File Ref.No.24326/GA-IV-K-ASST-2/2013/Admn

UNIVERSITY OF CALICUT

Abstract

General and Academic IV - Faculty of Science - Revised Scheme and Syllabus of B.Sc Statistics Honours Programme under CUFYUGP Regulations 2024 with effect from 2024 Admission - Approved by the Vice Chancellor, subject to report to the Academic Council- Reg

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G & A - IV - K Section

U.O.No. 13697/2024/Admn   Dated, Calicut University.P.O, 07.09.2024

Read:-1. U.O.No. 9035/2024/Admn dated 11/06/2024
      2.U.O Note No.83329/EX-III-ASST-2/2024/PB dated 30.06.2024
      3. Remarks from Chairperson, Board of Studies in Statistics
      4. Approval of the Dean, Faculty of Science dated 27/07/2024.

ORDER

1. The Scheme and Syllabus for B.Sc Statistics Honours Programme under CUFYUGP Regulations 2024 with effect from 2024 Admission were implemented in the University of Calicut,vide paper read as (1) above.

2.Vide paper read as (2), Pareeksha Bhavan identified discrepencies In the syllabus of B.Sc Statistics Honours Programme specifically that the codes for the General Foundation Courses (Multi disciplinary Courses and Skill Enhancement Courses) do not align with the CUFYUGP Regulations.

3.The Chairperson, Board of Studies in Statistics has forwarded the corrected syllabus for the B.Sc Statistics Honours Programme under CUFYUGP Regulations 2024 with effect from 2024 admission, including the addition of names for the group of minors offered by the Board of Studies in Statistics, vide paper read as (3).

4.The Dean, Faculty of Science, as per paper (4) referenced above, has approved the resolution of Board of Studies in Statistics UG.

5.Considering the matter in detail, Vice Chancellor has approved the implementation of the revised syllabus of B.Sc Statistics Honours Programme under CUFYUGP Regulations 2024 with effect from 2024 admission, incorporating the modifications.

6.Therefore, the revised scheme and syllabus for the B.Sc Statistics Honours Programme under CUFYUGP Regulations 2024, with effect from 2024 Admission, are implemented, subject to report to the Academic Council.

7.Orders are issued accordingly. (Syllabus appended)

Ajayakumar T.K

Assistant Registrar

To
      1.The Principals of all Affiliated Colleges,
      Copy to: PS to VC/PA to PVC/ PA to R/PA to CE/JCE I/JCE IV/EX IV and EG Sections/GA IF/CHMK Library/Information Centres/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

B.Sc. STATISTICS HONOURS
(MAJOR, MINOR AND GENERAL FOUNDATION COURSES)

SYLLABUS & MODEL QUESTION PAPERS
w.e.f. 2024 admission onwards

(CUFYUGP Regulations 2024)

B.Sc. STATISTICS HONOURS

(MAJOR, MINOR AND GENERAL FOUNDATION COURSES)

SYLLABUS

PROGRAMME OUTCOMES (PO):

At the end of the graduate programme at Calicut University, a student would:

PO1	Knowledge Acquisition: Demonstrate a profound understanding of knowledge trends and their impact on the chosen discipline of study.
PO2	Communication, Collaboration, Inclusiveness, and Leadership: Become a team player who drives positive change through effective communication, collaborative acumen, transformative leadership, and a dedication to inclusivity.
PO3	Professional Skills: Demonstrate professional skills to navigate diverse career paths with confidence and adaptability.
PO4	Digital Intelligence: Demonstrate proficiency in varied digital and technological tools to understand and interact with the digital world, thus effectively processing complex information.
PO5	Scientific Awareness and Critical Thinking: Emerge as an innovative problem-solver and impactful mediator, applying scientific understanding and critical thinking to address challenges and advance sustainable solutions.
PO6	Human Values, Professional Ethics, and Societal and Environmental Responsibility: Become a responsible leader, characterized by an unwavering commitment to human values, ethical conduct, and a fervent dedication to the well-being of society and the environment.
PO7	Research, Innovation, and Entrepreneurship: Emerge as a researcher and entrepreneurial leader, forging collaborative partnerships with industry, academia, and communities to contribute enduring solutions for local, regional, and global development.

PROGRAMME SPECIFIC OUTCOMES (PSO):

At the end of the BSc Statistics (Honours) programme at Calicut University, a student would:

PSO1	Acquire comprehensive understanding of concepts, principles, and theories of Statistics.
PSO2	Apply fundamental concepts of descriptive and inferential Statistics- exploratory data analysis
PSO3	Master skills in using Statistical Software's to meet the challenges of Employability, Research and Development.
PSO4	Identify the potential area of applications of Statistical theories.
PSO5	Construct Statistical models for real world problems and obtain solutions
PSO6	Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in Statistical Science

DISTRIBUTION OF MINOR COURSES IN STATISTICS

The minor courses given below should not be offered to the students who have taken statistics as the major discipline. They should be offered to students from other major discipline only.

Sl. No	Semester	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
								Internal	External	Total
1			**Descriptive and Inferential Statistics** (Preferable for Mathematics, Physics, Chemistry and Biochemistry students)							
	1	STA1MN101	**Descriptive Statistics for Data Science**	1	75	5	4	30	70	100
	2	STA2MN101	**Probability Theory I**	2	75	5	4	30	70	100
	3	STA3MN201	**Statistical Inference using R**	3	75	5	4	30	70	100
2			**Statistical Methodologies in Data Science** (Preferable for Computer Science and Electronics students)							
	1	STA1MN103	**Introductory Statistics with R**	1	75	5	4	30	70	100
	2	STA2MN103	**Regression and Probability Theory**	2	75	5	4	30	70	100
	3	STA3MN203	**Random Variables and CART**	3	75	5	4	30	70	100
3			**Behavioural Statistical Techniques** (Preferable for Psychology students)							
	1	STA1MN105	**Descriptive Statistics**	1	75	5	4	30	70	100
	2	STA2MN105	**Introduction to Probability**	2	75	5	4	30	70	100
	3	STA3MN205	**Inferential Statistics**	3	75	5	4	30	70	100

EVALUATION SCHEME

1. The evaluation scheme for each course contains two parts: internal evaluation (about 30%) and external evaluation (about 70%). Each of the Major and Minor courses is of 4-credits. It is evaluated for 100 marks, out of which 30 marks is from internal evaluation and 70 marks, from external evaluation. Each of the General Foundation course is of 3-credits. It is evaluated for 75 marks, out of which 25 marks is from internal evaluation and 50 marks, from external evaluation.

2. The 4-credit courses (Major and Minor courses) are of two types: (i) courses with only theory and (ii) courses with 3-credit theory and 1-credit practical.

• In 4-credit courses with only theory component, out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 10 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.

• In 4-credit courses with 3-credit theory and 1-credit practical components, out of the total 5 modules of the syllabus, 4 modules are for theory and the fifth module is for practical. The practical component is internally evaluated for 20 marks. The internal evaluation of the 4 theory modules is for 10 marks.

3. All the 3-credit courses (General Foundational Courses) in Statistics are with only theory component. Out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 5 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.

Sl. No.	Nature of the Course		Internal Evaluation in Marks (about 30% of the total)		External Exam on 4 modules (Marks)	Total Marks
			Open-ended module / Practicum	On the other 4 modules		
1	4-credit course	only theory (5 modules)	10	20	70	100
2	4-credit course	Theory (4 modules) + Practical	20	10	70	100
3	3-credit course	only theory (5 modules)	5	20	50	75

1. MAJOR AND MINOR COURSES

1.1. INTERNAL EVALUATION OF THEORY COMPONENT

Sl. No.	Components of Internal Evaluation of Theory Part of a Major / Minor Course	Internal Marks for the Theory Part of a Major / Minor Course of 4-credits			
		Theory Only		Theory + Practical	
		4 Theory Modules	Open-ended Module	4 Theory Modules	Practical
1	Test paper/ Mid-semester Exam	10	4	5	-
2	Seminar/ Viva/ Quiz	6	4	3	-
3	Assignment	4	2	2	-
		20	10	10	20*
	Total	30		30	

*Refer the table in section 1.2 for the evaluation of practical component

1.2. EVALUATION OF PRACTICAUM COMPONENT

The evaluation of practicum component in Major and Minor courses is completely by internal evaluation.

- Continuous evaluation of practicum by the teacher-in-charge shall carry a weightage of 50%.

- The end-semester practicum examination and viva-voce, and the evaluation of practicum records shall be conducted by the teacher in-charge and an internal examiner appointed by the Department Council.

- The process of continuous evaluation of practicum courses shall be completed before 10 days from the commencement of the end-semester examination.

- Those who passed in continuous evaluation alone will be permitted to appear for the end-semester examination and viva-voce.

The scheme of continuous evaluation and the end-semester examination and viva-voce of practicum component shall be as given below:

Sl. No.	Evaluation of Practicum Component of in a Major / Minor Course	Marks for Practical	Weightage
1	Continuous evaluation of practicum/ exercise performed in practicum classes by the students	10	50%

2	End-semester examination and viva-voce to be conducted by teacher-in-charge along with an additional examiner arranged internally by the Department Council	7	35%
3	Evaluation of the Practicum records submitted for the end semester viva–voce examination by the teacher-in-charge and additional examiner	3	15%
	Total Marks	20	

1.3. EXTERNAL EVALUATION OF THEORY COMPONENT

External evaluation carries 70% marks. Examinations will be conducted at the end of each semester. Individual questions are evaluated in marks and the total marks are converted into grades by the University based on 10-point grading system (refer section 5).

PATTERN OF QUESTION PAPER FOR MAJOR AND MINOR COURSES

Duration	Type	Total No. of Questions	No. of Questions to be Answered	Marks for Each Question	Ceiling of Marks
2 Hours	Short Answer	10	8 – 10	3	24
	Paragraph/ Problem	8	6 – 8	6	36
	Essay	2	1	10	10
				Total Marks	70

2. INTERNSHIP

- All students should undergo Internship of 2-credits during the first six semesters in a firm/industry / organization, or training in labs with faculty and researchers of their own institution or other Higher Educational Institutions (HEIs) or research institutions.

- Internship can be for enhancing the employability of the student or for developing the research aptitude.

- Internship can involve hands-on training on a particular skill/ equipment/ software. It can be a short project on a specific problem or area. Attending seminars or workshops related to an area of learning or skill can be a component of Internship.

- A faculty member/ scientist/ instructor of the respective institution, where the student does the Internship, should be the supervisor of the Internship.

2.1. GUIDELINES FOR INTERNSHIP

1. Internship can be in Statistics or allied Disciplines.
2. There should be minimum 60 hrs. of engagement from the student in the Internship.
3. Summer vacations and other holidays can be used for completing the Internship.

    BSc. Statistics (Honours) Programme, Institute/ Industry visit or study tour is a requirement for the completion of Internship. Visit to minimum one research institute, research laboratory and place of Statistical data anyalysis importance should be part of the study tour. A brief report of the study tour has to be submitted with photos and analysis.
4. The students should make regular and detailed entries in to a personal log book through the period of Internship. The log book will be a record of the progress of the Internship and the time spent on the work, and it will be useful in writing the final report. It may contain experimental conditions and results, ideas, mathematical expressions, rough work and calculation, computer file names etc. All entries should be dated. The Internship supervisor should periodically examine and countersign the log book.
5. The log book and the typed report must be submitted at the end of the Internship.
6. The Institution at which the Internship will be carried out should be prior-approved by the Department Council of the College where the student has enrolled for the UG (Honours) Programme.

2.2. EVALUATION OF INTERNSHIP

- The evaluation of Internship shall be done internally through Continuous Assessment mode by a committee internally constituted by the Department Council of the College where the student has enrolled for the UG (Honours) Programme.

- The credits and marks for the Internship will be awarded only at the end of semester 6.
- The scheme of continuous evaluation and the end-semester viva-voce examination based on the submitted report shall be as given below:

Sl. No.	Components of Evaluation of Internship		Marks for Internship 2 Credits	Weightage
1	Continuous evaluation of internship through interim presentations and reports by the committee internally constituted by the Department Council	Acquisition of skill set	10	40%
2		Interim Presentation and Viva-voce	5	
3		Punctuality and Log Book	5	
4	Report of Institute Visit/ Study Tour		5	10%
5	End-semester viva-voce examination to be conducted by the committee internally constituted by the Department Council	Quality of the work	6	35%
6		Presentation of the work	5	
7		Viva-voce	6	
8	Evaluation of the day-to-day records, the report of internship supervisor, and final report submitted for the end semester viva–voce examination before the committee internally constituted by the Department Council		8	15%
	Total Marks		50	

3. PROJECT

3.1. PROJECT IN HONOURS PROGRAMME

• In Honours programme, the student has the option to do a Project of 12-credits instead of three Core Courses in Major in semester 8.

• The Project can be done in the same institution/ any other higher educational institution (HEI)/ research Centre/ training Centre.

• The Project in Honours programme can be a short research work or an extended internship or a skill-based training programme.

• A faculty member of the respective institution, where the student does the Project, should be the supervisor of the Project.

LETTER GRADES AND GRADE POINTS

Sl. No.	Percentage of Marks (Internal & External Put Together)	Description	Letter Grade	Grade Point	Range of Grade Points	Class
1	95% and above	Outstanding	O	10	9.50 – 10	First Class with Distinction
2	Above 85% and below 95%	Excellent	A+	9	8.50 – 9. 49	
3	75% to below 85%	Very Good	A	8	7.50 – 8.49	
4	65% to below 75%	Good	B+	7	6.50 – 7.49	First Class
5	55% to below 65%	Above Average	B	6	5.50 – 6.49	
6	45% to below 55%	Average	C	5	4.50 – 5.49	Second Class
7	35% to below 45% aggregate (internal and external put together) with a minimum of 30% in external valuation	Pass	P	4	3.50 – 4.49	Third Class
8	Below an aggregate of 35% or below 30% in external evaluation	Fail	F	0	0 – 3.49	Fail
9	Not attending the examination	Absent	Ab	0	0	Fail

- When students take audit courses, they will be given Pass (P) or Fail (F) grade without any credits.

- The successful completion of all the courses and capstone components prescribed for the three-year or four-year programme with 'P' grade shall be the minimum requirement for the award of UG Degree or UG Degree (Honours) or UG Degree (Honours with Research), as the case may be.

5.1. COMPUTATION OF SGPA AND CGPA

- The following method shall be used to compute the Semester Grade Point Average (SGPA):

  The SGPA equals the product of the number of credits (C_i) with the grade points (G_i) scored by a student in each course in a semester, summed over all the courses taken by a student in the semester, and then divided by the total number of credits of all the courses taken by the student in the semester,

  i.e. SGPA $(S_i) = \Sigma_i (C_i \times G_i) / \Sigma_i (C_i)$

where C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course in the given semester. Credit Point of a course is the value obtained by multiplying the credit (C_i) of the course by the grade point (G_i) of the course.

$$SGPA = \frac{\text{Sum of the credit points of all the courses in a semester}}{\text{Total credits in that semester}}$$

ILLUSTRATION – COMPUTATION OF SGPA

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 x 8 = 24
I	Course 2	4	B+	7	4 x 7 = 28
I	Course 3	3	B	6	3 x 6 = 18
I	Course 4	3	O	10	3 x 10 = 30
I	Course 5	3	C	5	3 x 5 = 15
I	Course 6	4	B	6	4 x 6 = 24
	Total	20			139
	SGPA				139/20 = 6.950

- The Cumulative Grade Point Average (CGPA) of the student shall be calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a programme and is the criterion for ranking the students.

  CGPA for the three-year programme in CUFYUGP shall be calculated by the following formula.

$$CGPA = \frac{\text{Sum of the credit points of all the courses in six semesters}}{\text{Total credits in six semesters (133)}}$$

  CGPA for the four-year programme in CUFYUGP shall be calculated by the following formula.

$$CGPA = \frac{\text{Sum of the credit points of all the courses in eight semesters}}{\text{Total credits in eight semesters (177)}}$$

- The SGPA and CGPA shall be rounded off to three decimal points and reported in the transcripts.

- Based on the above letter grades, grade points, SGPA and CGPA, the University shall issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

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MINOR COURSES IN STATISICS

SYLLABUS

	University of Calicut
	Four Year UG Program **Syllabus - Minor**

Programme	BSc Statistics
Course Code	STA1MN101 (P)
Course Title	Descriptive Statistics for Data Science
Type of Course	Minor
Semester	I
Academic Level	100 - 199

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75

Pre-requisites	Basic knowledge of data, variables, charts and graphs, Basic computer skills
Course Summary	This course aims to equip students with a holistic understanding of different data types and probability, enabling them to make informed decisions and draw meaningful conclusions from data.

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Describe different types of data	U	F	Instructor-created exams / Quiz
CO2	Compare and differentiate various types of data	U	C	Instructor-created exams / Home Assignments
CO3	Visualize different types of data and analyze data to help entrepreneurial decisions using critical thinking skills.	R	P	Seminar Presentation / Group Tutorial Work
CO4	Summarize various descriptive measures of data and critically evaluate ethical implications of statistical methods aligning with human values.	U	C	Instructor-created exams / Home Assignments
CO5	Define basic terms in probability	R	F	One Minute

					Reflection Writing assignments
CO6	Solving uncertainty with sample data with spread sheet	Ap	P		Viva-Voce/Practical Assignment/Instructor-created exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)					

Detailed Syllabus:

Module	Unit	Content	Hours (45 +30)	Marks (70)
I		**Introduction to Statistics**	**8**	**10**
	1	Basic terms and types of Variables	2	
	2	Collection of data- Primary and secondary data,	2	
	3	Methods of collecting primary data	2	
	4	Sources of Secondary data	2	
	Sections from References: Unit 1: 1.2&1.3 [Ref 3] Unit 2: 2.2 [Ref 2] Unit 3: 2.3 [Ref 2] Unit 4: 2.5 [Ref 2]			
II		**ORGANIZING AND GRAPHING DATA**	9	**15**
	5	Frequency Distribution	2	
	6	Cumulative Frequency distribution	2	
	7	Diagrammatic Representations	3	
	8	Graphical Representation of data	2	
	Sections from References: Unit 5: 3.3 [Ref 2] Unit 6: 3.5 [Ref 2] Unit 7: 4.3(4.3.2 to 4.3.7) - [Ref 2] Unit 8: 4.4(4.4.3 to 4.4.5)- [Ref 2]			
III		**NUMERICAL DESCRIPTIVE MEASURES**	**12**	**25**
	9	Measures of central tendency	1	
	10	Arithmetic Mean	2	
	11	Median and Mode	2	
	12	Geometric mean and Harmonic Mean	2	
	13	Partition values	1	

	14	Measures of dispersion	3	
	15	Skewness and Kurtosis (Concept only)	1	
	Sections from References: Unit 9: 2.4 [Ref 1] Unit 10: 2.5 [Ref 1] Unit 11: 2.6, 2.7 [Ref 1] Unit 12: 2.8, 2.9 [Ref 1] Unit 13: 2.11 [Ref 1] Unit 14: 2.13 [Ref 1] Unit 15: 2.16, 2.17 [Ref 1]			
IV		**PROBABILITY**	**16**	**20**
	16	Random Experiment, Sample Space, Events (Basic terminology), Three Conceptual Approaches to Probability	2	
	17	Addition theorem (for two and three events) and simple problems	2	
	18	Conditional probability	3	
	19	Multiplication theorem of probability	2	
	20	Independent events and its Multiplication Theorem	2	
	21	Pairwise and mutual independence (Concept and Problems)	2	
	22	Baye's theorem	3	
	Sections from References: Unit 16: 3.3, 3.4, 3.5, 3.6 & 3.8 [Ref 1] Unit 17: 3.9 [Ref 1] Unit 18: 3.10[Ref 1] Unit 19: 3.11 [Ref 1] Unit 20: 3.12, 3.13& 3.14 [Ref 1] Unit 21: 3.15[Ref 1] Unit 22: 4.2 [Ref 1]			
V		**PRACTICUM**	**30**	
		Do practice problems in spreadsheet from any 5 units of the given list and one additional problem decided by the teacher-in-charge, related to the content of the course. Other units listed here may be used as demonstrations of the concepts taught in the course.		
	1	Types of data		
	2	Introduction to spreadsheet		
	3	Frequency distributions for organizing and summarizing data		
	4	Histograms		
	5	Graphs that enlighten and graphs that deceive		

	6	Measures of central tendency		
	7	Measures of dispersion		
	8	Measures of Relative Standing and Boxplots		
	Sections from References: Unit 1: 1.2 Ref [5] Unit 2: 1.4 Ref [5] Unit 3: 2.1 Ref [5] Unit 4: 2.2 Ref [5] Unit 5: 2.3 Ref [5] Unit 6: 3.1 Ref [5] Unit 7: 3.2 Ref [5] Unit 8: 3.3 Ref [5]			

Books and References:

1. Gupta, S. C. and Kapoor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th edition, Sulthan Chand, New Delhi
2. **Gupta, S. C. (2015). Fundamentals of Statistics, Himalaya Publishing House.**
3. Prem S. Mann (2016), Introductory Statistics 9 th Edition, Wiley
4. Neil A. Weiss, Introductory Statistics, 9th Edition, Addison Wesley Pearson Learning (2011)
5. Mario F Triola, Elementary Statistics using Excel, (2018), 6th edition.

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	3	1	2	-	-	2	-	2	-	-	-
CO 2	3	3	-	2	1	-	3	1	2	3	-	-
CO 3	1	2	-	2	-	-	2	-	2	-	-	-
CO 4	3	2	-	1	-	-	3	-	2	2	-	-
CO 5	3	2	-	-	-	-	3	-	2	-	-	-
CO 6	1	1	2	-	3	3	2	2	1	-	3	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6	✓			

Programme	BSc Statistics				
Course Code	STA2MN101 (P)				
Course Title	Probability theory I				
Type of Course	Minor				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Students should have a strong foundation in algebra and calculus, including functions, differentiation, and integration. Basic knowledge about descriptive Statistics				
Course Summary	Students will acquire a comprehensive understanding of key statistical concepts; random variable, standard theoretical distributions and sampling distributions.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define random variables and distinguish different types of random variables	R	C	Instructor-created exams / Quiz
CO2	Identify discrete and continuous probability function and analyze data to help entrepreneurial decisions using critical thinking skills.	R	C	Practical Assignment / Instructor-created exams
CO3	Describe standard theoretical distributions	R	F	Seminar Presentation / Group Tutorial Work/Instructor-created exams
CO4	Discuss various tools for association between the bivariate variables.	U	C	Instructor-created exams / Home Assignments
CO5	Distinguish between a population distribution and a sampling distribution and critically evaluate ethical implications of statistical methods aligning with human values.	U	F	One Minute Reflection Writing assignments, Instructor-created exams
CO6	Explain the calculation of correlation	U	P	Viva

		coefficent using spread sheet.			Voce/Instructor -created exams

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Units	Content	Hrs (45 +30)	Marks (70)
I		**DISCRETE RANDOM VARIABLES AND THEIR PROBABILITY DISTRIBUTIONS**	12	15
	1	Random Variables- Discrete	1	
	2	Probability mass function, properties and problems	1	
	3	Cumulative distribution function and its properties	1	
	4	Mathematical expectation of a random variable, function of a random variable and properties of expectation	1	
	5	Properties of variance	1	
	6	Covariance	2	
	7	Moments (definition only), Moment Generating Function (Definition, Simple problems and Properties (without proof))	1	
	8	Binomial Distribution (Mean, variance, m.g.f.,Simple Problems)	2	
	9	Poisson Distribution (Mean, variance, m.g.f.,Simple Problems)	2	
	Sections from References: Unit 1: 5.1 & 5.3 [Ref 1] Unit 2: 5.3.1 [Ref 1] Unit 3: 5.2, 5.2.1,5.3.2[Ref 1] Unit 4: 6.1,6.2,6.3,6.4 [Ref 1] Unit 5: 6.3 [Ref 1] Unit 6: 6.6 [Ref 1] Unit 7: 7.1,7.1.2 [Ref 1] Unit 8: 8.4, 8.4.1 [Ref 1] Unit 9: 8.5, 8.5.2 [Ref 1]			
II		**CONTINUOUS RANDOM VARIABLES AND THEIR PROBABILITY DISTRIBUTIONS**	12	20
	10	Probability density function, properties and problems	2	

	11	Rectangular distribution (Mean and Variance)	2	
	12	Exponential distribution (Mean and Variance)	2	
	13	Normal Distribution (Moments, Moment Generating Function, Additive Property ,Area property and their problems)	6	
		Sections from References: Unit 10: 5.4, 5.4.1, 5.4.2 [Ref 1] Unit 11: 9.3.1 [Ref 1] Unit 12: 9.8, 9.8.1[Ref 1] Unit 13: 9.2, 9.2.5, 9.2.7, 9.2.8, 9.2.11[Ref 1]		
III		**DESCRIPTIVE METHODS IN CORRELATION AND REGRESSION**	10	20
	14	Simple correlation	3	
	15	Simple regression	3	
	16	Coefficient of determination	2	
	17	Curve linear regression	2	
		Sections from References: Unit 14: 10.1, 10.2, 10.3, 10.4, 10.4.1, 10.4.2 [Ref 1] Unit 15: 11.1, 11.2, 11.2.1, 11.2.2 [Ref 1] Unit 16: 11.2.6 [Ref 1] Unit 17: 11.3 [Ref 1]		
IV		**SAMPLING DISTRIBUTIONS**	11	15
	18	Parameter and Statistic, sampling distribution, standard error.	2	
	19	Distribution of sample mean	2	
	20	Chi- square distribution (definition, mean, variance, m.g.f, additive property)	4	
	21	F distribution (definition only)	1	
	22	t distribution	2	
		Sections from References: Unit 18: 14.3, 14.3.1, 14.3.2 [Ref 1] Unit 19: 4.2 [Ref 3] Unit 20: 4.3 [Ref 3] Unit 21: 4.4 [Ref 3] Unit 22: 4.5 [Ref 3]		
V		**PRACTICUM**	30	
		Do practice problems in spreadsheet from any 5 units of the given list and one additional problem decided by the teacher-in-charge, related to the content of the course. Other units listed here may be used as demonstrations of the concepts		

		taught in the course.		
	1	Scatterplot and correlation		
	2	Linear correlation coefficient r		
	3	Regression		
	4	Calculate factorials, permutations and combinations		
	5	Concept of simulation		
	6	Finding mean and variance of a probability distribution		
	7	Methods for finding binomial probabilities		
	8	Methods for finding Poisson probabilities		
	Sections from References: Unit 1: 2.4 [Ref 5] Unit 2: 2.4 [Ref 5] Unit 3: 2.4 [Ref 5] Unit 4: 4.4 [Ref 5] Unit 5: 4.5 [Ref 5] Unit 6: 5.1 [Ref 5] Unit 7: 5.2 [Ref 5] Unit 8: 5.3 [Ref 5]			

Books and References:
1. Gupta, S. C. and Kapoor, V. K. (2002). Fundamentals of Mathematical   Statistics, 11th edition, Sulthan Chand, New Delhi
2. Prem S. Mann (2016), Introductory Statistics 9 th Edition, Wiley
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. Neil A. Weiss, Introductory Statistics, 9th Edition ,Addison Wesley Pearson Learning (2011)
5. Mario F Triola, Elementary Statistics using Excel, (2018), 6th edition.

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	3	-	-	-	2	3	2	-	-	-	-
CO 2	-	-	-	-	-	3	3	2	-	-	-	-
CO 3	-	-	-	-	-	2	2	3	-	-	-	-
CO 4	-	-	-	-	-	-	3	3	-	-	1	1

CO 5	-	2	-	3	2	-	2	-	1	-	2	-
CO 6	2	-	2	-	-	3	2	3	-	3	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓			✓

Programme	BSc Statistics
Course Code	STA3MN201 (P)

Course Title	Statistical inference using R				
Type of Course	Minor				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Students should be comfortable with concepts such as probability distributions, random variables, and conditional probability.				
Course Summary	Upon completion of this course, students will be proficient in understanding and applying the concept of estimation and testing of hypothesis in statistics, allowing them to make informed decisions and draw reliable conclusions from sample data.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Articulate the purpose of estimation in making inferences about population parameters based on sample data and analyze data to help entrepreneurial decisions using critical thinking skills.	Ap	C	Instructor-created exams / Quiz
CO2	Explain the difference between point estimation and interval estimation	U	C	Practical Assignment / Observation of Practical Skills
CO3	Calculate and interpret confidence intervals for both population mean and proportion and critically evaluate ethical implications of statistical methods aligning with human values	Ap	F	Seminar Presentation / Group Tutorial Work/ Instructor-created exams
CO4	Explain how to formulate null and alternative hypotheses for different types of research questions	U	C	Instructor-created exams / Home Assignments
CO5	Introduce R software and discuss R code for various graphical representations of data.	U	F	One Minute Reflection Writing assignments/ Instructor-creat

Module	Units	Content	*	#	
					ed exams
CO6		Apply estimation and hypothesis testing methods to real-world data sets.	Ap	P	Viva Voce/ Instructor-creat ed exams

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Units	Content	Hrs (45 +30)	Marks (70)
I		**THEORY OF ESTIMATION**	14	25
	1	Point estimation	1	
	2	Unbiasedness	2	
	3	Consistency	2	
	4	Efficiency	2	
	5	Sufficiency	2	
	6	Methods of estimation	2	
	7	Interval estimation	1	
	8	Confidence limits for mean	1	
	9	Confidence limits for proportion	1	
	Sections from References: Unit 1: 16.1, 16.2, 16.2.1 [Ref 1] Unit 2: 16.2.2 [Ref 1] Unit 3: 16.2.3 [Ref 1] Unit 4: 16.2.4 [Ref 1] Unit 5: 16.6.5 [Ref 1] Unit 6: 16.2.6 [Ref 1] Unit 7: 16.4 [Ref 1] Unit 8: 16.4.2 [Ref 1] Unit 9: 16.4.3 [Ref 1]				
II		**TESTING OF HYPOTHESIS**	10	20
	10	Statistical hypothesis, Simple and composite hypothesis	2	
	11	Null and alternate hypothesis, Two types of errors, Level of significance, Critical region, one tatiled and two tailed	2	

		tests		
	12	Large sample tests: Test for single proportion	3	
	13	Test of significance for a single mean	3	
	Sections from References:			
	Unit 10: 16.6.1 [Ref 1]			
	Unit 11: 16.6.3, 16.6.4, 16.6.5, 16.6.6, 16.6.7, 16.6.8 [Ref 1]			
	Unit 12: 17, 17.2.1 [Ref 1]			
	Unit 13: 17.3.2 [Ref 1]			
III	**CHI SQUARE TEST**		9	15
	14	Applications of Chi square distribution	2	
	15	Chi square test of goodness of fit	3	
	16	Chi square test for independence of attributes	4	
	Sections from References:			
	Unit 14: 18.3 [Ref 1]			
	Unit 15: 18.4 [Ref 1]			
	Unit 16: 18.6 [Ref 1]			
IV	**INTRODUCTION TO R**		12	10
	17	Installation & Basic Mathematical Operations	2	
	18	R Preliminaries	1	
	19	Methods of Data Input	1	
	20	Graphical Representations (R Code)	2	
	21	Diagrammatic Representations (R Code)	3	
	22	Descriptive Measures (Mean, Median, Mode, Range, Standard deviation, variance)	3	
	Sections from References:			
	Unit 19: 1.2&1.3 [Ref 5]			
	Unit 20: 1.4 [Ref 5]			
	Unit 21: 1.5&1.6 [Ref 5]			
	Unit 22: 1.8,2.3 [Ref 5]			
	Unit 23:2.2 [Ref 5]			
	Unit 24: 2.4,2.5 [Ref 5]			
V	**PRACTICUM**		30	
	Do practice problems in R software from any 5 units of the given list and one additional problem decided by the teacher-in-charge, related to the content of the course. Other units listed here may be used as			

		demonstrations of the concepts taught in the course.		
	1	Basic mathematical operations and R preliminaries		
	2	Methods of data input		
	3	Data accessing or indexing		
	4	Built in functions in R		
	5	Graphical representations (R Code)		
	6	Diagrammatic representations (R Code)		
	7	Mean, Median, Mode		
	8	Range, Standard deviation, variance		

Sections from References:

Unit 1: 1.3&1.4 [Ref 5]

Unit 2: 1.5 [Ref 5]

Unit 3: 1.6 [Ref 5]

Unit 4: 1.7 [Ref 5]

Unit 5: 1.8 [Ref 5]

Unit 6: 2.2 [Ref 5]

Unit 7: 2.4 [Ref 5]

Unit 8: 2.5 [Ref 5]

Books and References:
1. Gupta, S. C.. (2015). Fundamentals of Statistics, Himalaya Publishing House.
2. Gupta, S. C. and Kapoor, V. K. (2002). Fundamentals of Mathematical Statistics, 11th edition, Sulthan Chand, New Delhi
3. Prem S. Mann (2016), Introductory Statistics 9 th Edition, Wiley
4. The R book (2007) , Michael J. Crawley John Wiley Series
5. Sudha G Purohith, Sharad D Core, Shailaja R Deshmukh (2015), Statistics Using R

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CO 3	2	-	2	-	-	-	2	2	-	3	-	3

CO 4	-	-	3	-	-	-	1	3	-	3	-	-
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CO 6	2	-	2	-	-	-	1	2	-	2	-	2

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CO 4		✓		✓
CO 5		✓		✓
CO 6	✓			

Programme	BSc Statistics