Refer to section 7 of FYIMP- Computational Science - Scheme and Syllabus for the 4 credit courses with 3 Credit Theory + 1 Credit Practical.

Semester II

A2– DISCIPLINE SPECIFIC CORE COURSE

KU2DSCSTA102: FIRST COURSE ON THEORY OF PROBABILITY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	CORE	100	KU2DSCSTA102	4	90

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	1	1	50	50	100	3(T)+2(P)*

COURSE DESCRIPTION:

This course provides a comprehensive introduction to probability theory, covering foundational concepts, axiomatic definitions, conditional probability, independence, and the practical applications of Bayes' theorem. The course is structured into four units, each focusing on different aspects of probability theory.

COURSE OBJECTIVES:

- To develop a solid understanding of the fundamental concepts of probability theory, including random experiments, sample space, events, and basic probability calculations.
- To acquire knowledge of different definitions of probability, including classical, empirical, and axiomatic definitions, and understand the properties and limitations of each.
- To develop proficiency in applying mathematical concepts such as sets, sigma algebras, and measures to describe probability spaces and analyze probabilities of events.
- To enhance problem-solving skills by applying probability concepts to a variety of

real-world scenarios and numerical problems, including conditional probability, independence, and Bayes' theorem.

COURSE OUTCOME:
After successful completion of this course, students will be able to

SL #	Course Outcomes
CO1	Understand Probability Foundations: Students will demonstrate a solid understanding of the foundational concepts of probability theory, including random experiments, sample space, events, and the distinction between mutually exclusive and exhaustive events.
CO2	Apply Axiomatic Definition of Probability: Upon completion of the course, students will be able to apply the axiomatic definition of probability, understanding probability as a measure and its representation in a probability space.
CO3	Analyze Conditional Probability and Independence: Students will demonstrate proficiency in calculating conditional and marginal probabilities, as well as joint probabilities.
CO4	Apply Bayes' Theorem in Practical Situations: By the end of the course, students will be able to apply Bayes' theorem to solve practical problems involving conditional probability and independence.

MAPPING OF COs to PSOs

Sl No	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓
CO4	✓		✓	✓	✓

COURSE CONTENTS

UNIT 1

Elementary Probability Theory: Random experiment, sample space and events, mutually

exclusive and exhaustive events, partition of sample space, empirical and classical definitions of probabilities and properties, examples using classical definition of probability, merits and limitations of classical and empirical definitions. **(15 hrs)**

UNIT 2

Axiomatic Definition of Probability: Class of sets, sigma algebra of events, axiomatic definition of probability, probability as a measure, probability space, basic theorems in probability using axioms, advantageous of axiomatic definition of probability, addition theorem (for two and three events), generalization of addition theorem (without proof). Boole's inequality.
(20 Hours)

UNIT 3

Conditional Probability and Independence: Conditional and marginal probabilities, joint probability, independence of events, pairwise and mutual independence and their implications, examples. Multiplication theorem for two and three events, generalization of multiplication theorem for n-events (without proof), numerical illustrations**.**
(20 Hours)

UNIT 4

Bayes' Theorem and Applications: Total probability, Bayes' theorem, prior and posterior probabilities, Monty Hall problem, solution to various problems related to Bayes' theorem, numerical illustrations. **(15 Hours)**

UNIT 5 (Teacher Specific Module- Optional)

Prerequisites to Study Probability Theory: History of probability, paradoxes in probability, basic set theory for probability, representation of sets in Venn diagram, operations of sets- union, intersection, complementation, basic principle of counting, problems related to permutation and combination. Computations using R. **(20 Hours)**

TEXT BOOKS

1. Ross, S. (2010). ***A First Course in Probability***. 8th Ed., Pearson, Prentice Hall.
2. Spiegel, M. R., Schiller, J. J., and Srinivasan, R. A. (2013). ***Schaum's outline of Probability and Statistics***. McGraw-Hill Education**.**

SUGGESTED READINGS

1. Gupta, S. C. and Kapoor, V. K. (2020). ***Fundamentals of Mathematical Statistics***. Sultan Chand and Sons' Publishers, New Delhi.
2. Gut, A. (2005). ***Probability: A Graduate Course***. Springer, New York.
3. Baclawski, K. (2008). ***Introduction to Probability with R***. Chapman and Hall/CRC.
4. Feller, W. (1999). ***An Introduction to Probability Theory and Its Applications*** **(Vol. 1)**. Wiley.

TEACHING LEARNING STRATEGIES

- Lecturing, Visualization, Team Learning

MODE OF TRANSACTION

- Direct classroom, Lecture, Seminar, Discussion, ICT based lecture.

ASSESSMENT RUBRICS

Refer to section 5 of FYIMP- Computational Science - Scheme and Syllabus for the 4 credit courses with 3 Credit Theory + 1 Credit Practical.

Semester II

A3– DISCIPLINE SPECIFIC CORE COURSE

KU2DSCSTA103: INTRODUCTION TO R PROGRAMMING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	CORE	100	KU2DSCSTA103	4	90

Learning Approach (Hours/ Week)	Marks Distribution	Duration of