Head and Chairman of the Board of Studies, Dept. of Statistics
- 2. Dr. Sebastian George., Subject expert (External Member)
- 3. Dr. Smitha S, Subject expert (External Member)
- 4. Dr. Jayamol K.V. R., Internal member
- 5. Dr. Angel Mathew, Internal member
- 6. Dr. Priya P. Menon., Internal member
- 7. Dr. Merlymole Joseph K., Internal member
- 8. Dr. Bismi. G. Nadh, Internal member
- 9. Dr. Maya S.S., Internal member

Recommendations/Decisions of the Board of Studies were the following:

1. For the paper STA3CMM03 Probability distributions existing fourth module completely deleted. Instead of the deleted module the new first module in the syllabus contains correlation regression and curve fitting.

2. For the paper, 'Theory of Random Variables' STA2CMM02, the fourth module changes. In the new syllabus fourth module contains expectations, m.g.f. and characteristic functions.

3. For the paper STA4CMP04 'Statistical inference and random process' slight changes for the fourth module suggested is accepted.

4. For the paper ECH4COR15 'Operations Research', slight changes in all modules suggested is accepted.

I sincerely thank Dr. Sebastian George, Dr. Smitha S., Dr. Jayamol K.V., Dr. Angel Mathew, Dr. Priya P. Menon., Dr. Merlymole Joseph K, Dr. Bismi. G. Nadh, and Dr. Maya S.S. for their valuable suggestions/recommendations in modifying the syllabus. Also, I wish to express my thanks to my colleague Sri. Sujith P. for great efforts in preparing the syllabus in the light of the suggestions of the Board of Studies and Dr. Bismi. G. Nadh for coordinating the workshop. Also, I am thankful to Dr. Krishnakumar K., Member Secretary, Academic Council, Maharaja's College for the necessary directions in drafting the new syllabus.

Dr. James Kurian

Head & Chairman of the Board of Studies Dept. of Statistics Maharaja's College, Ernakulam

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Maharaja's College, Ernakulam (A Government Autonomous College)

(A Government Autonomous College) Affiliated to Mahatma Gandhi University, Kottayam Department of Statistics 2020 Admission Onwards Board of Studies in Statistics

SI. No.	Name of Member	Designation
1	Dr. James Kurian	Chairman, BoS Statistics
2	Dr. Sankaran PG	External Member
3	Dr. Sebastian George	External Member
4	Dr. Jineesh K. James	External Member [Industry]
5	Dr. Smitha S	External Member [Alumni]
6	Dr. Jayamol K.V.	Internal Member
7	Dr. Angel Mathew	Internal Member
8	Dr. Priya P Menon	Internal Member
9	Dr. Merlymole Joseph K.	Internal Member
10	Dr. Bismi G Nadh	Internal Member
11	Dr. Maya S.S.	Internal Member
12	University Nominee	

MAHARAJA'S COLLEGE, ERNAKULAM (A GOVERNMENT AUTONOMOUS COLLEGE) REGULATIONS FOR UNDER GRADUATE PROGRAMMES

UNDER CHOICE BASED CREDIT SYSTEM 2020

1. TITLE

1.1. These regulations shall be called "MAHARAJA'S COLLEGE (AUTONOMOUS) REGULATIONS FOR UNDER GRADUATE PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM 2020"

2. SCOPE

- 2.1 Applicable to all regular Under Graduate Programmes conducted by the Maharaja's College with effect from 2020 admissions
- 2.2 Medium of instruction is English except in the case of language courses other than English unless otherwise stated therein.
- 2.3 The provisions herein supersede all the existing regulations for the undergraduate programmes to the extent herein prescribed.

3. **DEFINITIONS**

- **3.1.** *'Academic Week'* is a unit of five working days in which the distribution of work is organized from day one to day five, with five contact hours of one-hour duration on each day.
- **3.2. 'Choice Based Course**' means a course that enables the students to familiarize the advanced areas of core course.
- **3.3.** *'College Coordinator'* is a teacher nominated by the College Council to co-ordinate the continuous evaluation undertaken by various departments within the college. He/she shall be nominated to the college level monitoring committee.
- 3.4. *Common Course I'* means a course that comes under the category of courses for English.
- **3.5.** *'Common Course II'* means additional language.

Complementary Course' means a course which would enrich the study of core courses.

3.6. *'Core course'* means a course in the subject of specialization within a degree programme. It includes a course on environmental studies and human rights.

- **3.7.** *Course*' means a portion of a subject to be taught and evaluated in a semester (similar to a paper under annual scheme).
- **3.8.** *'Credit'* is the numerical value assigned to a paper according to the relative importance of the syllabus of the programme.
- **3.9.** *Department* 'means any teaching department in a college.
- **3.10.** *'Department Coordinator'* is a teacher nominated by a Department Council to coordinate the continuous evaluation undertaken in that department.
- 3.11. 'Department Council' means the body of all teachers of a department in a college.
- 3.12. *'Faculty Advisor'* means a teacher from the parent department nominated by the Department Council, who will advise the student on academic matters.
- **3.13.** *Grace Marks* shall be awarded to candidates as per the University Orders issued from time to time.
- **3.14.** *'Grade'* means a letter symbol (A, B, C, etc.), which indicates the broad level of performance of a student in a Paper/Course/ Semester/Programme.
- **3.15.** *'Grade Point'* (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.
- **3.16. 'Parent Department'** means the department which offers core course/courses within an undergraduate programme.
- **3.17.** *'Programme'* means a three year programme of study and examinations spread over six semesters, the successful completion of which would lead to the award of a degree.
- **3.18.** 'Semester' means a term consisting of a minimum **90** working days, inclusive of tutorials, examination days and other academic activities within a period of six months.
- **3.19.** *'Vocational Course'* (Skill Enhancement Course) means a course that enables the students to enhance their practical skills and ability to pursue a vocation in their subject of specialization.

4. ELIGIBILITY FOR ADMISSION AND RESERVATION OF SEATS

4.1 Eligibility for admissions and reservation of seats for various Undergraduate Programmes shall be according to the rules framed by the University/ State Government in this regard, from time to time.

5. **DURATION**

- 5.1 The duration of U.G. programmes shall be *6 semesters*.
- **5.2** There shall be two Semesters in an academic year, the "ODD" semester commences in June and on completion, the "EVEN" Semester commences. There shall be two months' vacation during April and May.
- **5.3** No student shall be allowed to complete the programme by attending more than 12 continuous semesters.

6. **REGISTRATION**

- **6.1.** The strength of students for each programme shall be as per the existing orders, as approved by the University.
- **6.2.** Those students who possess the required minimum attendance during a semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next class.

7. SCHEME AND SYLLABUS

- 7.1. The U.G. programmes shall include (a) Common Courses I and II, (b) Core Course(s), (c) Complementary/Vocational Courses, and (d) Choice based course.
- **7.2.** There shall be Two Choice Based course (Elective Course) in the fifth and sixth semesters. In the case of B. Com Programme there shall be an elective stream from third semester onwards.
- **7.3.** Credit Transfer and Accumulation system can be adopted in the programme. Transfer of Credit consists of acknowledging, recognizing and accepting credits by an institution for programmes or courses completed at another institution. The Credit Transfer Scheme shall allow students pursuing a programme in one college to continue their education in another college without break.

- 7.4. A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass for a course. For a pass in a programme, a separate minimum of Grade D is required for all the individual courses. If a candidate secures F Grade for any one of the courses offered in a Semester/Programme, only F grade will be awarded for that Semester/Programme until he/she improves this to D Grade or above within the permitted period. The college shall allow credit transfer, subject to the approval of the concerned board of studies and Academic Council.
- **7.5.** Students discontinued from previous regulations CBCSS 2016, can pursue their studies under the new regulation "Regulations for Under Graduate Programmes under Choice Based Credit System 2020" after obtaining readmission.
- **7.6.** The practical examinations (external/internal) will be conducted only at the end of even semesters for all programmes. Special sanction shall be given for those programmes which need to conduct practical examinations at the end of odd semesters.

8. **PROGRAMME**

STRUCTURE Model I/II

BA/B.Sc.

а	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the	120
	Programme	
c	Credits required from Common Course I	22
d	Credits required from Common Course II	16
e	Credits required from Core course and Complementary courses	74
	including Project	
f	Choice Based Core Course	8
g	Minimum attendance required	75%

Model I or Model II B. Com

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120
c	Credits required from Common Course I	14
d	Credits required from Common Course II	8
e	Credits required from Core and Complementary/Vocational courses including Project	90
f	Choice Based Core Course	8
g	Minimum attendance required	75%

Model III B.A/B.Sc./B. Com

а	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the Programme	120
с	Credits required from Common Course I	8
d	Credits required from Core + Complementary + Vocational Courses including Project	109
e	Open Course	3
f	Minimum attendance required	75%

B.A Honours

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the	120
	Programme	
с	Credits required from Common Course I	16
d	Credits required from Common Course II	8
e	Credits required from Core + Complementary + Vocational	93
	Courses including Project	
f	Choice Based Core Course	8
g	Minimum attendance required	75%

9. EXAMINATIONS

- 9.1 The evaluation of each paper shall contain two parts:
 - i. Internal or In-Semester Assessment (ISA)
 - ii. External or End-Semester Assessment (ESA)
- **9.2.** The internal to external assessment ratio shall be 1:4. Both internal and external marks are to be rounded to the next integer.

All papers (theory & practical), grades are given **on a 7-point scale** based on the total percentage of marks, (*ISA+ESA*) as given below:-

Percentage of Marks	Grade	Grade Point
95 and above	S Outstanding	10
85 to below 95	A ⁺ Excellent	9
75 to below 85	A Very Good	8
65 to below 75	B ⁺ Good	7
55 to below 65	B Above Average	6
45 to below 55	C Satisfactory	5

35 to below 45	D Pass	4
Below 35	F Failure	0
	Ab Absent	0

10. CREDIT POINT AND GRADE POINT

AVERAGE Credit Point (CP) of a paper is calculated

using the formula:- $CP = C \times GP$, where C is the Credit

and GP is the Grade point

Semester Grade Point Average (SGPA) of a Semester is calculated using the formula:-

SGPA = *TCP/TC*, where *TCP* is the Total Credit Point of that semester. **Cumulative Grade Point Average (CGPA)** is calculated using the formula:-

CGPA = *TCP/TC*, where *TCP* is the Total Credit Point of that programme. **Grade Point Average (GPA)** of different category of courses viz. Common Course I, Common Course II, Complementary Course I, Complementary Course II, Vocational course, Core Course is calculated using the formula:-

GPA = *TCP/TC*, where *TCP* is the Total Credit Point of a category of

course. TC is the total credit of that category of course

Grades for the different courses, semesters and overall programme are given based on the corresponding CPA as shown below:

GPA	Grade
9.5 and above	S Outstanding
8.5 to below 9.5	A+ Excellent
7.5 to below 8.5	A Very Good
6.5 to below 7.5	B+ Good
5.5 to below 6.5	B Above Average

4.5 to below 5.5	C	Satisfactory
3.5 to below 4.5	D	Pass
Below 3.5	F	Failure

11. MARKS DISTRIBUTION FOR EXTERNAL AND INTERNAL EVALUATIONS

The external theory examination of all semesters shall be conducted by the college at the end of each semester. Internal evaluation is to be done by continuous assessment. For all courses without practical total marks of external examination is 80 and total marks of internal evaluation is 20. Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

11.1 For all courses without practical

- 1.a) Marks of external Examination : 80
- **1.b)** Marks of internal evaluation : 20

Components of Internal Evaluation of theory	Marks
Attendance	5
Assignment /Seminar/Viva	5
Test papers (2x5=10) (Marks of test paper shall be average)	10
Total	20

11.2 For all courses with practical total marks for external evaluation is 60 and total marks for internal evaluation is 15.

For all courses with practical

2.a)	Marks of external Examination	:	60
2.b)	Marks of internal evaluation	:	15

Components of Internal Evaluation	Marks
Attendance	5

Seminar/Assignments/Viva	2
Test paper (2x4)	8
Total	15

c. For practical examinations total marks for external evaluation is 40 for internal evaluation is 10

Components of Internal Evaluation (Practicals)	Marks
Attendance	2
Test (1x4)	4
Record*	4
Total	10

*Marks awarded for Record should be related to number of experiments recorded

11.3 Project Evaluation

Components of Project evaluation	Marks
Internal Evaluation*	20
Dissertation (end semester)	50
Viva Voce (end Semester)	30

Components of Project Internal evaluation *

Components of internal evaluation	Marks
Relevance and Contents	5
Analysis and Presentation	5

Presubmission Presentation and viva	10	
		I.

*Marks awarded for Record should be related to number of experiments recorded and duly signed by the teacher concerned in charge.

All three components of internal assessments are mandatory.

11.3 For projects

3. a)	Marks of external evaluation	:	80
3.b)	Marks of internal evaluation	:	20

c)

Components of External Evaluation of Project	Marks	
Dissertation (External)	50	
Viva-Voce (External)	30	
Total	80	

*Marks for dissertation may include study tour report if proposed in the syllabus.

Components of Internal Evaluation of Project	Marks		
Punctuality	5		
Experimentation/data collection	5		
Knowledge	5		
Report	5		
Total	20		

Attendance Evaluation for all papers

% of attendance	Marks	
90 and above	5	
85 - 89	4	
80-84	3	
76-79	2	

7	5	1

(Decimals are to be rounded to the next higher whole number)

13. ASSIGNMENTS

Assignments are to be done from 1^{st} to 6^{th} Semesters. At least one assignment should be done in each semester for all courses.

14. SEMINAR/VIVA

A student shall present a seminar in the 5th semester for each paper and appear for Viva-voce in the 6th semester for each course.

15. INTERNAL ASSESSMENT TEST PAPERS

Two test papers are to be conducted in each semester for each course. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for one year and shall be made available for verification. The responsibility of evaluating the internal assessment is vested on the teacher(s), who teach the course.

15.1 Grievance Redressal Mechanism

Internal assessment shall not be used as a tool for personal or other type of vengeance. A student has all rights to know, how the teacher arrived at the marks. In order to address the grievance of students, a three-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1: Department Level:

The Department cell chaired by the HOD, Department Coordinator, Faculty Advisor and Teacher in-charge as members.

Level 2: College level

A committee with the Principal as Chairman, College Coordinator, HOD of concerned Department and Department Coordinator as members.

The College Council shall nominate a Senior Teacher as coordinator of internal evaluations. This coordinator shall make arrangements for giving awareness of the internal evaluation components to students immediately after commencement of I semester **15.2** The internal evaluation marks/grades in the prescribed format should reach the Controller of Examination before the 4th week of October and March in every academic year.

16. External Examination

The external theory examination of all semesters shall be conducted by the Controller of Examinations at the end of each semester.

16.1 Students having a minimum of 75% average attendance for all the courses only can register for the examination. Condonation of shortage of attendance to a maximum of 10 days in a semester subject to a maximum of 2 times during the whole period of the programme may be granted by the subcommittee of the college council on valid grounds. This condonation shall not be counted for internal assessment. Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also. Those students who are not eligible even with condonation of shortage of attendance shall repeat the **semester** along with the next batch after obtaining readmission upon the recommendations of the head of the department and college council

16.2 All students are to do a **project in the area of core course.** This project can be done individually or in groups (not more than three students). for all subjects which may be carried out in or outside the campus. The projects are to be identified during the V semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the College.

16.3 There shall be supplementary exams only for fifth semester. Notionally registered candidates can also apply for the said supplementary examinations. For reappearance/ improvement for other semesters the students can appear along with the next batch.

16.4 A student who registers his/her name for the external exam for a semester will be eligible for promotion to the next semester.

- **16.5** A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.
- **16.6** A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the external examination for the same semester, subsequently. **There shall be no improvement for internal evaluation**.
- 17. All courses shall have unique alphanumeric code.

18. PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. She/he shall also submit a detailed scheme of evaluation along with the question paper. A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.

Pattern of Question Papers

Sl. No.	Pattern	Marks	Choice of questions	Total marks
1	Short Answer/problem type	2	10/12	20
2	Short essay/problem	5	6/9	30
3	Essay/problem	15	2/4	30
Total				80

(a) Without practical

(b) With practical

Sl. No.	Pattern	Marks	Choice of questions	Total marks
1	Short Answer/problem type	1	10/12	10
2	Short essay/problem	5	6/9	30
3	Essay/problem	10	2/4	20
			Total	60

Each BoS shall specify the length of the answers in terms of number of words. Pattern of questions for external examination of practical papers will decided by the concerned Board of Studies/Expert Committees.

19. MARK CUM GRADE CARD

The College shall issue to the students a MARK CUM GRADE CARD on completion of the programme.

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% are required for a pass for a paper. For a pass in a programme, a separate minimum of **Grade D** is required for all the individual papers. If a candidate secures **F Grade** for any one of the paper offered in a Semester/Programme only F grade will be awarded for that Semester/Programme until he/she improves this to **D GRADE** or above within the permitted period.

- **20.** There shall **be 2 level monitoring** committees for the successful conduct of the scheme. They are -
- **1.** Department Level Monitoring Committee (DLMC), comprising HOD and two senior- most teachers as members.
- College Level Monitoring Committee (CLMC), comprising Principal, Secretary Academic Council, College Council secretary and A.A/Superintendent as members.

COURSE STRUCTURE

Syllabus of various undergraduate course that offered by Department of Statistics

1. Complementary Courses for BSc. Mathematics

I Semester – Complementary Course for BSc. Mathematics

STA1CMM01 - BASIC STATISTICS

COURSE OUTCOME

- CO1. Students acquire an understanding about different kinds of data, their analysis and representation. They could also apply various sampling techniques in real life situations and know about the methods of generalization from sample to population.
- CO2. The students become acquainted with the fundamental properties of data like central tendency, dispersion, skewness and kurtosis. With these they could summarize a large mass of data to a meaningful form.
- CO3. The students are exposed to statistical tools like index numbers which are very much useful to understand the general pulse of economy.

Module I

Introduction to Statistics, Population and Sample, Collection of Data, Census and Sampling. Methods of Sampling – Simple Random Sampling (with and without replacement)– Stratified sampling – Systematic sampling (Method only), Types of data – quantitative and qualitative, Levels of measurement, Classification and Tabulation, Frequency Table, Diagrammatic representation of data-Bar diagrams and Pie diagram, Graphical representation of frequency distributions- Histogram, Frequency curve and Ogives.

Module II

Measures of Central Tendency – Mean; Median; Mode; Geometric Mean; Harmonic Mean, Partition values- Quartiles, Deciles, Percentiles, Identification of partition values from Ogives, Box Plot, Stem and leaf chart, Absolute and Relative measures of Dispersion – Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation.

Module III

Moments- Raw Moments, Central Moments, Inter Relationships (First Four Moments), Skewness-Measures of Skewness – Pearson's, Bowley's and Moment Measure; Kurtosis- Measures of Kurtosis – Moment Measure, Measure based on partition values.

Module IV

Index Numbers – definition, limitations, Uses, Simple Index Numbers; Weighted Index Numbers – Laspeyer's, Paasche's, Marshall-Edgeworth and Fisher's Index Numbers, Time reversal test and factor reversal test, Construction of Index Numbers, Cost of Living Index Numbers – Family Budget Method, Aggregate Expenditure Method.

Reference Books

- 1) Gupta S.P. (2011) Statistical Methods, Sultan Chand & Sons Delhi.
- 2) Gupta S.C. and Kapoor V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- 3) Agrawal B.L. (2012) Basic Statistics, Anshan Publishers
- 4) Parimal Mukhopadhya (2002) Mathematical Statistics, New Central Book Agency (P) Ltd, Calcutta
- 5) Murthy M.N. (1967) Sampling theory and Methods, Statistical Publishing Society, Calcutta.

CO No.	Objective	Module
C01	Understanding about different kinds of data, their analysis and representation. They could also apply various sampling techniques in real life situations and know about the methods of generalization from sample to population	1
CO2	Acquainted with the fundamental properties of data like central tendency, dispersion, skewness and kurtosis. With these they could summarize a large mass of data to a meaningful form	2,3
CO3	statistical tools like index numbers which are very much useful to understand the general pulse of economy	4

BLUE PRINT

SEMESTER I: PROGRAMME BSc. Mathematics Comp. Course for BSc. Mathematics: 7 COURSE CODE: STA1CMM01 COURSE TITLE: BASIC STATISTICS

Module	Hrs	Part A	Part B	Part C	Total questions
1	10	3	2	1	6
2	15	3	2	1	6
3	10	3	2	1	6
4	12	3	3	1	7

MODEL QUESTION PAPER

B.Sc Degree (C.B.C.S.) Examination

First Semester

Programme – B.Sc Mathematics

STA1CMM01 - **Basic Statistics**

Time : Three hours

Maximum : 80 Marks

(Use of scientific calculator permitted)

Part A

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

- 1. Differentiate between absolute and relative measures of dispersion
- 2. What is a pie diagram?
- 3 .Discuss the effect of change of origin and scale on central moments.
- 4. What is meant by classification of data?
- 5. Give the expression for the combined mean and combined variance when two groups are combined together.
- 6. A car travels at a speed of 40 km/hr for 15 km, then it travels at 80 km/hr for the next 50 km and finally travels at 20 km/hr for 5 km. Use an appropriate average to find the average speed of the car.
- 7 . Define Laspayer's index number
- 8. Index numbers are called economic barometers. Why?
- 9. Distinguish between class limits and class boundaries
- 10.Write one measure of kurtosis
- 11. What are percentiles?
- 12. What are ogives?

(10x2=20)

Part B

(Answer any six Questions . Each question carries 5 marks)

13. Explain different measures of dispersion

14. Find Arithmetic mean	n.
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Class	:	0-10	10-20	20-30	30-40
Frequenci	es :	8	10	15	12

15. What do you mean by secondary data? What are its sources?

- 16. Explain various steps in the construction of index number. Explain the uses of index numbers
- 17. Find simple AM index number

Commodity	Α	В	С	D
\mathbf{P}_0	40	45	90	100
\mathbf{P}_1	45	50	110	115

18. Explain systematic sampling and state its merits

19. Explain Sheppard's correction

21. The first four moments of a data about 4 are -1.5,17,-30, 108. Find the first four moments about i)

zero ii) 3

(6x5=30)

Part C

(Answer any two questions. Each question carries 15 marks)

(b) Calculate Standard deviation

Class	0-10	10-20	20-30	30-40
Frequencies	15	18	24	28

23.Calculate the median of the data

Class :	0-10	10-20	20-30	30-40	40-50
Frequencies :	3	9	15	30	18

Draw the cumulative frequency curve and read off the value of the median from it

24. Obtain a measure of skewness for the following data

25. Outline the method of constructing cost of living index number. Find cost of living index

number for the following data.

Expense on	Food 40%	Rent 10%	Cloth 15%	Fuel 15%	Other 20%
Price2012(P ₀)	50	25	70	20	35
Price2014(P ₁)	45	30	60	25	45

(2x15=30)

^{20.} Explain kurtosis

^{22 (}a)Write note on Standard deviation. State its merits.

II Semester – Complementary Course for BSc. Mathematics STA2CMM02 - THEORY OF RANDOM VARIABLES

COURSE OUTCOME

- CO1. Students could acquire a thorough understanding of probability theory which forms the foundation of statistics. They also acquire an understanding of the meaning and theory of random variables.
- CO2. Students could understand the bivariate data, nature and degree of their relationship and their analysis. They become familiar with the method of curve fitting for the bivariate data.
- CO3. Students could acquire a deep knowledge on concept of mathematical expectation and its applications in statistics and probability.

Hours per week 4

Module I

Probability concepts-Random Experiment, Sample space, Events, Probability measure, Different definitions of probability- Classical, Statistical and Axiomatic definitions, Addition theorem (upto three events), Conditional probability, Independence of events, Multiplication theorem (upto three events), Total Probability law, Baye's Theorem and its applications.

Module II

Random Variables-Discrete and Continuous, Probability Distributions- Probability Mass Function, Probability Density Function and Cumulative (distribution) function and their properties, Change of variables (Univariate only), Jacobian of transformation.

Module III

Bivariate random variables-Definition- Discrete and Continuous, Joint Probability Density Functions, Marginal and Conditional Distributions, Independence of Random Variables.

Module IV

Mathematical Expectation, Expectation of a Random Variable, Moments in terms of Expectations, Moment Generating Functions (m.g.f.) and its properties. Characteristic Functions and its simple properties, Conditional Expectations

Core Reference

- 1. John E. Freund: Mathematical Statistics, Prentice Hall of India
- 2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons
- 3. S.P. Gupta: Statistical Methods, , Sultan Chand and Sons, New Delhi

Additional References

1. V.K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

- 2. Mood A.M., Graybill F.A. and Boes D.C. Introduction to Theory of Statistics, McGraw Hill.
- 3. B.R. Bhat, Modern Probability Theory, New Age International (p) Ltd.

CO. No.	Objective	Module
CO1	Understand of probability theory which forms the foundation of statistics. Understand of the meaning and theory of random variables	1,2
CO2	Understand the bivariate data, nature and degree of their relationship and their analysis. Familiar with the method of curve fitting for the bivariate data	3
CO3	Acquire a deep knowledge on concept of mathematical expectation and its applications in statistics and probability	4

BLUE PRINT

SEMESTER II: PROGRAMME B.Sc. Mathematics Comp. Course for B.Sc. Mathematics: COURSE CODE: STA2CMM02 COURSE TITLE: THEORY OF RANDOM VARIABLES

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions
1	12	3	3	1	7
2	13	3	2	1	6
3	11	3	2	1	6
4	11	3	2	1	6

MODEL QUESTION PAPER B.Sc Degree (C.B.C.S.) Examination Second Semester Programme – B.Sc Mathematics STA2CMM02 - Theory of Random Variables

Time Three Hours

Maximum: 80 Marks

(Use of scientific calculator permitted)

Part A

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

1 Explain random variable

- 2 Explain probability density function
- 3 Define random experiment
- 4. Write statistical definition of probability
- 5. State addition theorem of probability
- 6 Define joint probability mass function
- 7. Define conditional expectation
- 8. Explain distribution function of a random variable What are the properties of distribution function?
- 9. Write note on independence of two random variable
- 10. A box contains 4 white balls, 3 green balls and 3 red balls .Three balls are chosen randomly. What is the probability of getting i) 1 green and 2 red ii) 1 red and 2 white
- 11. f(x) = x / 15 x = 1.2.3.4,5 Find F(x)
- 12. P(A)=.4 P(AB)=.5 Is this statement consistent? Why?

(10x2=20)

Part B

(Answer any six Questions. Each question carries 5 marks)

13. f(x,y) = 2 0<x<y<1

Find marginal distributions and conditional distribution of X given Y

- 14. $f(x) = c(2/3)^x$ x=1,2,.... Find 1) c 2) P(X>3)
- 15. $f(x) = e^{-x}$ x>0 Find p.d.f of Y = 3X-7
- 16. State and prove multiplication theorem of probability
- 17. State and prove Baye's theorem
- 18. Find p.d.f of $Y = X^2$ X -2 -1 0 1 2 P(x) 1/5 1/5 1/5 1/5 1/5 1/5

19. For a random variable X, $2 \log(M_X(t)) = 30t + 9 t^2$. Find its mean, variance and third central moment.

20. The joint pdf of (X,Y) is

 $f(x,y) = Ax^3/y$, $0 \le x \le 2$, $1 \le y \le 5$. Find (1) A (2) Marginal pdf's of X and Y

21. If the pdf of a Random variable is $f(x) = me^{-mx}$, x > 0, m > 0. Find its moment generating

function. Hence find its mean and variance .

(6x5=30)

Part C

(Answer any two questions. Each question carries 15 marks)

22 i) State and prove addition theorem of probability for three events

ii)Two bags B₁ and B₂ contains 8 white and 6 black balls,7 white and 10black balls respectively. One ball is randomly transferred from B₁ and B₂ and a ball is drawn from B₂.What is the probability that it is white?

23. Find conditional density of X/ Y=1 Examine whether X and Y are independent

Х	1	2	3
У			
1	.1	.1	.2
2	.2	.3	.1

24. (1) Define conditional variance

(2) Show that for two random variabl;es X and Y

 $(E(XY))^2 \leq E(X^2) E(Y^2)$

25. Two random variables have the joint pdf f(xy) = x+y, 0 < x < y < 1

Find (1) $E(X^2Y^2)$ (2) $E(X^2)$ (3) Corr(X,Y) and examine whether X and Y are independent.

(2x15=30)

III Semester – Complementary Course for Mathematics

STA3CMM03 - PROBABILITY DISTRIBUTIONS

COURSE OUTCOME

- CO1. Students could acquire a deep knowledge on correlation and regression
- CO2. Provide a solid introduction to well known discrete distributions.
- CO3. It is aimed that students be acquainted with most frequently used continuous distributions and their important properties.
- CO4. Enables students to understand limit theorems.

Module I

Introduction to Bivariate data; Scatter Diagram, Correlation – Karl Pearson coefficient of correlation and Spearman Rank correlation. Method of Least Squares; Curve Fitting ; Fitting of Straight Lines, Second Degree Equation, Exponential Curve, Power Curve,; Linear Regression- Fitting, identification of the regression lines and properties of the regression coefficients. Partial and Multiple correlations (definition only)

Module II

Discrete Probability Distributions – Uniform: Geometric; Bernoulli; Binomial; Poisson; Hypergeometric; Fitting of Distributions (Binomial and Poisson). Properties – Mean, Variance, Moment Generating Functions, Additive property; Recurrence relation for moments (binomial and Poisson), Lack of memory property of Geometric distribution.

Module III

Continuous distributions – Uniform, Exponential, Gamma, Beta (type I and II), Normal; Standard Normal – definitions, Cauchy Distribution (definition only), Mean, Variance, Moment Generating Function, Additive property, Lack of memory property of exponential distribution, Fitting of Normal distribution, Use of Standard Normal Tables for Computation of Various Probabilities.

Module IV

Tchebycheff's Inequality and its applications, Weak Law of Large Numbers, Bernoulli's Law of Large Numbers, Central Limit Theorem- Lindberg-Levy form.

Reference Books

- 1) Gupta S.C. and Kapoor V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- Hogg, R.V. and Craig A.T. (1970) Introduction to Mathematical Statistics, Amerind Publishing Co, Pvt. Ltd.
- 3) Rohatgi V. K. (1976) An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
- Mood A.M., Graybill F.A. and Boes D.C. (2001) Introduction to Theory of Statistics,3rd edition McGraw Hill
- Miller I. and Miller M. (2014) John E. Freund's Mathematical Statistics with applications, 8thEdn. Pearson Education
- Johnson, N.L, Kotz, S. and Balakrishnan N. (1994) Continuous Univariate Distribution, John Wiley, New York.

CO No.	Objective	Module
CO1	Acquire a deep knowledge on correlation and regression	1
CO2	Provide a solid introduction to well known discrete distributions	2
CO3	Acquainted with most frequently used continuous distributions and their important properties	3
CO4	Understand limit theorems in Statistics	4

BLUE PRINT

SEMESTER III: PROGRAMME B.Sc. Mathematics Comp. Course for B.Sc. Mathematics: COURSE CODE: STA3CMM03 COURSE TITLE: PROBABILITY DISTRIBUTIONS

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions
1	12	3	3	1	7
2	13	3	2	1	6
3	11	3	3	1	7
4	11	3	1	1	6

MODEL QUESTION PAPER

B.Sc Degree (C.B.C.S.) Examination

Third Semester

Programme – B.Sc Mathematics

STA3CMM03– Probability Distributions

Time Three Hours

Maximum: 80 Marks

4

Use of non-programmable Calculators and Statistical tables are allowed.

Part A

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

1. The mean and variance of a Binomial random variable X are 4 and $\overline{3}$. Find the parameters of the Binomial random variable Y = 6 - X.

2. Define Gamma distribution and find its variance

3. For which value of the parameter p, the skewness of Binomial distribution is zero?

4. . Define the Beta distribution of 2^{nd} kind. What is its relationship with Beta distribution of 1^{st} kind?

5. State and prove additive property of Binomial distribution.

6. In a normal curve, if the area to the right of the point x_1 is 0.6 and area to the left of the point x_2 is 0.7. Then which point, x_1 or x_2 , is greater? Why?

7. Points of inflexion of Normal distribution with mean μ and variance σ^2 are —.....

8. Define the convergence in probability.

9. If U is a uniform (a,b) distribution, what is the mean of U

10. Define multiple correlation

11 State principle of least squares

12 What are the advantage of rank correlation over product correlation

(10x2=20)

Part B

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

13. show that correlation coefficient is independent of change of origin and scale

14. Explain the method of fitting Y = aX+b

15. State and prove the Lack of Memory Property of exponential distribution

16. Derive the recurrence relation between central moments of Poisson distribution

17 The incidence of occupational disease in an industry is such that the workers have a chance of 20% chance of suffering from it. What is the probability that out of six workers chosen at random, four or more will suffer from the disease

18. A car hire firm has two cars which it hires day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which some demand is refused

19. . In an intelligence test administered to 1000 children, the average score is 42 and standard deviation is 24. Assuming the scores obtained by the children follows normal distribution, find the expected number of children exceeding the score 60

20 How many experiments should be performed so that the probability of obtaining at least 40 successes is at least 0.95, if the experiments are independent and probability of success in a trial is 0.2?

21. State Central Limit Theorem. Find the distribution of sample mean \overline{x} if the sample size is large,

using Central Limit Theorem 22. State Central Limit Theorem. Find the distribution of sample mean x if the sample size is large, using Central Limit Theorem.

(6x5=30)

Part C

(Answer any two questions. Each question carries 15 marks)

22. (a) Define Binomial distribution.Find its Moment Generating Function and hence the mean and variance.

(b) (ii) If X_1 and X_2 are two independent random variables such that $X_1: B(n_1, p)$ and $X_2: B(n_2, p)$, find the conditional distribution $X_1/X_1 + X_2$.

23. (a) Define Normal distribution .Find its mgf. State its properties

(b) For an examination, the marks obtained by students follow approximately normal with mean 43.5% with variance 39%. There are total 3500 students appeared for the examination. Find (i) Expected number of students scored above 30% (ii) The maximum marks of the lowest scored 40% students and (iii) The minimum marks of the top scored 10% students.

24. Fit a curve of the form $Y = aX+BX^2+c$

X 0 1 2 5 9

Y 4 11 15 8 2

25. a) State and prove Weak Law of Large Numbers.

(b) Examine whether the law of large numbers holds for the sequence $\{X_k\}$ independent random variables defined as follows $P[X_k = \pm 2^k] = 2^{-(2k+1)}$

$$P[X_k = 0] = 1 - 2^{-2k}$$

(2x15=30)

IV Semester – Complementary Course for Mathematics STA4CMM04 - STATISTICAL INFERENCE

- CO1. Enables students to cover foundations in sampling distributions and their applications
- CO2. Enables students to understand methods of estimation.
- CO3. Provide a solid base on testing of hypothesis introduction this enables students to understand the concepts and methods of statistical inference and to draw inferences whenever statistical decisions are meaningful.

Module I

Sampling Distributions– definition of χ^2 , t and F distributions, Statistic, Parameter, Standard Error, Sampling distributions- Distributions of sample mean and Sample variance of normal population, χ^2 , t and F statistics (without derivation)- inter relationships.

Module II

Concepts of Estimation, Types of Estimation – Point Estimation, Properties of Estimates – Unbiasedness, Consistency; Sufficiency and Efficiency. Methods of Estimation – Maximum likelihood estimation and Methods of Moments, Cramer-Rao Inequality (without proof), Interval Estimation – Mean and Variance of Normal population, Large sample confidence interval for Proportion.

Module III

Testing of hypothesis- Statistical hypothesis, Simple and composite hypothesis Null and Alternate hypothesis, Type I and Type II errors, Critical Region, Size of the test, P-value, Power, Most powerful test, Neyman Pearson Lemma (Statement only).

Module IV

Large Sample tests – Z test (mean and proportion), test for the equality of means and proportions. Small sample tests–Normal tests, t – test (one sample, Independent sample, Paired Sample), Chi-square test for variance, F- test for equality of variances, Test for correlation coefficient, Chi-Square test (goodness of fit, Independence).

Reference Books

- 1. Gupta S.C. and Kapoor V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- 2. Hogg, R.V. and Craig A.T. (1970) *Introduction to Mathematical Statistics*, Amerind Publishing Co, Pvt. Ltd.
- 3. Rohatgi V. K. (1976) An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
- 4. Mood A.M., Graybill F.A. and Boes D.C. (2001) *Introduction to Theory of Statistics*,3rd edition McGraw Hill
- 5. Miller I. and Miller M. (2014) *John E. Freund's Mathematical Statistics with applications*, 8thEdn. Pearson Education
- 6. Johnson, N.L, Kotz, S. and Balakrishnan N. (1994) *Continuous Univariate Distribution*, John Wiley, New York.

CO No.	Objective	Module
CO1	Cover foundations in sampling distributions and their applications	1
CO2	Understand methods of estimation	2
CO3	Provide base on testing of hypothesis introduction this enables students to understand the concepts and methods of statistical inference and to draw inferences whenever statistical decisions are meaningful	3, 4

BLUE PRINT

SEMESTER IV: PROGRAMME B.Sc. Mathematics Comp. Course for B.Sc. Mathematics: COURSE CODE: STA4CMM04 COURSE TITLE: STATISTICAL INFERENCE

Module	Hrs	Part A	Part B	Part C	Total	
	Allotted	2 Mark	5 Marks	15 Marks	questions	
		10/12	6/9	2/4		
1	12	3	3	1	7	
2	13	3	3	1	7	
3	11	3	2	1	6	
4	11	3	1	1	5	

MODEL QUESTION PAPER

B.Sc Degree (C.B.C.S.) Examination

Fourth Semester

Programme – B.Sc Mathematics

STA4CMM04-STATISTICAL INFERENCE

Time Three Hours

Maximum: 80 Marks

(Use of scientific calculator and statistical tables are permitted)

Part A

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

1. Define Standard error of an estimate

2. If X ~ F (n₁; n₂), write the p.d.f. of Y= 1/X

3. Write an unbiased estimator of θ if the population has pdf

$$f(x) = \frac{1}{\theta} e^{-\frac{x}{\theta}}; \quad 0 < x < \infty$$

4. Write an estimator which is consistent but not unbiased.

5. Find the degrees of freedom of the χ^2 statistic for testing the independance of attributes of a 5×4 contingency table.

6. If a random variable X has Students t distribution with n degrees of freedom, find the distribution of $Y = X^2$

7. What is the relation between t and F

8. Differentiate simple and composite hypothesis

9 Define confidence interval and coefficient of confidence

10. Define the method of moments for estimating a ppulation parameter

11. Find the distribution of the mean x of a sample taken from a normal population

12. Show that the square of a standard normal random variable is Chi-square (10x2=20)

Part B

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

13. Find the mean and variance of χ^2 distribution with *n* degrees of freedom

14. A sample of size 70 is taken from a population with variance $^{56.5}$. Find the probability that the mean of the population is in between 34 and 40 , if the sample mean is found to be $^{35.1}$

15. If x_1, x_2, \dots, x_n is a random sample from a Normal population $N(\mu, 1)$. Show that

 $t = \frac{1}{n} \sum_{i=1}^{n} x_i^2$ is an unbiased estimator of $1 + \mu^2$

16.State factorization theorem in estimation

17. Explain the method of estimating the parameters 'a' and 'b' of a rectangular distribution with parameters 'a' and 'b' by MLE method

18. Let p be the proportion of tea drinkers in Kerala. If a random sample of 1234 Keralites yielded 789 tea drinkers, find 95% confidence interval of p

19. A sample of size 100 taken from a population found to have mean 67.2 and variance 78.6. Test whether the population mean is greater than 70.1 at 5% level of significance.

20. A sample from a population is 7,4,6,11,20,8,10,6,13,11 and 9. Can it be regarded as taken from a normal population with mean 10.5

21. Explain χ^2 test for goodness of fit

(6x5=30)

Part C

(Answer any two questions. Each question carries 15 marks)

22. (a) Define Students t-distribution. Mention any two statistics having t-distribution.

(b) Two samples of size 16 and 12 are taken from a normal population. Find the maximum difference between the sample means with probability $^{0.9}$

23(a) State Cramer-Rao inequality and explain the metod of minimum variance for estimating a population parameter.

(b) Find the Minimum Variance Unbiased Estimator for λ , if the population follows Poisson distribution with parameter.

24(a) Describe the F -test for testing the equality of variance of two normal populations.

(b) Samples of sizes 10 and 8, taken from two populations are as follows,

Sample - I:	12	29	31	22	51	67	10	92	64	16
Sample - II:	45	54	43	59	61	48	39	44		

Examine the variances of the populations are same at 5% level of significance.

25. (a) Derive the expression of Chi-square statistics for testing independence in 2×2 contigency table.

(b) Examine the influence of gender in watching TV serial.

	Male	Female
Like TV serial	42	33
Dont like TV serial	18	17

(2x15=30)

2. Complementary Courses for BSc. Physics

I Semester –Complementary Course for Physics

STA1CMP01 - DESCRIPTIVE STATISTICS

COURSE OUTCOME

- CO1. Students acquire an understanding about different kinds of data, their analysis and representation. They could also apply various sampling techniques in real life situations.
- CO2. The students become acquainted with the fundamental properties of data like central tendency, dispersion, skewness and kurtosis. With these they could summarise a large mass of data to a meaningful form.
- CO3. Students could understand the bivariate data, nature and degree of their relationship and their analysis. They become familiar with the method of curve fitting for the bivariate data, correlation and regression.

Module I

Population and Sample, Collection of Data, Primary and Secondary data, Various methods of data collection, Census and Sampling. Types of data – quantitative, qualitative, Classification and Tabulation, Frequency Table, Diagrammatic representation of data-Bar diagram and Pie diagram, Graphical representation of frequency distribution.

Module II

Measures of Central Tendency – Mean; Median; Mode; Geometric mean; Harmonic mean and their properties, Absolute and Relative measures of Dispersion – Range, Quartile Deviation, Mean Deviation, Standard Deviation

Module III

Moments - Raw moments, Central moments, Inter Relationships (First Four Moments), Sheppard's correction for moments for grouped data, Skewness –Pearson's, Bowley's and Moment Measure; Kurtosis– Moment Measure

Module IV

Correlation and Regression: Karl-Pearson's correlation coefficient and properties scatter diagram, Spearman's Rank correlation coefficient and its properties. Linear regression: regression coefficients and their properties. Principles of least squares, Fitting of linear, quadratic, exponential.
Reference Books

- 1) GuptaS.P. (2011), Statistical Methods, Sultan Chand & Sons Delhi.
- 2) Gupta S.C. and KapoorV.K. (2007): Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- 3) Agrawal B.L. (2012) *Basic Statistics*, Anshan Publishers
- 4) Murthy M.N. (1967) Sampling theory and Methods, Statistical Publishing Society, Calcutta.

CO No.	Objective	Module
CO1	Understand about different kinds of data, their analysis and representation. Also able to apply various sampling techniques in real life situations	1
CO2	Understand the fundamental properties of data like central tendency, dispersion, skewness and kurtosis. Understand how to summarize a large mass of data to a meaningful form	2,3
CO3	Understand the bivariate data, nature and degree of their relationship and their analysis. Familiar with the method of curve fitting for the bivariate data, correlation and regression.	4

BLUE PRINT

SEMESTER I: PROGRAMME B.Sc. Physics Comp. Course for B.Sc. PHYSICS: COURSE CODE: STA1CMP01 COURSE TITLE: DESCRIPTIVE STATISTICS

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions	
1	12	3	2	1	6	
2	13	3	3	1	7	
3	11	3	2	1	6	
4	11	3	2	1	6	

MODEL QUESTION PAPER B.Sc Degree (C.B.C.S.) Examination First Semester Programme – B.Sc Physics STA1CMP01 - Descriptive Statistics

Time Three Hours

Maximum: 80 Marks

(Use of scientific calculator permitted)

Part A

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

- 1. Distinguish between Census and Sampling.
- 2. Define (i)geometric mean (ii) mean deviation.
- 3. Explain ogives.
- 4. Define Central moment.
- 5. Distinguish between class limits and class boundaries.
- 6. Write any two measure of skewness.
- 7. What are the properties of good measures of dispersion?
- 8. Find AM
 class
 0-10
 10-20
 20-30
 30-40

 frequencies
 8
 10
 15
 12
- 9. Explain Scatter Diagram.
- 10. Write note on Rank Correlation.
- 11. State any two properties of regression coefficients.
- 12. Explain kurtosis.

Part B

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

- 13. What are the advantages and limitations of sampling?
- 14. Distinguish the difference between simple and weighted arithmetic mean.
- 15. Define systematic sampling and state its merits.

Turn Over

(10x2=20)

16. Find mean deviation about mean

class	0-10	10-20	20-30	30-40
frequencies	8	11	18	14

- 17. Define correlation coefficient. Show that correlation coefficient is the G.M of regression coefficients.
- 18. Derive the relation between central moments and raw moments.
- 19. Explain the Principle of least squares method for fitting a straight line.

- 20. Show that first central moment is always zero.
- 21. The first four moments of a data about 4 are -1.5, 17, -30, 108. Find the first four moments of a data about i) zero ii) 3

(6x5=30)

Part C

(Answer any two questions. Each question carries 15 marks)

- 22. Explain in detail: (a) primary data and (b) secondary data along with uses and limitations.
- 23. Calculate the median of the data

class0-1010-2020-3030-4040-50frequencies39153018

Draw the cumulative frequency curve and read off the value of the median from it.

24. Obtain a measue of skewness for the following data

X 10 20 30 40 50

Y 7 15 23 31 18

- 25. Find Pearson correlation coefficient between X and Y
 - X181186189185188190Y207201208204205209

(2x15=30)

II Semester – Complementary Course for Physics (main) STA2CMP02 - PROBABILITY AND RANDOM VARIABLES

COURSE OUTCOME

- CO1. Students acquire a thorough understanding of probability theory which forms the foundation of Statistics.
- CO2. They also acquire an understanding of the meaning and theory of random variables.
- CO3. Students could understand the bivariate data, nature and degree of their relationship and their analysis.
- CO4. It enables students to cover foundations of expected values of a random variable.

Module I

Probability Concepts – Random Experiment, Sample Space, Events, Probability Measure, Different definitions of probability – Classical, Statistical and Axiomatic, Addition Theorem (up to 3 events), Conditional Probability, Independence of events, Multiplication theorem (up to 3 events), Baye's Theorem and its applications, Distribution of n molecules. Examples related to distribution of modules.

Module II

Random Variables – Discrete and Continuous, Probability Distributions – Probability Mass Function; Probability Density Function and Cumulative (distribution) function and their properties, change of variables (Univariate only), Jacobian of transformation.

Module III

Bivariate random variables – Definition – Discrete and Continuous, Joint probability density functions, Marginal and Conditional Distributions, Independence of Random Variables.

Module IV

Mathematical Expectation, Definition and elementary properties, mean, variance, moment generating function, characteristic function and their elementary properties

Reference Books

- 1) Agrawal B.L. (2012) *Basic Statistics*, Anshan Publishers
- 2) Gupta S.C. and Kapoor V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- 3) Gupta S.P. (2011) Statistical Methods, Sultan Chand & Sons Delhi.
- 4) Martin B.R. (1971) Statistics for Physicists, Academic Press, London
- 5) Miller I. and Miller M. (2014) *John E. Freund's Mathematical Statistics with applications*, 8th Edn. Pearson Education
- 6) Rohatgi V. K. (1976) An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

CO No.	Objective	Module
CO1	Understand the probability theory which forms the foundation of Statistics	1
CO2	Understand the theory of random variables	2
CO3	Understand the bivariate data, nature and degree of their relationship and their analysis	3
CO4	Lay foundations of expected values of random variables	4

BLUE PRINT

SEMESTER II: PROGRAMME B.Sc. Physics Comp. Course for B.Sc. PHYSICS: COURSE CODE: STA2CMP02 COURSE TITLE: PROBABILITY AND RANDOM VARIABLES

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions	
1	12	3	2	1	6	
2	13	3	3	1	7	
3	11	3	2	1	6	
4	11	3	2	1	6	

MODEL QUESTION PAPER B.Sc Degree (C.B.C.S.) Examination Second Semester Programme – B.Sc Physics STA2CMP02 - PROBABILITY AND RANDOM VARIABLES

Time Three Hours

Maximum: 80 Marks

(Use of scientific calculator permitted)

Part A

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

- 1 Explain random variable
- 2 Explain probability density function
- 3 Define random experiment
- 4. Write statistical definition of probability
- 5. State addition theorem of probability

- 6 Define joint probability mass function
- 7. Define conditional expectation
- 8. Explain distribution function of a random variable What are the properties of distribution function?
- 9. Write note on independence of two random variable
- 10. A box contains 4 white balls, 3 green balls and 3 red balls .Three balls are chosen randomly. What is the probability of getting i) 1 green and 2 red ii) 1 red and 2 white
- 11. f(x) = x / 15 x = 1.2.3.4,5 Find F(x)
- 12. P(A)=.4 P(AB)=.5 Is this statement consistent? Why?

(10x2=20)

Part B

(Answer any six Questions. Each question carries 5 marks)

13. f(x,y) = 2 0 < x < y < 1

Find marginal distributions and conditional distribution of X given Y

- 14. $f(x) = c(2/3)^x$ x=1,2,... Find 1) c 2) P(X>3)
- 15. $f(x) = e^{-x}$ x>0 Find p.d.f of Y = 3X-7
- 16. State and prove multiplication theorem of probability
- 17. State and prove Baye's theorem
- 18. Find p.d.f of $Y = X^2$ X -2 -1 0 1 2 P(x) 1/5 1/5 1/5 1/5 1/5 1/5

19. For a random variable X, $2 \log(M_X(t)) = 30t + 9 t^2$. Find its mean, variance and third central moment.

20. The joint pdf of (X,Y) is

 $f(x,y) = Ax^3/y$, $0 \le x \le 2$, $1 \le y \le 5$. Find (1) A (2) Marginal pdf's of X and Y

21. If the pdf of a Random variable is $f(x) = me^{-mx}$, x > 0, m > 0. Find its moment generating function. Hence find its mean and variance.

(6x5=30)

Part C

(Answer any two questions. Each question carries 15 marks)

22 i) State and prove addition theorem of probability for three events

- ii)Two bags B₁ and B₂ contains 8 white and 6 black balls,7 white and 10black balls respectively. One ball is randomly transferred from B₁ and B₂ and a ball is drawn from B₂.What is the probability that it is white?
- 23. Find conditional density of X/ Y=1 Examine whether X and Y are independent
- x 1 2 3 y 1 .1 .1 .2 2 .2 .3 .1

24. (1) Define conditional variance

- (2) Show that for two random variabl; es X and Y
 - $(E(XY))^2 \leq E(X^2) E(Y^2)$
- 25. Two random variables have the joint pdf f(xy) = x+y, 0 < x < y < 1

Find (1) $E(X^2Y^2)$ (2) $E(X^2)$ (3) Corr(X,Y) and examine whether X and Y are independent.

(2x15=30)

III Semester – Complementary Course for Physics

COURSE OUTCOME

- CO1. Provide a solid introduction to well-known discrete distributions.
- CO2. Provide a solid introduction to well-known continuous distributions.
- CO3. Enables students to understand limit theorems.
- CO4. Enables students to cover foundations in sampling distributions and their applications.

STA3CMP03 -Standard Distributions

Module I

Discrete Probability Distributions – Uniform; Bernoulli; Binomial; Poisson; Geometric- Properties – Mean, Variance, Moment generating function, Additive property; recurrence relation for moments (binomial and Poisson) Lack of memory property of Geometric distribution.

Module II

Continuous distributions – Uniform; Exponential; Gamma; Normal- properties and applications –Mean, Variance, m.g.f., Additive property, Lack of memory property of exponential distribution, characterization of normal distribution by the property of entropy,Use of Standard Normal tables for computation of various probabilities, Maxwell-Boltzmann distribution.

Module III

Law of large Numbers, Tchebycheff's Inequality, Empirical rule, Weak law of large numbers, Central limit theorem (Lindberg-Levy form) without proof, Applications of central limit theorem.

Module IV

Sampling Distributions– definition of χ^2 , t and F distributions, Statistic, Parameter, Standard Error, Sampling distributions- Distributions of sample mean and sample variance of normal population, χ^2 , t and F statistics (without derivation)- inter relationships and applications

Reference Books

- 1) Gupta S.C. and KapoorV.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- 2) Hogg, R.V. and Craig A.T. (1970) *Introduction to Mathematical Statistics*, Amerind Publishing Co, Pvt. Ltd.
- 3) Rohatgi V. K. (1976) *An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern.
- 4) Miller I. and Miller M. (2014) *John E. Freund's Mathematical Statistics with applications*, 8thEdn. Pearson Education
- 5) Johnson, N.L, Kotz, S. and Balakrishnan N. (1994) *Continuous Univariate Distribution*, John Wiley, New York.

CO No.	Objective	Module
CO1	introduction to well-known discrete distributions	1
CO2	Introduction to well-known continuous distributions	2
CO3	Understand the important understand limit theorems	3
CO4	Lay foundations to sampling distributions and their applications	4

BLUE PRINT

SEMESTER III: PROGRAMME BSc. Physics Comp. Course for BSc. PHYSICS: COURSE CODE: STA3CMP03 COURSE TITLE: STANDARD DISTRIBUTIONS

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions
1	12	3	3	1	7
2	13	3	3	1	7
3	11	3	2	1	6
4	11	3	1	1	5

MODEL QUESTION PAPER B.Sc Degree (C.B.C.S.) Examination Third Semester Programme – B.Sc Physics STA3CMP03 - Standard Distributions

Time: 3 Hours

Total Marks :80

Use of non-programmable Calculators and Statistical tables are allowed.

Section A

(Answer *Ten* questions. Each question carries 2 marks.)

- 1. Distinguish between parameter and statistic.
- 2. Find the mean and variance of Binomial distribution.
- 3. If X & Y are independent Poisson variates having means 1 and 3 respectively. Find the variance of 3X + Y
- 4. Define Gamma distribution and find its variance.
- 5. Find the mean deviation about mean of Normal distribution.
- 6. Show that the square of a standard normal random variable is Chi-square.
- 7. What are the advantages of Tchebycheff's Inequality
- 8. Find the m.g.f of Exponential distribution with parameter λ and hence find its mean and variance.
- 9. State (a) Bernoulli Law of Large Numbers (b)Weak Law of Large Numbers.
- 10. If $X \sim N(15, 16)$, Find P [12 < X < 20].
- 11. Mention the assumptions of Lindberg Levy form of CLT.
- 12. Define F distribution. If $X \sim F(n_1; n_2)$, write the p.d.f. of Y = 1/X.

(10 x 2 = 20 marks)

Section B

(Answer any *six* questions. Each question carries 5 marks.)

13. State and prove the recurrence relation for Central moments of a B(n, p) distribution.

14. A random variable X has mean 5 and variance 3. Find *h* such that $P[|X - 5| < h] \ge 0.99$.

15. A random sample of size 16 is taken from a normal population with mean 30 and variance 64.

Find the probability that the sample variance s^2 will be less than population variance.

16. If X1 and X2 are two independent random variables such that X1~ B(n1; p) and X2~ B(n2; p),

find the conditional distribution $X_1/(X_1 + X_2)$.

17. State Central Limit Theorem. Find the distribution of sample mean if the sample size is

large, using Central Limit Theorem.

18. State and prove the additive property of Gamma distribution.

19. State the relation between the normal, Chi-square, t and F distributions.

20. If E(X) = 50 and $\sigma = 5$, how large a sample should you take in order that

$$P\{|\bar{x}-50|<1\}\geq 0.99$$

21. Find the mode of a Poisson distribution

(6x5=30)

Section C (Answer any *two* questions, each from the bunch of two. Each question carries 15 marks.)

22. (a).Define Normal distribution and find its m.g.f. Hence derive the mean and variance.

(b)If X1& X2 are independent normal random variables wit respective means -1 and 2 and respective variance 3 and 7, find *a* and *b* such that *aX*1 + *bX*2 is standard normal.
23. a)The screws produced by certain machine were checked by examining samples. The following table shows the distribution of 128 samples according to the number of defective items they contained.

No. of defectives	0	1	2	3	4	5	6	7
No. of squares	7	6	19	35	30	23	7	1

Fit a binomial distribution to find the mean and variance of the distribution.

b)If X and Y are independent Poisson variates with parameters λ_1 and λ_2 find the m.g.f of Z=X-Y.

24.(i) State and prove Chebyshev's inequality.

(ii)Two unbiased dice are thrown. If X is the sum of the numbers showing up, prove that $P[|X-7|] \ge 3] \le 35/54$.

25. (a) Define Students t-distribution. Mention any two statistics having t-distribution.

(b) Two samples of size 16 and 12 are taken from a normal population. Find the maximum difference between the sample means with probability 0.9

(2x15=30)

IV Semester – Complementary Course for Physics

STA4CMP04 - STATISTICAL INFERENCE AND RANDOM PROCESSES

COURSE OUTCOME

- CO1. To learn the essential concepts in the theory of estimation of unknown parameters.
- CO2. Understand various types of hypothesis of testing including both small sample tests and large sample tests.
- CO3. To understand some basic concepts about random process, Markov Chain, Random walk.

Module I

Concepts of Estimation, Types of Estimation – Point Estimation, Properties of Estimates – Unbiasedness, Consistency; Sufficiency and Efficiency. Methods of Estimation – Maximum likelihood estimation and Methods of Moments. Interval Estimation- mean, proportion and variance

Module II

Testing of hypothesis- Statistical hypothesis, Simple and composite hypothesis Null and Alternate hypothesis, Type I and Type II errors, Critical Region, Size of the test, P-value, Power, Most powerful test, Neyman Pearson Lemma (Statement only).

Module III

Small sample tests– z and t tests (One sample, Independent sample, Paired Sample), Large Sample tests – z test (mean and proportion), Chi-Square test (goodness of fit, Independence).

Module IV

Random processes, time and state space, classification of random processes with examples for each processes (Random Walk, Poisson Process & Brownian Motion), special class of random processes-Markov processes, process with independent increments

Reference Books

- 1. Gupta S.C. and Kapoor V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
- 2. Hogg, R.V. and Craig A.T. (1970) *Introduction to Mathematical Statistics*, Amerind Publishing Co, Pvt. Ltd.
- 3. Rohatgi V. K. (1976) An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
- 4. Miller I. and Miller M. (2014) *John E. Freund's Mathematical Statistics with applications*, 8th Edn. Pearson Education
- 5. Johnson, N.L, Kotz, S. and Balakrishnan N. (1994) *Continuous Univariate Distribution*, John Wiley, New York.

- 6. Veerarajan, T.(2002) Probability Statistics and Random Processes, 2nd edn. Tata McGraw-Hill education
- 7. Ross S. M (2009) Introduction to Probability models, Tenth edition, Academic Press.

CO No.	Objective	Module
CO1	Learn the essential concepts in the theory of estimation of unknown parameters	1
CO2	Understand various types of hypothesis of testing including both small sample tests and large sample tests	2, 3
CO3	Understand some basic concepts about random process, Markov Chain, Random walks	4

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SEMESTER IV: PROGRAMME BSc. Physics Comp. Course for BSc. PHYSICS: COURSE CODE: STA4CMP04 COURSE TITLE: STATISTICAL INFERENCE AND RANDOM PROCESSES

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions
1	12	3	3	1	7
2	13	3	3	1	7
3	11	3	2	1	6
4	11	3	1	1	5

MODEL QUESTION PAPER B.Sc Degree (C.B.C.S.) Examination Fourth Semester Programme – B.Sc Physics STA4CMP04 - Statistical Inference and Random Processes

Time: 3 Hours

Total Marks :80

Use of non-programmable Calculators and Statistical tables are allowed.

Section A

(Answer *Ten* questions. Each question carries 2 marks.)

- 1. Define estimator and estimate.
- 2. If Find the MLE of *a* and *b* of a rectangular distribution with $(x) = \frac{1}{(b-a)}$; a < X < b.
- 3. Write an unbiased estimator of λ , if the population has p.d.f. $f(x) = \lambda e^{-\lambda x}$, X>0.

- 4. Write an estimator which is consistent but not unbiased.
- 5. Find the degrees of freedom of the χ^2 statistic for testing the independence of attributes of a 5x 4 contingency table.
- 6. Define confidence interval and coefficient of confidence. .
- 7. State factorization theorem in estimation.
- 8. To test $H_0: p = 1/2$ against $H_1: p = 2/3$ in tossing a coin, the test procedure is throw 6 coins and if at least 5 heads appear H_0 is rejected. Find the significance level of the test.
- 9. Discuss any two uses of t-statistic in hypothesis of testing
- 10. Define null hypothesis and alternate hypothesis with examples each
- 11. Define time space and state space.
- 12. Explain a process with stationary independent increments

(10 x 2 = 20 marks)

Section B

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

- 13. Find an unbiased estimator of σ^2 when the samples are taken from $N(\mu, \sigma)$ where μ is unknown
- 14. Explain the method of moments. Find the moment estimate of θ from a Poisson population $P(\theta)$
- 15. Let p be the proportion of tea drinkers in Kerala. If a random sample of 1234 Keralites yielded 789 tea drinkers, find 95% confidence interval of p.
- 16. A sample of size 100 taken from a population found to have mean 67.2 and variance 78.6. Test whether the population mean is greater than 70.1 at 5% level of significance.
- 17. A sample from a population is 7,4,6,11,20,8,10,6,13,11 and 9. Can it be regarded as taken from a normal population with mean 10.5?
- 18. Explain $\chi 2$ test for goodness of fit.
- 19. Explain Markov process and Markov chain with examples.
- 20. A machine produced 20 defective parts in a batch of 400. After overhauling, it produced 10 defectives in a batch of 300. Has the machine improved?(significance level 5%)
- 21. Explain the method MLE. Find the MLE of μ and σ when the samples are taken from $N(\mu, \sigma)$

(6 x 5 = 30 marks)

Section C

(Answer any *two* questions, each from the bunch of two.

Each question carries **15** marks.)

22. (i) Describe paired and independent sample tests for equality of means of two normal populations.(ii) The following data give the gains of weights of 20 rats, half of which received their protein from raw peanuts and the other half from roasted peanuts. Test whether roasting has any effect on the increase in weights of the rats.

Raw	: 62	60	56	63	56	63	54	56	44	61
Roaste	d: 57	56	49	61	55	61	57	54	62	58

23 (i) Derive the confidence interval for the mean of a normal population.

(ii) A sample of size 14, taken from a normal population with variance 16, has mean 56.7. Find

90% confidence interval for the mean of the population.

- 24. State and prove Cramer-Rao inequality
 - (ii) Show that if 'T' is an unbiased and consistent estimator of θ , then T^2 is a biased estimator of θ^2 , whereas it is a consistent estimator of θ^2
- 25. (i) What are the classification of stochastic process? Give example of each.
 - (ii) Explain Brownian motion process.

(2x15=30 marks)

3. Courses for BA. Economics Curriculum for BA Economics Programme Semester V ECO5COR07- Quantitative Techniques for Economic Analysis-I No. of Credits-4 No. of Contact hours –108

Learning Objectives

The objective of this course is to equip the students with primary statistical and mathematical tools for analyzing economic problems. It helps to assist students of Economics the way to interpret and analyses data and to understand the implication of a trend and the interpretation of numerical data.

Module I

Role of Statistics in Economics –limitations. Statistical data: Primary and Secondary – their sources: Census and sampling techniques – Sample designs – preparation of questionnaires – classification and Tabulation of statistical data – Presentation of data with the help of charts and diagrams (Histogram, Polygon, frequency curve, Bar chart, Pie diagram, Ogives)

Central Tendency - Various central tendency measures - Arithmetic mean – properties – merits and demerits –methods of calculation – weighted, unweighted and combined. Median – definition – merits and demerits – method of calculation – graphic location – Mode – merits and demerits – methods of calculation: (40 hrs)

Module II

Dispersion and various measures of dispersion, absolute and relative measures – Range, quartile deviation, mean deviation, standard deviation – Lorenz curve and its economic applications. Skewness, Kurtosis, Moments: Types of skewness –measurement - Kurtosis – Definition and types (graphic presentation) Moments: central and raw moments (for ungrouped data only). (35 Hrs.)

Module III

Index numbers – Different types – Importance and limitations, Problems in construction – Weighted and Unweighted price index numbers – Different methods of construction (Price indices only) – Simple aggregative, simple average of price relatives, Laspeyre's, P

aache's, Fisher's and Marshall Edgeworth's indices, Cost of living index numbers: significance and construction (Family budget method only). (20 hrs)

Module IV

Basic Mathematics for Economic Analysis – Basic concepts: variables, constants, parameters, equations, sequences, progression, population (only definitions with examples) The real number system. Types of numbers – properties of real numbers –Functions: Important economic functions –Introduction to matrices – Definition and types of matrices-Matrix addition and multiplication (2x2 case)

(13hrs)

Readings

- 1. Chiang A.C. (2005), Fundamental Methods of Mathematical Economics, McGraw Hill.
- 2. Gupta S.P., Statistical Methods, Sultan Chand & Sons, New Delhi.
- 3. Allen R.G.D., Mathematical Analysis for Economists, Palgrave mac Millan.
- 4. Monga G.S., Mathematics and Statistics for Economists, Vikas Publishing House, New Delhi.
- 5. Thomas P.M., Quantitative Economics, Chinnu Publications, Kottayam.

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SEMESTER V: PROGRAMME BA Economics COURSE CODE: ECO5COR07 COURSE TITLE: Quantitative Techniques for Economic Analysis-I

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions
1	40	3	3	1	7
2	35	3	3	1	7
3	20	3	2	1	6
4	13	3	1	1	5

MODEL QUESTION PAPER

BA Degree (C.B.C.S.) Examination Fifth Semester Programme – BA Economics ECO5COR07 - Quantitative Techniques in Economic Analysis-1

Time: 3 Hours

Total Marks :80

Part A

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

- 1. Define primary data
- 2. Define sampling
- 3. What is bar diagram
- 4. Define range
- 5. Define standard deviation
- 6. What is skewness
- 7. Define index number
- 8. Write down Laspeyer's Index Number and explain each term
- 9. What is price index number?

10. Define matrix

11. Define sequence

12. What id progression

(10x2=20 marks)

Part B

(Answer any six questions. Each carry 5 marks)

- 13. Write down merits and demerits of Arithmetic mean
- 14. Draw simple bar diagram for the data

C	ountry		D	eath F	Rate					
I	ndia			45						
U	K		20							
С	hina			50						
S	weedon			16						
G 15 Find Ma No 16 W 17. Fin	ermany range an rks . of stude hat is disj nd Standa	nd coef : ents : persior ard dev	18 ficient 10-20 6 n? Wri viation	of ran 20-3 10 te dov	lge 0 30 12 vn dif)-40 fferen	40-5 8 t meas	50 Sures	50-60 4 of disp	ersion
Si	ze	: 2	3	4	5	6	7	8		
Frequ	uency :	1	2	3	5	3	2	1		
18. write dow	n charact	teristics	s of inc	lex nu	mber	S				
19. what are	the probl	ems in	the con	nstruc	tion o	of cost	t of liv	ing i	index n	umbers
20. Calculate	simple in	ndex nu	ımber							
Commo	lity P	rice 20	10	Pri	ce 20	15				
А		5			7					
В		8			9					
С		12			15					
D		25			24					
E		3			4					
21. write dov	n proper	ties of	real nu	umber	s.	_				

(6x5=30)

Part C

Answer any two questions. (Each carries 15 marks)

22. Write down limitations of statistics

23. 1	Draw Lorenz Curve						
	Total Income(in '000 Rs)	:	5	30	125	350	400
	No. of families	:	22	78	124	24	9

Curriculum and Syllabus (2020 Admission onwards)

24.	Construc	ct co	ost of l	iving iı	ndex nu	ımber		
	Group	:	А	В	С	D	E	
	Index	:	350	200	240	150	250	
	Weight	:	5	2	3	1	2	
25. E	Define mat	rix	and wi	rite dov	vn diffe	erent ty	pes of matrices	(2x15=30

Semester VI

ECO6COR12: Quantitative Techniques for Economic Analysis-II No. of Credits : 4 No. of Hours: 108

Learning objectives

This paper attempts to familarise the students with statistical operations such as correlation, regression. it also intend to give an introductory awarenss of mathematial operations which are crucial for the students of Economics.

Module I

Correlation and regression analysis: their significance in Economics – Correlation and regression compared – types of correlation – measurement, scatter diagram, Karl Pearson's correlation coefficient (for raw data only). Rank correlation – regression equations and regression lines – prediction of values based on equations 'y on x' and 'x on y'. (30 Hrs.)

Module II

Time series analysis: uses, components, measurement of trend free hand method and semi averagemethod, moving averages method, least square method. Fitting straight-line trend.(30 hrs)

Module III

Differential Calculus: Its significance in Economics. Rules of differentiation – First order and second order derivatives – some practical applications – Maxima and Minima of functions. (20 Hrs.)

Module IV

Set theory – Types – Set operations – Venn diagrams – Probability and Distribution: Concept – Rules of probability (addition and multiplication theorem – statement only) – Different approaches – Important terms related to probability (Random experiments, sample space, events) – Simple problems based on theorems – Random variables and Probability distributions – binomial, Poisson and normal – their properties and uses – Estimation of probabilities using standard normal table. (28 Hrs.)

Readings

- 1. Chiang A.C. (2005), Fundamental Methods of Mathematical Economics, McGraw Hill.
- 2. Gupta S.P., Statistical Methods, Sultan Chand & Sons, New Delhi.

Curriculum and Syllabus (2020 Admission onwards)

- 3. Allen R.G.D., Mathematical Analysis for Economists, Palgrave mac Millan.
- 4. Monga G.S., Mathematics and Statistics for Economists, Vikas Publishing House, New Delhi.
- 5. Thomas P.M., Quantitative Economics, Chinnu Publications, Kottayam.

BLUE PRINT SEMESTER VI: PROGRAMME BA ECONOMICS COURSE CODE: ECO6COR12 COURSE TITLE: Quantitative Techniques for Economic Analysis-II

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions
1	30	3	3	1	7
2	30	3	3	1	7
3	20	3	1	1	5
4	28	3	2	1	6

MODEL QUESTION PAPER BA Degree (C.B.C.S.) Examination Sixth Semester Programme – BA Economics ECO6COR12: - Quantitative Techniques in Economic Analysis-11

Time : Three Hours

Max: 80 marks

(Use of non-programmable calculator and statistical tables are allowed)

Part A

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

- 1. Define correlation
- 2. Define normal distribution
- 3. Define probability
- 4. What do you mean by probable error?
- 5. Define null set
- 6. Explain union of two sets
- 7. Define cyclic variation
- 8. Define time series
- 9. What is moving average
- 10. Differentiate $5x^4$
- 11. Define Poisson distribution
- 12. Define mutually exclusive events

(10x2=20marks)

Part B

(Answer any six questions. Each carry 5 marks)

- 13. Distinguish between positive and negative correlation
- 14. Find coefficient of correlation between X and Y for the following data

X:	1.2	1.1	1.9	1.8	1.0	0.9
Y:	15	10	20	10	10	5

15. Explain the concept of regression and write down limitations of regression analysis

16. Explain dependent and independent variable with suitable example

- 17. Define principle of least squares
- 18. Examine whether the following distribution is a probability distribution

X :	-1	0 1	2	3
P (X):	.01	.10.50	.30	.09

20. Represent the following using Venn diagram (1). A \cap B (2). AU(BUC) (3). A \cap (BUC)

21. For the data find regression equation of x on y

X	5	6	7	3	2
Y	4	5	8	2	2

(6X5=30)

Part C

Answer any two questions selecting one question from each bunch (Each carries 15 marks)

22. Calculate Karl Pearson's Coefficient of correlation for the following data and interpret the value

i.	Х	2	3	4	5	6	7	8
ii.	Y	4	5	6	12	9	5	4

- 23. Define time series and explain its component
 - a. State addition and multiplication theorem of probability.
- 24. 2.Two unbiased coins are tossed. Find the probability that(a) both the dies show the same number (b)the total of the number on the dice is eight
- 25. Obtain trend value using free hand curve method and obtain the value for the year2003 and 2004

Year:199596979899000102Value:648297717811211513

(2X15=30)

4. Courses for BA. Economics (Hons)

ECH1COR03: STATISTICAL METHODS IN ECONOMICS I

COURSE OUTCOME

- CO1. Students acquire an understanding about different kinds of data, their analysis and representation. They could also apply various sampling techniques in real life situations.
- CO2. The students become acquainted with the fundamental properties of data like central tendency, dispersion, skewness and kurtosis. With these they could summarise a large mass of data to a meaningful form.
- CO3. Students could understand the bivariate data, nature and degree of their relationship and their analysis. They become familiar with the method of curve fitting for the bivariate data, correlation and regression.
- CO4. The students are exposed to statistical tools like index numbers which are very much useful to understand the general pulse of economy.

MODULE I

Introduction to Statistics, Population and Sample, Collection of Data, Various methods of data collection, Census and Sampling, Methods of Sampling- Simple Random Sampling; Stratified Sampling, Systematic Sampling. Types of data, Classification and Tabulation, Diagrams and Graphs - Bar diagram, Pie diagram, histogram and ogives, Lorenz curve.

MODULE II

Measures of Central Tendency – Mean; Median; Mode, Partition values (Concepts only), Measures of dispersion – Range; Standard deviation, Coefficient of variation, Moments, Skewness-Pearson and Moment measures, Kurtosis-Moment measure.

MODULE III

Correlation – Scatter diagram, Types of correlation, Coefficient of correlation – Karl Pearson's and Spearman's rank correlation, Regression – regression lines and regression coefficients. Use of Computer for the computation of correlation and regression.

MODULE IV

Index Numbers – Definition and uses, Simple Index Numbers; Weighted Index Numbers – Laspeyer's, Paasche's and Fisher's Ideal Index Numbers, Cost of Living Index Numbers-Family Budget Method, Aggregate Expenditure Method. Time series analysis – components of time series, Measurement of trend using graphical, semi-average, moving average, least-square methods.

Note: Review exercises should be based on the recommended books. Each module should have at least two assignments.

REFERENCES:

- David Freedman, Robert Pisani, Roger Purves And Ani Adhikari: Statistics, (Second Edition) Norton.
- 2. Astana : Statistics (With The Use Of SPSS)
- 3. Gupta, S P : Statistics Methods, Sultan Chand & Sons
- 4. Douglas A. Lind, William G. Marchal, Samuel A. Wathen : Statistical Techniques in Business and Economics (15th Edition), Mc GrawHill.

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PROGRAMME *BA. Economics (Hons)* SEMESTER I: *CORE III* COURSE TITLE: STATISTICAL METHODS IN ECONOMICS I

	-	-	-	·	-
Module	Hrs	Part A	Part B	Part C	Total questions
	Allotted	2 Mark	5 Marks	15 Marks	
		10/12	6/9	2/4	
1	30	3	3	1	7
2	30	3	3	1	7
3	20	3	2	1	6
4	18	3	1	1	5

Question Paper Blue Print [Theory 40 % Problems 60%]

MODEL QUESTION PAPER

BA Degree (C.B.C.S.) Examination

First Semester

Programme – BA Economics (Hons) ECH1COR03: - STATISTICAL METHODS FOR ECONOMICS I

Time: Three Hours

Maximum Marks: 80

Use of non - programmable calculator allowed

Part A (Short Answer Questions) Answer *ten* questions. *Each question carries* 2 *mark.*

- 1. Define Statistics
- 2. Define Simple Random Sampling
- 3. What is a histogram
- 4. What are the important measures of central tendency?
- 5. Define Coefficient of variation.
- 6. Define median of a data
- 7. What is the standard deviation of the three observations 1,1,1,1,1.
- 8. Find the first central moment for the observations 2,5,7,9.

- 9. What would be your interpretation if the coefficient of correlation is zero?
- 10. When will you say that the two regression lines are perpendicular
- 11. Define Index number
- 12. Define a time series

(10x2=20)

Part B (Brief Answer Questions)

Answer *any six* questions. Each question carries 5 marks.

- 13. What are the advantages of sampling over census.
- 14. Write short notes on i) Bar diagram, ii) Pie diagram, and iii) Histogram.
- 15. Show that the sum of deviations of observations from their mean is always zero.
- 16. The standard deviation of a list of numbers is 10. If we multiply each entry by 2 and then add 5, what will be the standard deviation of the new list of numbers?
- 17. There are 500 workers working in a factory. Their mean wage was calculated as 200. Later on it was discovered that the wage of two workers were misread as 100 and 20 in place of 80 and 220. Find the correct average.
- 18. If the correlation coefficient between two variables x and y is 0.6 and regression coefficient of x on y is 0.3, find the regression coefficient of y on x.
- 19. A regression analysis between sales (y) and advertising cost (x) resulted in the following regression line: y
 - = 750 + 60 x. Estimate the value of sales if the adverting cost is 250.
- 20. What are the components of time series.
- 21. Explain Cost of living index number.

Part C

(6x5 = 30)

Answer any two questions. Each question carries 15 marks.

22. The mark distribution of 100 students in a class is given below. Estimate mean and standard deviation of the marks of students.

Marks	0-10	10-20	20-30	30-40	40-50
No. of Students	13	16	30	24	17

23. The following table consists of the test scores of 6 randomly selected students and the number of hours they

studied for the test. Obtain the regression equation for the test score related to hours of preparation:

Hours of preparation (x)	5	10	4	6	10	9
Test score (y)	14	46	19	26	40	30

Estimate the test score of a student who studied 7 hours for the test.

24. Calculate the Rank correlation coefficient for the following data on heights of father and son.

Height of father	65	63	67	64	68	62	70	66	68	67
Height of son	68	66	68	65	69	66	68	65	71	67

25. From the following data calculate Laspeyer's and Paasche's index number

		1999	,	2000
Commodity	Price (Rs)	Expenditure on quantity consumed (Rs)	Price (Rs)	Expenditure on quantity consumed (Rs)
А	8	200	65	1950
В	20	1400	30	1650
С	5	80	20	900
D	10	360	15	300
Ε	27	2160	10	600

Hence find Fisher's ideal index number

(2x15 = 30)

ECH2COR07: STATISTICAL METHODS FOR ECONOMICS

OBJECTIVE

Apart from the general objective stated in statistics-I, this course enables students to know the various aspects of probability distributions and tests of significance.

MODULE I

Probability Concepts, Approaches to Probability - Classical, Statistical and Axiomatic, Addition theorem, Conditional Probability, Independence of events, Multiplication theorem, Baye's Theorem and its applications.

MODULE II

Random Variables -Discrete and Continuous, Probability Distributions, Expected value, Theoretical Distributions: Binominal, Poisson and Normal. Central limit theorem and its applications.

MODULE III

Testing of hypothesis -null and alternative hypothesis, Type I and Type II errors, Critical Region, Significance level, P-value, One sample Tests – test concerning population mean and proportion, Two sample Tests – test concerning population means (dependent and independent samples).

MODULE IV

F-test and Analysis of Variance (one-way ANOVA, concept only), Test for significance of correlation coefficient, Chi-Square test for independence of attributes.

REFERENCES:

1. Douglas A. Lind, William G. Marchal, Samuel A. Wathen : Statistical Techniques in Business and Economics (15th Edition), McGrawHill.

2. David Freedman, Robert Pisani, Roger Purves And Ani Adhikari: Statistics, (Second Edition) Norton.

3 Gupta, S P : Statistics Methods, Sultan Chand & Sons

BLUE PRINT

PROGRAMME *BA. Economics (Hons)* SEMESTER I: *ECH2COR07* COURSE TITLE: <u>STATISTICAL METHODS FOR ECONOMICS</u> II

Module	Hrs Allotted	Part A 2 Mark 10/12	Part B 5 Marks 6/9	Part C 15 Marks 2/4	Total questions
1	30	3	3	1	7
2	30	3	3	1	7
3	20	3	2	1	6
4	18	3	1	1	5

Question Paper Blue Print [Theory 40 % Problems 60%]

MODEL QUESTION PAPER BA Degree (C.B.C.S.) Examination Second Semester Programme – BA Economics (Hons) ECH2COR07 - STATISTICAL METHODS FOR ECONOMICS II

Time: Three Hours

Maximum Marks: 80

Use of non - programmable calculator and statistical tables allowed

Part A (Short Answer Questions)

(Answer any ten questions. Each question carries 2 mark.)

- 1. State the classical definition of probability.
- 2. If a coin is tossed twice, what is the probability of getting exactly one head?
- 3. State the addition theorem of probability.
- 4. Define conditional probability
- 5. If A and B are two independent events with P(A) = 0.25 and P(B) = 0.5, find P(A | B)
- 6. Write down the probability mass function of a Binomial distribution.
- 7. Find the area between 0 and 2.4 under the standard normal curve.
- 8. Define critical region.

Curriculum and Syllabus (2020 Admission onwards)

- 9. Define significance level.
- 10. What is the null hypothesis in one-way ANOVA?
- 11. Explain how you will determine the expected value of a discrete random variable
- 12. If A and B are two independent events with P(A) = 0.5 and P(B) = 0.6, find $P(A \cap B)$

(10 x 2=20)

Part B (Brief Answer Questions)

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

- 13. If A and B are two independent events with P(A) = 0.5 and P(B) = 0.6, find $P(A \cap B)$.
- 14. Distinguish between a discrete and continuous random variable.
- 15. A coin is tossed 5 times. Find the probability of getting exactly 2 heads.
- 16. Define a Poisson distribution and give its characteristics.
- 17. State the properties of a normal distribution
- 18. Distinguish between null and alternative hypothesis.
- 19. What are Type I and Type II errors?
- 20. What do you mean by analysis of variance?
- 21. Distinguish between paired t-test and independent samples t-test.

(6x5 = 30)

Part C (Descriptive / Short Essay Questions)

(Answer any two questions. Each question carries 15 marks.)

- 22. In 1989, there were three candidates for the position of principal Mr. A, Mr. B and Mr. C whose chances of getting the appointment are in the proportion 4:2:3 respectively. The probability that Mr. A if selected would introduce co-education in the college is 0.3. The probabilities of Mr. B and Mr. C doing the same are respectively 0.5 and 0.8. What is the probability that there was co-education in the college in 1990.
- 23. According to the Internal Revenue Service, the mean tax refund for the year 2013 was \$2000. Assume the standard deviation is \$600 and that the amounts refunded follow normal distribution. a) What percent of the refunds are more than \$2500? b) What percent of the refunds are more than \$2500 but less than \$3500?
- 24. Two sample polls of votes for two candidates A and B are taken, one each from among the residents of rural and urban areas. The results are given in the following table. At the 5% level of significance, examine whether the type of area is related to voting preferences.

1 100	Votes for	Votes for	Total
Area	Α	В	Total
Rural	620	380	1000
Urban	550	450	1000
Total	1170	830	2000

25. The following data gives marks obtained by a sample of 10 students before and after a period of training. Assuming normality test whether the training was of any use.

Student No.	1	2	3	4	5	6	7	8	9	10
Before training	91	95	81	83	76	79	101	85	88	81
After training	88	89	97	88	92	92	90	99	97	87

(2x15 = 30 marks)

Note: at least 50% questions should be problems

ECH4COR15: OPERATIONS RESEARCH

OBJECTIVE

Planning and decision making are very important in military operation research was initially developed in the context of defence strategy. This was later become popular in the academic world, especially in business and industry. Hence this course is introduced to empower students in the realms of planning and decision making.

MODULE I

Introduction: Meaning and scope of Operations research (OR) Applications in Business and economicslimitations of OR

Linear Programming problem (LPP) mathematical formulation of LPP- solution to the LPP using graphic method, simplex method and Big M method (up to 3 variables) duality in LPP-concept and interpretation

MODULE II

Transportation Problem: Description and Formulation of transportation problem –initial basic feasible solution by 1) North West Corner Rule 2) Least cost method 3) Vogel's Approximation method - Solution of balanced and unbalanced transportation problem. Assignment problem – Introduction balanced and unbalanced assignment problem, solution using Hungarian method. Travelling Salesman problem and its solution.

MODULE III

Inventory models, costs in inventory management deterministic inventory models- EOQ Model with instantaneous replenishments and constant rate of Demand.

Queuing models: Basic elements of queuing models, Probability distributions in Queuing models; M/M/1, M/M/c, M/M/ ∞ and M/E_k/1.

MODULE IV

Sequencing models: Solution of sequencing problem – Processing n jobs through 2 machines – Processing n jobs through 3 machines – Processing 2 jobs through m machines – Processing n jobs through m machines.

Replacement models: Replacement of items that deteriorate whose maintenance costs increase with time without change in the money value. Replacement of items that fail suddenly.

MODULE V

Theory of Games: Basic concepts and definitions, Two person zero sum game, saddle point pure and mixed strategies Optimal solution of the game with saddle point Reducing the size of the game using dominance property, optimal solution to a 2×2 game without saddle point, graphical solution to $2 \times n$ and m x 2 games

REFERENCES:

• Sharma J.K (2013) Operations research, Theory and Applications 5th Edition Laxmi Publications New Delhi

• Taha H.A (2007) Operations research 8th Edition Pearson

• Kanti Swarup, Gupta, P.K. and Man Mohan (2001) Operations Research, Ninth edition, Sultan Chand & Sons.

• Hillier F.S and Lieberman G.J (2010) Introduction to Operations Research 9th Edition Mc Graw Hill

BLUE PRINT

PROGRAMME *BA. Economics (Hons)* SEMESTER IV: *ECH4COR15* COURSE TITLE: <u>OPERATIONS RESEARCH</u>

Module	Hrs Allotted	Part A 2 Mark	Part B 5 Marks	Part C 15 Marks	Total questions
		10/12	6/9	2/4	
1	25	3	3	1	7
2	25	3	2	1	6
3	18	2	1	0	3
4	20	2	1	1	4
5	20	2	2	1	5

MODEL QUESTION PAPER

B.A. DEGREE (C.B.C.S.) EXAMINATION Fourth Semester Programme - B.A. Economics (Hons) ECH4COR15 - OPERATIONS RESEARCH (2020 Admission -Regular)

Time: Three Hours

Part A

(Answer any **ten** *Questions*. Each question carries **2** marks)

- 1. Find the saddle point and value of the game with the payoff matrix $\begin{bmatrix} 1 & 3 \\ -2 & 10 \end{bmatrix}$.
- 2. What is the difference between a solution and feasible solution of an LPP?
- 3. What do you mean by a basic feasible solution for an LPP?
- 4. Define (i) Slack Variable (ii) Artificial Variable.
- 5. What are the commonly used methods for getting an initial solution to a transportation problem?
- 6. Explain total replacement cost of items whose maintenance cost increase with time for m years.
- 7. Describe a M/M/2 queuing model.
- 8. Define economic order quantity.
- 9. Name any two methods for finding the initial basic feasible solution of a TP.
- 10. Define Total elapsed time.
- 11. Define an Unbalanced Assignment problem.
- 12. Define Saddle point.

Part B

 $(10 \times 2 = 20)$

Maximum: 80 Marks

(Answer any six Questions. Each question carries 5 marks)

- 13. Write down the assumptions of EOQ model with uniform rate of demand.
- 14. Explain the Big M method for solving LPP.
- 15. Find the initial basic feasible solution of the transportation problem.

	D_1	D_2	D ₃	D_4	Supply
O_1	5	3	6	2	19
O_2	4	7	9	1	37
O ₃	3	4	7	5	34
Demand	16	18	31	25	

16. Explain the dominance principle in game theory.

- 17. Describe Travelling Salesman problem.
- 18. Define duality in LPP.
- 19. Explain sequencing problem for processing n jobs through 2 machines.
- 20. Explain the assumptions of a Two person Zero sum game.
- 21. Draw a simplex table and explain the headings?

(6×5=30)

Part C

(Answer any two questions. Each question carries 15 marks)22. Solve the following linear programming problem graphically.

Maximize $Z = 3x_1 + 2x_2$

Subject to $x_1 + x_2 \ge 5$, $4x_1 - x_2 \le 15$, $-x_1 + 4x_2 \le 15$ and $x_1, x_2 \ge 0$

23. In a factory, there are seven jobs to process, each of which should go to machines M1 & M2 in the order M1M2. The processing timings in minutes are given, determine the optimal sequencing of jobs and idle time of machines.

Jobs	А	В	С	D	E	F	G
Machine M1	9	5	8	3	4	1	7
Machine M2	2	4	10	5	6	11	6

24. Find the saddle point and the value of the game with the payoff matrix

	1		~		
	1	2	3	4	
1	-5	3	1	20	
2	5	5	4	6	
3	-4	-2	0	-5	

25. Solve the following transportation problem.

	Ι	II	III	IV	Supply
А	15	10	17	18	2
В	16	13	12	13	6
С	12	17	20	11	7
Demand	3	3	4	5	_

(2×15=30)

5. Courses for BCom.

Semester -I COM1COR01-BUSINESS STATISTICS

Instructional Hrs-72

[Theory 30 % Problems 70%]

OBJECTIVE

- To provide basic knowledge of statistical techniques as are applicable to business.
- To enable the students to apply statistical techniques for quantification of data in business.

Course Outcome

After completing the course, the student shall able to

- Outcome 1 Understand various term in statistics/data measurement and Collection techniques
- Outcome 2 Understand and apply the uses of measures of central tendency and dispersion in business problems
- Outcome 3 Understand and apply basic matrix representations for statistical data and its applications
- Outcome 4 Understand different types of time series components in its application in business decisions
- Outcome 5 Understand different types of standardizes indices and their applications in decision making.

Module 1

Introducing Statistics as a subject – Descriptive and Inferential Statistics – Meaning – Definition – Origin – Role of Statistics in Business and Industry – Limitations.

-Methods of Data Collection – Primary and Secondary Data – Sources – Census and Sampling-Comparison-Methods of Sampling - Probability and Non-Probability Sampling - Classification and Tabulation of Data – Construction of Frequency Table

(12 hours)

Credit-3

Module 2

Measures of Central Tendency – Mean, Median, Mode, Geometric mean, Harmonic mean, Measures of Dispersion – Absolute and Relative Measures –Partition Values – Concepts of Quartiles, Deciles, Percentiles – Range –Quartile Deviation – Mean Deviation – Standard Deviation – Merits and Limitations – Coefficient of Variation – Applications in Business – Moments – Skewness – Kurtosis

(24 hours)

Module 3

Basics of Matrix Theory: Types of Matrices – Order, Addition, Multiplication, Determinant, Inverse (2 x 2 matrix only) – Solution of Simultaneous Equations-Cramers rule.

(8 hours)

Module 4

Time Series Analysis – Meaning – Definition – Components – Methods of Determination of Trend – Semi Averages – Moving Averages – Trend by Methods of Least Square (Linear and Exponential) – Applications to Business – Business Forecasting (12 hours)

Module 5

Index Numbers – Meaning – Importance – Uses – Price Indices and Quantity Indices – Methods of Construction – Simple and Weighted – Laspeyer, Paasches and Fishers Indices – Test of Adequacy – Cost of Living Index and Uses – Problems in the Construction – Chain Base and Fixed Base Index – Base Shifting – Splicing and Deflation – Simple Examples

(16 hours)

SUGGESTED READING

- 1. Gupta SP, Statistics Methods, Sultan Chand 43rd edition
- 2. Sharma JK, Business Statistics, Pearson, 2012 edition
- 3. Elhance DN, Fundamentals of Statistics, KitabMahal, 2018
- 4. Aggarwal BM, Business Mathematics and Statistics
- 5. Sanchetti and Kapoor, Business Statistics, Sultan Chand
- 6. Kothari CR, Research Methodology, New AgeInternational Publishers, 2019
- 7. Desai SS, Business Statistics
- 8. S.C Gupta, Fundamentals of statistics, Himalaya Publishing House, 2018

Semester 1 COM1COR01-BUSINESS STATISTICS

Question Paper Setting Guideline [Theory 30 % Problems 70%]

Module	Hours	2 Marks questions10 out of 12	5 Marks questions6 out of 9	15 Marks questions2 out of 4	Total
1	12	2	2	1	29
2	24	3	2	1	31
3	8	3	1	0	11
4	12	2	2	1	29
5	16	2	2	1	29
		12 Theory Questions	6 problem 3 theory questions	4 Problem questions	129 Marks

Model Question Paper MAHARAJA'S COLLEGE (A GOVERNMENT AUTONOMOUS COLLEGE B.Com. DEGREE (C.B.C.S.) EXAMINATION First Semester Programme – B.Com. – Finance & Taxation (Model II) COM1COR01 - BUSINESS STATISTICS

Time: 3 hours

Maximum : 80 Marks

(Use of scientific calculator permitted)

Part A

(Answer any ten Questions. Each question carries 2 marks

- 1 Define Geometric Mean.
- 2 Define moments
- 3 Explain weighted mean
- 4 Which average is called positional average?
- 5 What is Transpose of a Matrix?
- 6 Define Symmetric distribution.
- 7 What is frequency of a class?
- 8 Define deciles.
- 9 Distinguish between primary data and secondary data.
- 10 Explain the relationship among Mean, Median and Mode in a skewed distribution
- 11 Explain about Moving averages
- 12 What is base year in index number construction?

(2x10=20 Marks)

Part B

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

- 13 Distinguish between questionnaire and interview schedule.
- 14 Briefly explain about the important relative measures of dispersion
- 15 Express your idea about measure of peakedness
- 16 For a distribution the coefficient of variation is 33.6 % and the value of arithmetic mean is 12. Find out the value of standard deviation.
- 17 Write about types of movements in time series
- 18 Calculate value of Quartile deviation and its Coefficient from the following data

Roll No	1	2	3	4	5	6	7
Marks	70	60	110	30	93	88	101

19 Construct an index number based on Simple Aggregative Method

Commodity	Price in base year	Price in current year
А	45	73
В	30	58
С	55	67

20. Calculate first four moments of the following distribution. 8, 12, 13, 15, 22

21. Mr. X rolled a die a number of times and recorded his result in a table, as follows.

Number of goals	1	2	3	4	5	6
Frequency	8	6	5	9	6	4

Calculate mean deviation and coefficient of mean deviation

Part C

(Answer any **two** questions, Each question carries **15** marks)

22. Following figures relate to the output of a FMCG Company. Find the 4-yearly moving averages. What conclusion do you draw from the results?

Years	Out put	Years	Out put
	(in lakhs units)		(in lakhs units)
2004	29	2011	43
2005	37	2012	47
2006	43	2013	51
2007	34	2014	63
2008	40	2015	53
2009	42	2016	45
2010	55	2017	54

23. From the following data construct 23. Fisher's Ideal Index Number and show how it satisfies Time Reversal Test and Factor Reversal Test.

Commodity	Base Year		Current Year		
	Price (Rs)	Quantity (Kg)	Price (Rs)	Quantity (Kg)	
А	20	20	50	15	
В	40	4	80	5	
С	10	10	20	12	
D	50	5	100	6	

24. Calculate the median of the data

Class :	0-10	10-20	20-30	30-40	40-50	
Frequencies :	3	9	15	30	18	
D	·			1 1	CC /1 1	

Draw the cumulative frequency curve and read off the value of the median from it

25. Write note on Standard deviation. State its merits.

Calculate Standard deviation

Class	0-10	10-20	20-30	30-40
Frequencies	15	18	24	28

(2x15=30)

Credit-3

Semester 2 COM2COR05-QUANTITATIVE TECHNIQUES FOR BUSINESS RESEARCH

Instructional Hrs-72

[Theory 30 % Problems 70%]

Objective

- To enable the students to apply the simple statistical tools in business research
- To familiarize students with writing research reports

Course Outcome

After completing the course, the student shall able to

- Outcome 1 Theoretical understanding of few mathematical models for business problem solving.
- Outcome 2 Understand and analyze different types of relations among variables and their applications in business research.
- Outcome 3 Understand and analyze different types of relations among variables and their applications in business research.
- Outcome 4 Analyse uncertainty using statistical models and its applications in decision making
- Outcome 5 Testing hypothesis in business problems.

Module 1: Interpolation and Extrapolation - Meaning and Utilities of Interpolation and Extrapolation -Binomial Expansion Method of Interpolation and Extrapolation - Newton's and Lagrange's.- Merits andLimitations - Applications(12 hours)

Module 2: Bivariate Data: Correlation – Meaning and Definition – Types – Coefficient Measures – Karl Pearson and Spearman's Rank Correlation (untied only) – Regression Analysis – Lines of Regression -Regression Coefficients – Properties – Curve Fitting – Method of Least Squares (Linear; y = a + bx and exponential; $y = ae^{bx}$) (16 hours)

Module 3: Probability: Concept of Probability – Three Approaches to Define Probability – Permutations and Combinations – Theorem of Addition and Multiplication – Conditional Probability and Bayes' Theorem – Problems : Random Variables and Distributions: Random Variables – Definition – Simple Examples – Expectation and Variance – Probability Distributions – Concept – Binomial and Normal Distributions – Properties. (20 hours)

Module 4: - Research: Socialscience research Meaning-Definition-Business Research-Exploratory, Descriptive, Empirical, Qualitative and Quantitative Research, identification of research problem formulation research design research methodology – formulation of hypothesis Null hypotheses-

Alternative Hypotheses-Level of significance-Degrees of freedom-Type I Error-Type II Error

(12 hours)

Module 5

Testing of Hypotheses: Parametric and non-parametric tests- Population parameter – sample statistic- Chisquare test-Condition for validity of Chi-square test – Test for goodness of fit - Test for independence (both theory and simple problems)

Report Writing: Integral Part of Report – Characteristics of a good report – Contents of a Report – IMRDFramework – Bibliography12 hours(16 hours)

SUGGESTED READINGS

- 1. Hooda R.P, Statistics for Business and Economics, 3rd Edition, McMillan, New Delhi
- 2. Richard Levin and David Rubin, statistics for Management, 8th Edition, PHI, New Delhi
- 3. Gupta SP, Statistical Methods, Sultan Chand, 2014 Edition.
- 4. Elhance D. N, Fundamentals of Statistics, 2018 Edition.
- 5. Gupta S C, Fundamentals of Statistics ,Himalaya Publishing Company,7th Edition, 2019
- 6. Kothari CR, Research Methodology, New Age, Second Revised Edition.
- 7. Upagade Vijay & Shende Arvind, Research Methodology, S Chand & Company, (1 December 2010)
- 8. R. Panneerselvam, Research Methodology, PHI Learning; 2 edition (4 April 2014)

SEMESTER II

QUANTITATIVE TECHNIQUES FOR BUSINESS RESEARCH

Module	Hours	2 Marks questions10 out of 12	5 Marks questions6 out of 9	15 Marks questions2 out of 4	Total
1	12	3	2		16
2	16	3	2	1	31
3	16	3	2	1	31
4	12	1	1	1	22
5	16	2	2	1	29
		12	9	4	129

Question Paper Blue Print [Theory 30 % Problems 70%]
Model Question Paper MAHARAJA'S COLLEGE (A GOVERNMENT AUTONOMOUS COLLEGE B.Com. DEGREE (C.B.C.S.) EXAMINATION Second Semester

Programme – B.Com. – Finance & Taxation (Model II) COM2COR05- QUANTITATIVE TECHNIQUES FOR BUSINESS RESEARCH Time : 3 hours Maximum : 80 Marks

Part A

(Answer any ten questions. Each question carries2 marks)

- 1. What do you mean by statistical hypothesis?
- 2. What is regression?
- 3. A die is thrown once. What is the probability of getting number 4 or 6?
- 4. Define combinations.
- 5. Distinguish between a technical report and a popular report.
- 6. What do you mean by references?
- 7. State multiplication theorem of probability.
- 8. What do you mean by level of significance?
- 9. What is Interpolation?
- 10. What are exhaustive events?
- 11. Distinguish between dependent and independent variables
- 12. What do you mean by regression lines?

Part B

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

- 13. From the following table showing age of cars of a certain make and annual maintenance costs, obtain the regression equation for costs related to age:
 - Age of car (Years):246781012Annual maintenance Costs (Rs.):1600150018001900170021002000
- 14. A problem in statistics is given to two students. Their chances of solving it are 2/3 and 3/4 respectively. What is the probability that the problem is not solved?
- 15. Calculate Pearson's coefficient of correlation from the following data: Advertising expenses (*Rs.in '000*):39, 65, 62, 90, 62, 75, 25, 98, 36, 78 Sales (*Rs.in lakh*) : 47, 53, 58, 86, 62, 68, 60, 91, 51, 84
- 16. Find out the spearman's co- efficient of rank correlation from the following data relating to the ranks assigned by the two judges on certain competition.
- 17. Explain the applications of Extrapolation.
- 18. What are the important contents of a research report?
- 19. A bag contains 4 white, 3 black and 5 red balls. What is the probability of getting a white or red ball at random in a single draw?
- 20. Given r = 0.8, $\sum xy = 60$, $\sigma y = 2.5$, $\sum x^2 = 90$, find the number of items.
- 21. The odds against students X solving a Business Statistics problem are 8 to 6 and odds in favour of Y solving the same are 14 to 16.
 - i) What is the chance that the problem will be solved if both try?
 - ii) What is the probability that they both working independently of each other solve the problem?

(10x2=20)

iii) What is the probability that neither solves the problem?

(6x5=30)

Part C

(Answer any **two** question. Each question carries15 marks)

22. From the data given below in the following table, test for independence between students' interest in statistics and commerce using χ^2 test at 5 percent level of significance.

Interest	Interest in Commerce						
in	Low	Average	High	Total			
Statistics							
Low	63	42	15	120			
Average	58	61	31	150			
High	14	47	29	90			
Total	135	150	75	360			

23. Following data shows the maximum and minimum temperature on a certain day at 10 important cities located throughout India.

Max. Temperature: 2923	25	15	27	29	24	31	32	35
Min. Temperature: 8 3	7	5	8	1910	7	5	8	

a) Fit a regression line of *x* on *y* and *y* on*x*.

b) Estimate the maximum temperature when minimum temperature is 12.

c) Estimate the minimum temperature when maximum temperature is 40

d) Calculate correlation coefficient.

24. 200 digits were selected at random from a set of tables. The frequencies of digits were:

Digits:	0	1	2	3	4	5	6	7	8	9
f:	18	19	23	21	16	25	22	20	21	15

Use the χ^2 test to assess the correctness of the hypothesis that the digits were distributed in equal numbers in the tables from which these were chosen.

25. A panel of judges A and B graded seven debaters and independently awarded the following marks Marks by A: 40 34 28 30 44 38 31 26 39 38 34 Marks by B: 32 30 28

An eighth debater was awarded 36 marks by judge A while judge B was not present. If judge B were also present, how many marks would you expect him to award to the eighth debater assuming that the same degree of relationship exists in their judgment.

(2x15=30)

