Programme	**B.Sc. Statistics**
Course Code	**STA3MN211 (P)**
Course Title	**Probability theory and statistical distributions**
Type of Course	**Minor**
Semester	**III**
Academic	**200-299**

Level					
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	4	**3**	**-**	**2**	**75**
Pre-requisites	Familiarity with basic calculus such as differentiation and integration, basic knowledge of set theory. Experience with basic data visualization techniques.				
Course Summary	Provide students with a solid foundation in probability theory, including classical and axiomatic approaches, conditional probability, random variables, probability distributions and their applications.				

Course Outcomes (CO):

CO	**CO Statement**	**Cognitive Level***	**Knowledge Category#**	**Evaluation Tools used**
CO1	Calculate probabilities of events using classical probability rules and understand their limitations and compute marginal probabilities and identify their role in joint probability	Ap	C	Practical Assignment / Observation of Practical Skills/ Instructor-created exams
CO2	Define random variables and distinguish between discrete and continuous random variables and analyze data to help entrepreneurial decisions using critical thinking skills.	Ap	F	Seminar Presentation / Group Tutorial Work/ Instructor-created exams
CO3	Understand the significance of probability distributions	Ap	C	Instructor-

	in statistical analysis and critically evaluate ethical implications of statistical methods aligning with human values.			created exams / Home Assignments
CO4	Apply discrete and continuous probability distributions and understand their properties and applications.	Ap	F	One Minute Reflection Writing assignments/ Instructor-created exams
CO5	Use the R programming language to perform graphical representations of statistical distributions	Ap	P	Viva 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	Unit	Content	Hrs (45+30)	Marks
I	**Probability**		**9**	**15**
	1	Basic concepts of Probability, Classical definition of Probability, Axiomatic approach to Probability	2	
	2	Addition Theorem, Multiplication Theorem	3	
	3	Conditional Probability	2	
	4	Independence of events	2	
	Sections from References: Unit 1: 3.3-3.8 [Ref 1] Unit 2: 3.9,3.11 [Ref 1] Unit 3: 3.10[Ref 1] Unit 4: 3.11-3.15 [Ref 1]			
II	**Random Variables**		**9**	**15**
	5	Random Variables, Discrete and continuous random variables	2	
	6	Probability distribution, Distribution function (Applications in discrete case)	3	
	7	Mathematical expectation (Applications in discrete case)	2	
	8	Variance (Applications in discrete case)	2	
	Sections from References: Unit 5&6: 5.1-5.4.2 [Ref 1] Unit 7: 6.1-6.4 [Ref 1] Unit 8: 6.6 [Ref 1]			
III	**Discrete and Continuous distributions**		**19**	**25**

	9	Binomial distribution (Definition and problems)	2	
	10	Poisson distribution (Definition and problems)	2	
	11	Normal distribution (Definition and problems)	1	
	12	Properties of Normal distribution	3	
	13	Uniform distribution (Definition and properties)	3	
	14	Exponential distribution (Definition and properties)	3	
	15	Gamma distribution (Definition and properties)	1	
	16	Beta distribution (Definition and properties)	1	
	17	Cauchy, Pareto distribution (Definition only)	3	
	Sections from References: Unit 9:14.2 [Ref 2] Unit 10:14.3[Ref 2] Unit 11:14.4 [Ref 2] Unit 12:14.5 [Ref 2] Unit 13:14.6[Ref 2] Unit 14:14.7 [Ref 2] Unit 15:14.8 [Ref 2] Unit 16&17:14.9[Ref 2]			
IV	**R programming**		**8**	**15**
	18	R as a set of statistical tables	2	
	19	Cumulative distribution	2	
	20	Probability density function	2	
	21	Plotting probability curves for standard discrete distributions	1	
	22	Plotting probability curves for standard continuous distributions	1	
	Sections from References: Unit 18&19: 2.1-2.3[Ref 3] Unit 20: 7.5 [Ref 2] Unit 21: 6.2 [Ref 2] Unit 22: 7.3 [Ref 2]			
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	Graph of Binomial distribution		
	2	Graph of Poisson distribution		
	3	Graph of Normal distribution		
	4	Graph of Uniform distribution		

	5	Graph of Exponential distribution		
	6	Graph of Gamma distribution		
	7	Graph of Beta distribution		
	8	Graph of Cauchy distribution		
	Sections from References: Unit 1,2: 3.3 [Ref 3] Unit 3,4,5: 3.4 [Ref 3] Unit 6,7,8: 3.5 [Ref 3]			
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. Sudha G Purohith, Sharad D Core, Shailaja R Deshmukh (2015), Statistics Using R.				

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	0	0	0	1	0	2
CO2	2	0	0	0	1	0	2
CO3	2	0	0	0	1	0	2
CO4	2	0	0	0	1	0	2
CO5	2	0	0	0	1	0	2

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
CO1	✓	✓		✓
CO2	✓			✓
CO3		✓		✓
CO4	✓	✓		✓
CO5	✓			