Mahatma Education Society's

Pillai HOC College of Arts, Science & Commerce

(Autonomous)

Rasayani

Affiliated to University of Mumbai
NAAC Accredited with "A+" Grade in cycle II
ISO 9001:2015 Certified

SYLLABUS

B.Sc. Artificial Intelligence & Machine Learning(AIML)

F. Y. B. Sc. Artificial Intelligence & Machine Learning(AIML)

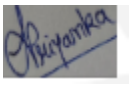
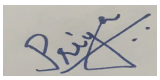
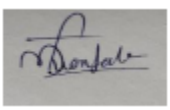
As per National Education Policy 2020

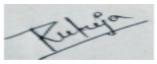
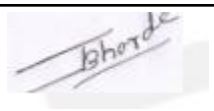
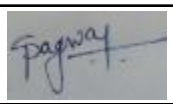
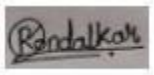
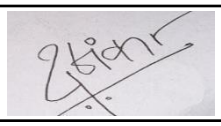
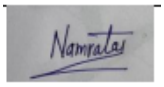
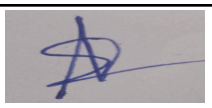
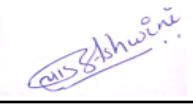
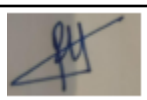
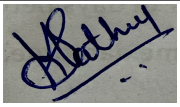
Academic Year 2026-27

Mahatma Education Society's
College Code: 870
PILLAI HOC COLLEGE OF ARTS, SCIENCE & COMMERCE
Pillai HOCL Educational Campus, HOC Colony, Rasayani, Via. Panvel, Dist. Raigad. Pin 410207
Tel: 02192 - 669000 / 01 / 02 / 03 / 04 / 05 / 06 / 07 / 08 / 09 Website : www.phcasc.ac.in Email : phcasc@mes.ac.in
(NAAC Accredited 'A+' Grade , CGPA – 3.26 in Cycle 2 & ISO 9001:2015 Certified)
Affiliated to the University of Mumbai, Approved by Government of Maharashtra
(AUTONOMOUS COLLEGE)

Ref.No: PHCASC/BOS Meeting/Attendance/2026-27 Date: 01.04.2026

Board of Studies Mathematics, Statistics and Computer Application

Sr. No	Name	Signature
1	Dr. Swapna Kadam Vice Chancellor Nominee	
2	Dr. Annie Rajan, Subject Experts	
3	Dr. Homraj Patelpaik Subject Experts	
4	Mr. Swapnil H. Patil Industry Expert	
5	Mr. Akash Ghadge Meritorious Alumnus	
6	Dr. Rinkoo Shantnu Principal	
7	Ms. Priyanka Sorte Chairperson (Programme Co-ordinator BSc. CS)	
8	Ms. Priya Prakash Member (Mathematics, Statistics)	
9	Ms. Harshita Singh Member (Mathematics, Statistics)	
10	Ms. Mrunal Wanjale Member (Mathematics, Statistics)	
11	Ms. Arpita Kante Member (Programme Co-ordinator BSc. DS)	

12	Ms. Anita Mhatre Member (Programme Co-ordinator MSc. DS)	
13	Ms. Sangeeta Menon Member (Programme Co-ordinator BSc.AIML)	
14	Ms. Aarti Wani Member	
15	Ms. Rutuja Madane Member	
16	Ms. Kranti Vartak Member	
17	Ms. Jyoti Borade Member	
18	Ms. Sonali Dagwar Member	
19	Ms. Rutuja Kondalkar Member	
20	Mr. Yash Karkhanis Member	
21	Ms. Aishwarya Mokal Member	
22	Ms. Vinaya Bhoir Member (Programme Co-ordinator BSc. Cyber Security)	
23	Ms. Namrata Kedari Member	
24	Ms. Ashwini Patil Member	
25	Ms. Ashwini Lad Member (Programme Co-ordinator MSc.IT)	
26	Ms. Priyanka Sonawane Member (Programme Co-ordinator BSc.IT)	
27	Mr. Shinoj Mathew Member	

Introduction

A B.Sc. in Artificial Intelligence and Machine Learning is a three-year undergraduate program designed to equip students with both foundational knowledge and advanced skills in intelligent systems and data-driven technologies. The program focuses on bridging the gap between theoretical concepts and practical implementation, enabling students to develop a strong understanding of algorithms, machine learning models, neural networks, and data analytics. The comprehensive curriculum integrates core areas such as programming, statistics, deep learning, natural language processing, computer vision, and big data technologies, along with exposure to real-world applications across industries. Students gain hands-on experience by designing and building AI-based solutions, enhancing their problem-solving abilities, critical thinking, and innovation skills. The program also emphasizes ethical AI practices, teamwork, research orientation, and continuous learning to keep pace with rapidly evolving technologies. With opportunities for internships, industry collaborations, and project-based learning, graduates are well-prepared for careers in AI development, data science, automation, and research, as well as for higher education and entrepreneurial ventures in emerging technological domains. This interdisciplinary training in Artificial Intelligence and Machine Learning prepares graduates for careers in technical roles, higher education, research, and entrepreneurship. Supported by strong placements, industry collaborations, and incubation for AI startups, the program exposes students to emerging areas like deep learning, generative AI, robotics, and intelligent automation, enabling them to adapt to evolving technologies and build responsible AI solutions.

Programme Outcomes (POs)

PO. No.	PO Title	POs in brief
PO1	Fundamental Knowledge Acquisition	Graduates will demonstrate a comprehensive and foundational knowledge of their chosen discipline along with an awareness of interdisciplinary connections.
PO2	Critical Thinking and Analytical Reasoning	Graduates will be able to analyse complex problems, synthesize data from multiple sources (qualitative and quantitative), and employ logical reasoning to formulate well-supported conclusions and arguments.
PO3	Effective Communication	Graduates will exhibit proficiency in both written and oral communication, articulating ideas clearly, persuasively, and ethically to diverse audiences
PO4	Problem Solving	Graduates will possess the ability to identify, formulate, and design solutions for real-world problems in their professional or social contexts, applying relevant theoretical knowledge and practical skills.
PO5	Information and Digital Literacy	Graduates will demonstrate the capability to locate, evaluate, and effectively use information from various sources, and utilize modern tools and Information and Communication Technology (ICT) for professional and academic tasks.
PO6	Research Skills and Scientific Temperament	Graduates will develop a sense of inquiry and research methodology, including the ability to design experiments (where applicable), collect and analyse data, and interpret results while maintaining scientific rigor and intellectual honesty.
PO7	Ethical Reasoning and Professional Integrity	Graduates will recognize ethical dilemmas, commit to professional and academic ethics, and demonstrate an understanding of moral and social responsibilities in their personal and professional conduct.
PO8	Employability and Professional Skills	Graduates will acquire the necessary job-ready skills, managerial competencies, and professional values to secure gainful employment or pursue advanced education in their respective fields.
PO9	Environmental and Sustainability Consciousness	Graduates will understand the importance of environmental conservation and sustainable development, displaying responsibility toward ecological challenges and advocating for healthy environmental practices.
PO10	Life-Long Learning	Graduates will develop the capacity for independent and self-directed learning to continuously upgrade their knowledge and skills, enabling them to adapt to rapid technological and societal changes.
PO11	Civic and Social Responsibility	Graduates will act as responsible citizens with an informed awareness of constitutional values, engaging proactively in community development and addressing social needs.
PO12	Empathy and Social Intelligence	Graduates will be able to cultivate and demonstrate affective, interpersonal, social and emotional intelligence.

Programme Specific Outcomes (PSOs)

PSOs. No.	PSO Title	PSOs in brief
PSO1	Technical Design & System Development	Graduates will be able to design, develop, and implement intelligent systems and AI-based applications using machine learning, deep learning, and data-driven approaches across domains such as healthcare, finance, robotics, and automation.
PSO2	Application of AI Algorithms and Data-Driven Techniques	Graduates will apply core concepts of artificial intelligence, machine learning algorithms, statistical methods, and data analytics tools to model, analyze, and solve complex real-world problems effectively.
PSO3	Innovation, Research Mindset & Professional AI Ethics	Graduates will stay updated with emerging AI technologies, foster innovation and research thinking, and adhere to ethical standards, ensuring responsible development and deployment of AI systems.
PSO4	Teamwork, Project Management & Lifelong Career Growth	Graduates will work efficiently in multidisciplinary teams, manage AI/ML projects, and engage in lifelong learning to adapt to evolving technologies and advance in careers or higher education in AI and related fields.

Evaluation Pattern

Marking Code	Marking Scheme
A	50 Marks Semester End Exam, 50 Marks Continuous Assessment (distributed within 15 Marks Class Test, 15 Marks Presentation & Assignment, 10 Marks Online Quiz, 10 Marks Attendance & Class Participation)
B	50 Marks Semester End Exam
C	100 marks Continuous Assessment (distributed within 30 Marks Class Test, 30 Marks Presentation & Assignment, 30 Marks Online Quiz, 10 Attendance & Class Participation)
D	50 Marks of Continuous Assessment (distributed within 15 Marks Class Test, 15 Marks Presentation & Assignment, 10 Marks Online Quiz, 10 Marks Attendance & Class Participation)
E	50 Marks Practical Examination (distributed within 30 Marks Practical Module 1 & 2, 10 Marks Journal, 10 Marks Viva)

Course Structure

Semester I							
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Marks**	**Credits**	**Lectures / Week**	**Evaluation Pattern**
HUSAIML1	Major	INTRODUCTION TO PYTHON PROGRAMMING	Theory	100	2	2	A
HUSAIML1P	Major - Practical	PRACTICAL(HUSAIML1)	Practical	50	1	2	E
HUSAIML2	Major	FUNDAMENTALS OF COMPUTERS AND COMPUTATIONAL THINKING	Theory	100	2	2	A
HUSCS209P	Major - Practical	PRACTICAL(HUSCS209)	Practical	50	2	2	E
HUSCS210	Major		Theory	100	2	2	A
HUSCS210P	Major - Practical	PRACTICAL(HUSCS210)	Practical	50	1	2	E
HUSCS211	Minor	DESCRIPTIVE STATISTICS	Theory	100	2	2	A
HUSCS211P	Minor - Practical	PRACTICAL(HUSCS211)	Practical	50	1	2	E
HUSCS212	SEC	BASIC PROBABILITY THEORY AND DISCRETE DISTRIBUTIONS	Theory	100	2	2	A
HUSCS212P	SEC - Practical	PRACTICAL(HUSCS212)	Practical	50	1	2	E
	AEC	COMMUNICATION SKILLS IN ENGLISH	Theory	50	2	2	D
	OE	OE (FROM POOL)	Theory	100	3	3	C
	CC	EXTENSION / NSS	-	50	2	2	D
Total				**950**	**22**		**

Abbreviations:

SEC: Skill Enhancement Course
AEC: Ability Enhancement Course
VAC: Value Added Course VEC: Value Education CourseOE: Open Elective

BOS	**Mathematics, Statistics and Computer Application**				
Course	**Introduction to Python programming**				
Course Code	**HUSCS208**	**Level**	**4.5**		
		Type	**Theory**	**Practical**	**Total**
Semester	**I**	**Credits**	2	1	3
Type	**Major**	**No of Teaching Hours**	30	30	60

Evaluation Pattern	**Total Marks**	**Semester End**	**Continuous**	**Practical**
	150	50	50	50

Learning Objectives

1	To introduce fundamental concepts of data structures and abstract data types
2	To develop understanding of linear and non-linear data structures
3	To enable analysis of time and space complexity using Big-O notation
4	To provide practical knowledge of commonly used data structures in computing
5	To apply data structures to solve real-world computational problems

Course Outcomes	
After successful completion of this course, students would be able to: -	
CO1	Explain fundamental Python concepts, syntax, and programming constructs relevant to AI/ML applications.
CO2	Develop Python programs to solve computational problems using logical reasoning and structured approaches.
CO3	Implement and manipulate core data structures (lists, tuples, dictionaries, sets), functions, and file handling operations in Python.
CO4	Perform data preprocessing, analysis, and visualization using Python libraries for real-world datasets,tools and libraries to build basic AI/ML workflows and simple automation tasks.

Modules at Glance

Module No.	Content	No. of Hours	CO Mapping
1	Foundations of Python Programming and Core Constructs	15	CO1, CO2, CO3
2	Python Libraries, File Handling, and AI/ML Applications	15	CO3, CO4,

Syllabus

Module No.	Content	No. of Lectures
1	**Introduction to Python Programming**History, Features, and Applications of Python ,Installation, IDEs (Anaconda, Jupyter, VS Code) ,Python Syntax, Variables, Data Types,Input/Output, Type Casting, Simple Programs and Debugging **Control Structures and Functions**Conditional Statements (if, elif, else),Loops (for, while, nested),Break, Continue, Pass statements, Functions: Definition, Parameters, Return Values,Recursion, Lambda, and Scope **Data Structures in Python**Strings, Lists, Tuples, Sets, Dictionaries, Operations and Methods,Comprehensions (List, Dict, Set),Iteration and Manipulation	15
2	**File Handling and Modules** File Operations: Text, Binary, CSV, Exception Handling (try, except, finally),Modules, Packages, and Importing Built-in Modules (math, random, os, datetime) **Python for AIML Application** Introduction to Libraries: NumPy, Pandas, Matplotlib ,DataFrames, Series, Basic Statistics,Data Cleaning & Manipulation,Data Visualization: Line, Bar, Pie, Scatter Plots,Simple Linear Regression using Scikit-learn,Flask.	15
Case Study Scenario		
M1	A smart city project requires a console-based parking management prototype developed using core Python concepts without external libraries. The system must store parking slot IDs, track availability, and allow users to reserve or release slots. It should accept user input, validate entries, and prevent invalid bookings while displaying updated slot status. The solution must use variables, conditionals, loops, functions, and data structures such as lists or dictionaries. Exception handling should be implemented to ensure robustness against incorrect inputs.Develop a Python function that checks whether a slot is available before booking.	
M2	A retail company wants to analyze historical sales data (date, category, units sold, revenue) to identify trends and predict future revenue using Python. The solution must read data from a CSV file, clean missing or inconsistent entries, and compute metrics such as total sales, average revenue, and best-selling category. It should visualize patterns using charts and apply simple linear regression for sales prediction. The implementation must use Pandas, NumPy, Matplotlib, Scikit-learn, and file handling concepts**Questions:** Outline steps for preprocessing the dataset; write code logic for computing summary statistics; explain how visualization aids decision-making;	

Reference Books:

1. Severance, C. R. (2016). Python for Everybody: Exploring Data in Python 3. CreateSpace.
2. Lutz, M. (2013). Learning Python (5th ed.). O'Reilly Media.
3. Downey, A. B. (2015). Think Python: How to Think Like a Computer Scientist (2nd ed.). O'Reilly Media.
4. Python Official Docs: https://docs.python.org
5. W3Schools / TutorialsPoint Python Tutorials
6. Kaggle Datasets and Colab Notebooks for Practice

Semester End Evaluation (50 Marks) **Time : 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks : 50
Q1	Attempt 3 out of 5	15
Q2	Attempt 3 out of 5	15
Q3	Attempt 3 out of 5	15
Q4	Case Study	05

Practical Syllabus

Sr. No	List of Practical	No. of. Lectures	CO Mapping
1	**Environment Setup and Basic Programs** Write a program to perform basic arithmetic operations such as addition, subtraction, multiplication, and division. Write a program to take user input and display formatted output using variables and string operations.	3	CO1,CO2
2	**Programs Using Conditionals, Loops, and Functions** Write a program to check whether a given number is even or odd using conditional statements. Write a program to find the factorial of a number using loops.	3	CO3, CO4
3	**Data Structures Implementation** Write a program to demonstrate list operations such as append, insert, delete, and sorting. Write a program to implement a student record system using dictionaries.	3	CO3, CO4
4	**File Operations and Exception Handling** Write a program to read the contents of a text file and display them on the screen. Write a program to write and append data to a file.	3	CO4,CO3
5	**Data Analysis and Visualization** Write a program to create and manipulate NumPy arrays. Write a program to load a dataset into a Pandas DataFrame and perform basic data analysis (mean, median, mode, etc.).	3	CO3
6	**Introduction to Web GUI**: Design a simple web interface using **Flask** to accept user input (Number/Name) and display it back on a webpage.	3	CO2, CO4,CO3,
7	**Functions and Modular Programming** Write a program to create user-defined functions for different operations (e.g., prime check, palindrome check). Demonstrate the use of function arguments, return values, and recursion.	3	
8	**Object-Oriented Programming Concepts** Write a program to create a class and objects to represent real-world entities (e.g., Student/Bank Account). Demonstrate concepts of inheritance and method overriding.	3	CO3, CO4
9	**Data Visualization using Matplotlib/Seaborn** Write a program to create different types of plots (line chart, bar graph, pie chart). Visualize a dataset using appropriate graphs and interpret the results.	3	CO3
10	**Mini Project (Integration of Concepts)** Develop a small application combining concepts such as file handling, data structures, and basic data analysis (e.g., student management system with file storage). Present output with simple visualization or interface.	3	CO1, CO2,CO4

Semester End Practical Evaluation **Time: 2 Hours**

Question No.	Questions	Total Marks
Q.1	Program	30
Q.2	Journal	10
Q.3	Viva & Attendance	10

BOS	**Mathematics, Statistics and Computer Application**				
Course	**Fundamentals of Computers and Computational Thinking**				
Course Code		**Level**	**4.5**		
		Type	**Theory**	**Practical**	**Total**
Semester	**I**	**Credits**	2	1	3
Type	**Major**	**No of Teaching Hours**	30	30	60

Evaluation Pattern	Total Marks	Semester End	Continuous	Practical
	150	50	50	50

Learning Objectives	
1	To introduce students to the basic structure and functioning of computer systems.
2	To apply syntax and semantics of the C language
3	To analyse loops and decision making in programming.
4	To use arrays, structures, union and pointers and dynamic memory allocation
5	To examine functions for modular code and handle errors.
6	To introduce students to the basic structure and functioning of computer systems.

Course Outcomes	
After successful completion of this course, students would be able to: -	
CO1	Understand the historical evolution of computing systems and contributions of key pioneers like Charles Babbage, Alan Turing, and John von Neumann.
CO2	Identify and explain major hardware components of a computer system.
CO3	Install and configure basic computer hardware components.
CO4	Differentiate types of software, install and configure operating systems such as Microsoft Windows and Linux, and apply computational thinking to analyze and solve basic computing problems.

Modules at Glance

Module No.	Content	No. of Hours	CO Mapping
1	Evolution of Computers	15	CO1 & CO2
2	Computer Hardware and Software	15	CO3, CO4,

Syllabus

Module No.	Content	No. of Lectures
1	**Module 1: Evolution of Computers** **Evolution of Computers** – History, Generations Overview of Computer System-Von Neumann Model, Number Systems (Binary, Hexa, Octal, Decimal) **Number Conversion and Digital Codes** - Conversion from one number system to another, Digital Codes(Gray, Excess-3, BCD) **Computing Systems:**Single Core, Dual-Core and Multi-Core Processors, Graphics Processing Unit (GPU),Accelerated Processing Unit, Quantum Processing Units (QPU)(Concept only). **Memory Components:** Input devices, output devices, CPU (ALU and Control Unit), memory (primary((DRAM, SRAM, DDR SDRAM) and secondary storage). **Computer Components:** SMPS, Motherboard, and Storage Devices – HDD, SSD, and NVMe (Concept only).	15
2	**Module 2: Problem Solving and Computational Thinking** **Problem Solving:** Understanding and Defining the Problem, Adopting a Systematic Approach. **Computational Thinking:** Concepts of Problem Decomposition, Pattern Recognition, Abstraction, and Generalization. **Logical Thinking:** Inductive and Deductive Reasoning, and the Use of Logical Expressions. **Algorithmic Thinking:** Understanding Intuition vs. Precision, and Defining Algorithms. **Algorithm:** Importance of Algorithms, Characteristics of a Good Algorithm, and Illustrative Examples. **Flowchart:** Flowchart Symbols, Practical Examples	15
Case Study Scenario		
M1	A national bank in India plans to upgrade its legacy computer systems to handle increasing digital transactions, UPI payments, and AI-based fraud detection. Earlier, the bank used single-core processor systems with limited memory and storage. Now, it is migrating to multi-core processors and GPU-supported servers to improve performance and security analytics. **During training, employees are introduced to:** Evolution of computers from first to fifth generation.The John von Neumann stored-program architecture model.Binary and hexadecimal number systems used in digital transactions.Concept of GPUs and modern processing systems The technical team must also convert transaction data between binary and decimal systems and understand how digital codes such as BCD are used in financial computations.	
M2	A college plans to establish a new computer laboratory. The technical team must select appropriate hardware components including motherboard, CPU, RAM (DDR SDRAM), SMPS, HDD/SSD, and cooling systems. **While assembling systems, students learn about:** Active components (diodes, transistors, integrated circuits),Passive components (resistors, capacitors, inductors),PCIe expansion slots and I/O ports POST and booting process.The team must ensure hardware-software compatibility	

	before installing the operating system.

Reference Books:

1. Gary B. Shelly, Thomas J. Cashman, and Misty E. Vermaat. “Introduction to Computers”, Cengage Learning, 2008.
2. Pradeep K. Sinha and Priti Sinha, Computer Fundamentals: Concepts, Systems & Applications. BPB Publications.
3. Kevin Wilson, Computer Hardware: The Illustrated Guide to Understanding Computer Hardware. Amazon Digital Services LLC – KDP, 2018.
4. John Hanna, OS Installation 101: A Step-by-Step Approach for Newbies.
5. David Riley and Kenny Hunt, Computational thinking for modern solver, Chapman & Hall/CRC, 2014.
6. R.G. Dromey, How to solve it by Computer, PHI, 2008.

Semester End Evaluation (50 Marks) **Time: 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks: 50
Q1	Attempt 3 out of 5	15
Q2	Attempt 3 out of 5	15
Q3	Attempt 3 out of 5	15
Q4	Case Study	05

Practical Syllabus

Sr. No	List of Practical	No. of. Lectures	CO Mapping
1	a. Identify, categorize and list out specifications of given electronic components. b. Identify and list out specifications of given motherboard components. c. Identify and Describe various ports and connectors on the motherboard.	3	CO1
2	Creation of a Bootable USB Drive using specialized software (like Rufus) for Windows or Linux installation	3	CO1
3	Write an algorithm and pseudocode to read a number and print its value, focusing on correct variable naming.	3	CO1, CO2
4	a.Design an algorithm to read the price of three items and calculate the total bill amount including a 5% tax.Write program based on the same. b.Write pseudocode to read the ages of two persons and print the elder one using relational operators.	3	CO1, CO2
5	a.Create an algorithm to calculate an electricity bill based on different unit slabs (e.g., first 100 units at ₹5, next at ₹8). b.Develop pseudocode to determine if a year is a leap year using AND/OR logical operators.	3	CO1, CO2, CO3
6	Write an algorithm to print the first N natural numbers using a "Repeat-Until" or "While" loop structure..	3	CO1, CO2, CO3
7	To read the ages of two persons and print the elder one.	3	CO1, CO2, CO3
8	To read the number of units of electricity consumed and print the bill amount for various slabs	3	CO1, CO2, CO3, CO4
9	To read a year and check whether it is a leap year.	3	CO1, CO2, CO3,CO4
10	To print first N numbers (using loop).	3	CO1, CO2, CO3, CO4

Semester End Practical Evaluation **Time: 2 Hours**

Question No.	Questions	Total Marks
Q.1	Program	30

~~BOS~~	**~~Mathematics, Statistics and Computer Application~~**					
Course	**Descriptive Statistics**					
Course Code		**Level**		**4.5**		
		Type		**Theory**	**Practical**	**Total**
Semester	**I**	**Credits**		2	1	3
Type	**Minor**	**No of Teaching Hours**		30	30	60
Evaluation Pattern	**Total Marks**	**Semester End**		**Continuous**	**Practical**	
	150	50		50	50	
Q.2	Journal			10		
Q.3	Viva & Attendance			10		

Learning Objectives	
1	To understand statistical data and methods of data presentation.
2	To learn calculation of averages and measures of dispersion.
3	To study correlation and its types for analyzing relationships.
4	To understand regression and its application in prediction.

Course Outcomes	
After successful completion of this course, students would be able to: -	
CO1	Understand basic concepts of statistics and represent data using frequency tables, histograms, and ogives.
CO2	Calculate and interpret measures of central tendency and dispersion for grouped and ungrouped data.
CO3	Understand and compute correlation using Karl Pearson and Spearman methods..
CO4	Apply regression analysis and least square method to study relationships between variables.

Modules at Glance

Module No.	**Content**	**No. of Hours**	**CO Mapping**
1	1.1 Introduction of Statistics:	15	CO1, CO2,

	1.2. Measures of Central Tendencies: 1.3. Measures of Dispersion:		
2	2.1. Correlation 2.2. Regression 2.3. Relation between Correlation and Regression	15	CO3, CO4

Syllabus

Module No.	Content	No. of Lectures
1	1.**Introduction of Statistics**: Meaning of Statistics, Importance of Statistics, Types of Characteristics, Different types of Scales: Nominal, Ordinal, Interval and ratio. Univariate frequency distribution of discrete and continuous variables and Cumulative frequency distribution. Data Presentation: Frequency Distribution, Histogram and Ogives Curves. 2. **Measures of Central Tendencies**: Concept of Central Tendency, characteristics of good measures of Central Tendency, Positional Averages: Median, Mode , Partition values: Quartiles, Deciles and Percentiles -examples of ungrouped and grouped data 3. **Measures of Dispersion**: Concept of Dispersion, Requirements of good measures of Dispersion, Absolute and Relative measures of Dispersion: Range, Quartile Deviation, Mean Absolute Deviation, Standard Deviation, Combined Standard Deviation-examples of ungrouped and grouped data	15
2	1.**Correlation**: Concept of Correlation, types and interpretation, Scatter Diagram, Product Moment Correlation Coefficient, and its properties, Spearman' s Rank Correlation (with and without ties) 2. Concept of Linear Regression, Principle of Least Square, Fitting a straight line by method of least square. 3. Relation between Correlation and Regression, difference between Correlation and Regression	15
Case Study Scenario		
M1	**Student Performance Prediction:** A college wants to predict whether a student will pass or fail based on study hours and attendance Calculate mean study hours and attendance	

	Use correlation to check if more study hours lead to better results Apply simple linear regression to predict performance
M2	**Customer Purchase Behavior:** An online store wants to understand how customer age affects spending behavior. Create histogram to see most active age group Calculate median spending to identify typical purchase Use correlation to see if age affects spending

Reference Books:

1. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, NewDelhi.
2. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, NewDelhi.
3. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi.
4. Schaum‟s Outline Of Theory And Problems Of Beginning Statistics, Larry J. Stephens, Schaum‟s Outline Series Mcgraw-Hill

Semester End Evaluation (50 Marks) **Time : 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks : 50
Q1	Attempt 3 out of 5	15
Q2	Attempt 3 out of 5	15
Q3	Attempt 3 out of 5	15
Q4	Case Study	05

Practical Syllabus

Sr. No	List of Practical	No. of. Lectures	CO Mapping
1	**Introduction to Excel** a. Understanding Data Tools. b. Understanding Formula Tools, insert functional library using insert function.	CO1	3

	c. Add-Ins Analysis tool packs d. Formula writing, Functions, using Cell reference, Sort, Filter and Advance Filter		
2	**Data Entry and Manipulation** a. Tools for data entry and accuracy: Quick Access toolbar customization, Form tool b. Data Transposition to fit Excel (as an Array) c. Data Conversion with the Logical If, VLOOKUP, Pivot table, Pivot chart. d. Data conversion to Text from Non-Excel Sources. Using text to Column	CO1	3
3	**Data Validation** a. Specifying a valid range of values for a cell. b. Specifying a list of valid values for a cell c. Specifying custom validation based on formula for a cell.	CO1	3
4	**Diagrams and Graphs** a. Excel program to plot Histogram. b. Excel program to plot Bar Graphs. c. Excel program to plot Pie chart. d. Boxplot and multiple Boxplots	CO1	3
5	**Measures of Central Tendency** a. Excel program to find Mean. b. Excel program to find Median. c.Excel program to find Mode	CO2	3
6	**Measures of Dispersion** a.Excel program to find Range, Interquartile Range b. Excel program to find Variance. c. Excel program to find Standard Deviation.	CO2	3
7	**Correlation** a. Excel program to find Positive Correlation. b. Excel program to find Negative Correlation. c. Excel program to find Zero Correlation	CO3	3
8	**Regression-1** a. Excel program to perform linear regression for prediction.	CO4	3
9	**Regression – 2** a. Excel program to perform multiple linear regression for prediction.	CO4	3
10	Design a survey form, get primary data and analyse it. (given case study)	CO1,CO2, CO3,CO4	3

BOS	**Mathematics, Statistics and Computer Application**				
Course	**Basic Probability theory and Discrete Distributions**				
Course Code		**Level**	**4.5**		
		Type	**Theory**	**Practical**	**Total**
Semester	**I**	**Credits**	2	1	3
Type	**SEC**	**No of Teaching Hours**	30	30	60
Evaluation Pattern	**Total Marks**	**Semester End**	**Continuous**	**Practical**	
	150	50	50	50	

Semester End Practical

Evaluation **Time: 2 Hours**

Question No.	Questions	Total Marks
Q.1	Program	30
Q.2	Journal	10
Q.3	Viva & Attendance	10

Learning Objectives	
1	To introduce the fundamental concepts of probability theory, including random experiments, sample spaces, events, and probability models used to analyze uncertainty in real-life situations.
2	To develop an understanding of counting principles, permutations, and combinations for solving probability problems and constructing probability models.
3	To explain conditional probability, multiplication theorem, and Bayes' theorem, enabling students to analyze dependent events and posterior probabilities in practical applications.
4	To introduce the concepts of sensitivity and specificity of a procedure and demonstrate the application of Bayes' theorem in analyzing false positive and false negative outcomes in diagnostic and decision-making processes.
5	To develop an understanding of random variables and standard discrete probability distributions, including probability mass function, distribution function, expectation, and variance, and apply these concepts to solve real-life numerical problems.

Course Outcomes	
After successful completion of this course, students would be able to: -	
CO1	Students will be able to understand and apply fundamental concepts of

	probability.
CO2	Students will be able to analyze and solve probability problems using conditional probability, independence of events, and important probability theorems such as addition theorem, multiplication theorem, and Bayes' theorem with appropriate proofs and applications.
CO3	Students will be able to understand and apply the concepts of discrete random variables and distribution functions.
CO4	Students will be able to analyze and solve problems involving standard discrete probability distributions such as Discrete Uniform, Bernoulli, Binomial, Poisson, Hypergeometric, and Geometric distributions, including derivation and application of their mean and variance.

Modules at Glance

Module No.	Content	No. of Hours	CO Mapping
1	Introduction to the basic concepts of probability	15	CO1, CO2,
2	Random Variables and Discrete Probability Distributions	15	CO3, CO4

Syllabus

Module No.	Content	No. of Lectures
1	**Introduction to the basic concepts of probability**: Counting principles, permutations, and combinations, and their role in constructing deterministic and non-deterministic models. Random experiments, sample spaces (finite and countably infinite), and events. Discussion of different types of events and operations on events. Concept of probability, including the classical definition of probability, probability models, and the axioms of probability. Calculation of the probability of an event and study of important probability theorems (with proof): (i) $0 \leq P(A) \leq 1$	15

	(ii) $P(A) + P(A') = 1$ (iii) If $A \subset B$, then $P(A) \leq P(B)$ (iv) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ Application of these results through numerical problems related to real-life situations. Conditional probability definition and its concept. Study of the multiplication theorem of probability $P(A \cap B) = P(A)P(B \mid A)$. Bayes' theorem (without proof) and the concept of posterior probability, along with numerical problems involving posterior probabilities.	
2	**Random Variables and Discrete Probability Distributions:** Introduction to the concept of sensitivity and specificity of a procedure, particularly in diagnostic or decision-making processes. Application of Bayes' theorem in designing procedures to analyze false positive and false negative outcomes. Concept of independence of two events and its implications in probability theory. Solution of numerical problems based on real-life situations involving independent events. Definition of random variables, with emphasis on the definition of a random variable and discrete random variable. Discussion of the probability mass function (p.m.f.) and distribution function (cumulative distribution function) along with their important properties. Mathematical expectation and variance of a random variable, including important theorems related to expectation, with applications through numerical problems based on practical situations. Study of important standard discrete probability distributions, including their definitions, properties, mean, and variance: Discrete Uniform Distribution – definition, mean, and variance. Bernoulli Distribution – Definition, mean, variance, and additive property. Binomial Distribution – Definition, mean, variance, and additive property. Geometric Distribution $p(x) = pqx$, $x = 0,1,2,\ldots$ Definition, mean, and variance. Poisson Distribution – Definition, mean, variance, mode, additive	15

	property, and its limiting relationship with the Binomial distribution B(n,p). Illustration of real- life situations. Numerical problems related to real life situations	
Case Study Scenario		
M1	A university is analyzing participation of students in two extracurricular activities: sports and music club.In a college survey of 200 students:80 students participate in sports,70 students participate in music club and 30 students participate in both sports and music.The administration wants to find the probability that a randomly selected student participates in at least one of the two activities.	
M2	A hospital emergency department studies the number of patients arriving per hour. Past records show that on average 3 patients arrive per hour. The arrivals are independent and occur randomly over time.Find the probability that exactly two patients arrive in an hour.	

Recommended Reference Books:

- Statistical Methods, G.W. Snedecor, W.G. Cochran, John Wiley & sons, 1991, Eighth Edition
- Fundamentals of Applied Statistics, Gupta and Kapoor, S.Chand and Sons, New Delhi, 2014, Fourth Edition
- An Introductory Statistics, Kennedy and Gentle.
- Modern Elementary Statistics, Freund J.E., Pearson Publication, 2006, Twelfth Edition.
- Probability, Statistics, Design of Experiments and Queuing theory with applications Computer Science, Trivedi K.S., Prentice Hall of India, New Delhi,2001, Second Edition.
- A First course in Probability, Ross, Pearson Publication, 2013, Ninth Edition.
- A First Course in Probability and Statistics, L. S. Prakasa Rao, World Scientific Publishing Co Pte Ltd, 2008.
- Applied Probability Models, D. L. Minh, Brooks/Cole, 2000.

Semester End Evaluation (50 Marks) **Time : 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks : 50

Q1	Attempt 3 out of 5	15
Q2	Attempt 3 out of 5	15
Q3	Attempt 3 out of 5	15
Q4	Case Study	05