THIRUVALLUVAR UNIVERSITY
SERKKADU, VELLORE–632115

B.SC. DATA SCIENCE

SYLLABUS
(University Department)

FROM THE ACADEMIC YEAR
2024 – 2025

1. About the Programme

Data Science is a vast field comprising many topics of statistics, mathematics, and IT. A Data Science course syllabus for beginners covers basic and advanced concepts of data analytics, machine learning, statistics, and programming languages like Python or R. It also teaches students how to interpret large datasets and identify patterns to create predictive models. The course is enabled to include several interdisciplinary areas like: programming languages, algorithms, operating systems, databases, machine learning, data mining, business intelligence, big data, probability and statistics, data optimization, statistical simulation and data analysis, management decision analysis, decision models and predictive analysis. Data Science has gained paramount importance in the computer science domain. The need for scientists who understand data in all its aspects will continue to grow strongly. Students graduating from the program will have significantly more depth and breadth in the broad area of Data Science and receive all the information they need to work with various kinds of data and statistical data. Data science is the area where applications of various tools and techniques from the disciplines of applied statistics, mathematics and computer science are used to get greater insight and to make better and informed decisions for various purposes by analyzing a large amount of data. Consequently, the study of data science as a discipline has become essential to cater the growing need for professionals and researchers to deal with the future challenges.

2. Programme Objectives

- **Interdisciplinary Knowledge:** To provide a solid foundation in the interdisciplinary areas of computer science, business analytics, and artificial intelligence**.**
- **Practical Skills:** To offer practical exposure to key areas such as applied statistics, big data analytics, machine learning, data mining, predictive modeling, and data visualization**.**
- **Problem-Solving Abilities:** To develop critical and analytical thinking skills necessary for effective problem-solving in real-world data-related challenges**.**
- **Industry Readiness:** To prepare graduates to manage and analyze various forms of data, enabling them to carry out data-driven investigations and decision-making**.**
- **Continual Learning**: To encourage a mindset of continual learning and adaptation to keep pace with technological advancements and industry trends continual learning: To encourage a mindset of continual learning and adaptation to keep pace with technological advancements and industry trends

3. Admission Eligibility

The candidate must have qualified for their 10 +2 examination or equivalent from a recognized board. The students should have secured a minimum of 55% aggregate marks in either of the three courses (Physics, Chemistry, Mathematics, Biology or Computer Science).

4. Duration of Programme

The programme shall normally extend over a period of three academic years consisting of six semesters.

5. Programme Benefits

- A unique program, designed with inputs from eminent academicians and industry leaders, to focus on building skillsets for the growing requirement of data scientists in the industry.
- Curriculum focuses on mainly on theoretical as well as practical aspects of Statistics, Computer Science and Mathematics
- Graduates will excel with professional skills, fundamental knowledge, and advanced futuristic technologies to become Data Scientists, Data Analyst, AI Research Scientists, or Entrepreneurs.
- They will establish their knowledge by adopting Data Science Technologies to solve complex real-world problems with accurate, thoughtful solutions.

6. B.Sc., (Data Science) Career Opportunity

Graduates of the B.Sc Data Science program can look forward to a wide array of career opportunities in various sectors. Some of the potential job roles include:

- **Data Analyst:** Analyzing data to help organizations make informed decisions.
- **Data Scientist:** Using statistical and machine learning techniques to extract insights from data**.**
- **Machine Learning Engineer:** Designing and implementing machine learning models.
- **Business Analyst:** Bridging the gap between IT and the business using data analytics to assess processes, determine requirements, and deliver data-driven recommendations**.**
- **Data Engineer:** Building and maintaining the architecture (databases, large-scale processing systems) for data generation**.**
- **Research Scientist:** Conducting research and experiments to advance the field of data science.
- **Quantitative Analyst:** Applying mathematical and statistical methods to financial and risk management problems.

With experience, these roles can lead to more advanced positions and the potential for higher salaries. Companies like Amazon, Deloitte, LinkedIn, Flipkart, IBM, and Accenture are among the top recruiters in this field, offering competitive salaries and opportunities for career growth. The B.Sc Data Science program is a stepping stone to a promising future in the digital era, where data is an invaluable asset across all industries.

7. Learning Outcomes-Based Curriculum Framework Guidelines Based Regulations for Under Graduate Programme:

Programme:	**B.Sc., Data Science**
Programme Code:	

Duration:	3 Years of Under Graduates
Program Outcome:	**PO1: Knowledge-** Students are motivated to utilize their understanding of mathematics and science basics to solve intricate problems. They are introduced to a diverse range of topics across different subjects and receive thorough instruction in each course that involves laboratory work. Students are equipped with comprehensive knowledge in the key areas of the subjects provided. **PO2: Ability to analyze and solve problems-** Well equipped with an understanding of the analytical methods involved, they are in a position to interpret and analyze results so obtained from experiments and draw suitable conclusions against their supported data acquired. At the end of the program, students will be able to identify, formulate and analyze scientific problems and reach concrete solutions using various principles of mathematics and sciences. **PO3: Communication skills**- Graduates will possess the essential skills to proficiently convey complex technical concepts to a wide range of individuals, irrespective of their technical proficiency. This includes effectively communicating information through both written and verbal means. **PO4: Modern tool usage-** Students develops the skills to effectively utilize various techniques, resources, and IT tools to analyze and synthesize data. **PO5: Ethical and legal awareness**- Understand the impact of IT analyst solutions in societal and environmental contexts and demonstrate the knowledge and need for sustainable development. Apply ethical principles and commit to professional ethics and responsibilities. **PO6: Soft-Skill Development-**In addition to acquiring knowledge and practical skills in a subject, learners must also possess soft skills and values that will enable them to function effectively as individuals and as members or leaders in diverse teams and multidisciplinary groups. These soft skills include leadership, teamwork, project management, a positive outlook, innovative approaches, and effective communication.

Programme Specific Outcomes:	**PSO1:** Build foundational understanding of key technologies and tools driving data science to develop machine learning models for computer-based business solutions. **PSO 2**: Hands-on experience with appropriate data analysis tools to enhance their knowledge in the field of data science. **PSO 3**: Equipped with creative and technical skills in various domains of Data Handling, Predictive Modelling and Data Visualization. **PSO 4**: Integrate professional ethics and intellectual integrity in algorithm development to build secured computing systems, contributing to the effort to transform into a digitally empowered society and knowledge economy. **PSO 5:** Apply quantitative modeling techniques and develop skills to present inferences using tools that are adaptable to evolving technologies, laying the foundation for lifelong learning. **PSO6:** Ability to critique the role of information and analytics for a innovative career, research activities and consultancy

PO / PSO	PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
PO 1	✓	✓	✓			
PO 2		✓	✓			
PO 3				✓	✓	
PO 4				✓		✓
PO 5				✓	✓	✓
PO 6					✓	✓

8. Teaching Methodology

The teaching methodology adopted for the course will utilize participatory learning methods, like workshops, discussions, assignments, industry visit, seminars, peer teaching, and group work, apart from regular lectures.

The method suggested is only indicative; the concerned course teacher can use other methods or a combination of many methods, in order to improve the quality of knowledge transfer.

C. Course teachers adopting participatory teaching methods may please take extra care on the following issues

Set a brief, clear task rather than lecturing
Use hands-on, multi-sensory materials rather than rely only on verbal communication
Create an informal, relaxed atmosphere
Choose growth-producing activities evoking feelings, beliefs, needs, doubts, perceptions, aspirations
Encourage creativity, analysis, planning
Decentralize decision-making

D. The suitable teaching-learning methods for this program to be adopted by the course teachers is given below.

Lectures: Traditional lectures provide foundational knowledge and theoretical concepts related to data science.
Practical Sessions: Hands-on labs where students apply their knowledge to solve real-world problems using data science tools and software.
Group Discussions: Encouraging collaborative learning and problem-solving among students.
Jigsaw Learning: This method can be adapted to teach complex data science topics by dividing the content into segments, mastered by different groups, and then shared among all.
Brainstorming: This technique involves generating a variety of ideas in response to a question or scenario, which can be useful for problem-solving in data science.
Demonstrations/Practical Exposure: Demonstrating data science concepts and tools can effectively show students the application of theories they learn.
Case Analysis: Utilizing case studies can help students apply theoretical knowledge to practical, real-world data science problems
Seminars: Inviting industry experts to share insights and current trends in the field of data science.
Research Papers: Assigning research projects that require students to explore and analyze specific topics in depth.
Project Work: Engaging students in long-term projects that span multiple aspects of data science, from data collection to analysis
Machine Learning Workshops: Specific workshops focusing on machine learning algorithms and their implementation.
Data Visualization Exercises: Teaching students how to effectively communicate data findings through visual representations.
Internships: Providing practical work experience by partnering with companies and organizations in the data science field.

9. Cognition Level Assessment	
Remembering(K1)	Retrieving, Recognizing and Recalling Relevant knowledge from long – term memory.
Understanding(K2)	Constructing meaning from oral, written and graphic message through interpreting, exemplifying, classifying, summarizing, inferring, comparing and explaining.
Apply(K3)	Carrying out or using a procedure for executing or implementing.
Analyze(K4)	Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing and attributing.
Evaluate(K5)	Making Judgments based on criteria and standards through checking and critiquing.
Create(K6)	Putting elements together to from a coherent or functional whole, recognizing elements into a new pattern or structure through generating, planning or producing.

FIRSTYEAR

Semester-I

Part	List of Courses	Credit	Hours
Part-1	Tamil or any other Language	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses	13	16
Part-4	Skill Enhancement Course -1	2	2
	Foundation Course	2	2
		23	**32**

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Tamil or other Languages	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including Lab	13	16
Part-4	Skill Enhancement Course-2	2	2
	Skill Enhancement Course-3 (Discipline/Subject Specific)	2	2
		23	**32**

SECOND YEAR

Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Tamil or any other Language	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including Lab	13	15
Part-4	Skill Enhancement Course-4 (Entrepreneurial-based)	2	2
	Skill Enhancement Course-5 (Discipline/Subject Specific)	2	2
	Environmental Studies	2	2
		24	**32**

Semester- IV

Part	List of Courses	Credit	No. of Hours
Part-1	Tamil or any other Language	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including Lab laboratory	13	16
Part-4	Skill Enhancement Course-6 (Discipline/Subject Specific)	2	2
	Skill Enhancement Course-7 (Discipline/Subject Specific)	2	2
	Environmental Studies	-	-
		23	**32**

THIRD YEAR

Semester-V

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project/Elective	22	28
Part-4	Value Education	2	2
	Internship	2	
		26	**30**

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project/Elective & Lab	18	28
Part-4	Extension Activity	1	-
	Professional Competency Skill	2	2
		21	**30**

17. Credit Distribution for UG Programmes

Sem I	Cdt	H	Sem II	Cdt	H	Sem III	Cdt	H	Sem IV	Cdt	H	Sem V	Cdt	H	Sem VI	Cdt	H
1.1 Part-I Tamil/	3	6	2.1 Part-I Tamil/Other Language	3	6	3.1 Part-I Tamil/Other Language	3	6	4.1 Part-I Tamil/Other Language	3	6	**5.1Core Course IX**	4	5	**6.1Core Course XIII**	4	6
1.2Part-2 English	3	6	2.2 Part-2 English	3	6	3.2Part-2 English	3	6	4. Part-2 English	3	6	**5.2 Core Course X**	4	5	**6.2 Core Course XIV**	4	6
1.3 Core Course I	5	6	**2.3 Core Course III**	5	5	**3.3 Core Course V**	5	5	**4.3 Core Course VII Core Industry Module**	5	5	**5.3.Core Course XI**	4	5	**6.3 Core Course XV**	4	6
1. 4 Core Course II	5	5	**2.4Core Course IV**	5	5	**3.4Core Course VI**	5	5	**4.4 Core Course VIII**	5	5	**5.4.Core Course– /Project with viva voce XII**	4	5	6.4 Elective VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	5	2.5 Elective II Generic/ Discipline Specific	3	6	3.5 Elective III Generic/ Discipline Specific	3	5	4.5 Elective IV Generic/ Discipline Specific	3	6	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course-1	2	2	2.6 Skill Enhancement Course-2	2	2	3.6 Skill Enhancement Course 4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course 6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course 3	2	2	3.7 Skill Enhancement Course 5	2	2	4.S kill Enhancement Course 7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2

						3.8 Environmental Studies	2	2				5.8 Summer Internship /Industrial Training	2				
	23	**32**		**23**	**32**		**24**	**32**		**23**	**32**		**26**	**30**		**21**	**30**
Total –140 Credits																	

18. Programme Structure for B. Sc., Data Science

Semester I				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part-III		Core Course CC- I **Python for Data Science**	5	6
Part-III		Core Course CC-II **Python Programming Lab**	5	5
Part-III		Elective Course I (Generic/Discipline Specific) **Mathematical Statistics – I**	3	5
Part- IV		Skill Enhancement Course SEC-1 **Fundamentals of Information Technology**	2	2
Part- IV		Foundation Course FC **Problem Solving Techniques**	2	2
TOTAL			**23**	**32**
Semester II				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part III		Core Course CC III **Data Structures and Algorithms**	5	5
Part III		Core Course CC IV **Data Structures and Algorithms Lab**	5	5
Part III		Elective Course II (General /Discipline) **Mathematical Statistics – II**	3	6

Part IV		Skill Enhancement Course SEC 2 **Office Automation**	2	2
Part IV		Skill Enhancement Course SEC 3 **Quantitative Aptitude**	2	2
TOTAL			**23**	**32**
Semester III				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part I		Language – Tamil	3	6
Part II		English	3	6
Part-III		Core Course CC- V Data Analysis	5	5
Part-III		Core Course CC-VI	5	5
Part-III		Elective III (Generic/Discipline Specific) **Financial Analytics**	3	5
Part- IV		Skill Enhancement Course SEC-4 E-Commerce	1	1
Part- IV		Skill Enhancement Course SEC-5 Advance Excel	2	2
		Environmental Studies	2	2
TOTAL			**24**	**32**
Semester V				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part-III		Core Course CC- IX **R Programming**	4	5
Part-III		Core Course CC-X **R programming Lab**	4	5
Part-III		Core Course CC XI	4	5

		Main Project		
Part-III		Core Course CC-X II **Machine Learning**	4	5
Part-III		Elective Course V (Generic/Discipline Specific) **Software Engineering**	3	4
Part-III		Elective Course VI (Generic/Discipline Specific) **Data Visualization Tools and Techniques**	3	4
Part- IV		Value Education	2	2
Part- IV		Summer Internship / Industrial Training	2	-
TOTAL			**26**	**30**
Semester VI				
Component	**Course code**	**List of courses**	**Credits**	**No. of Hrs**
Part III		Core Course CC XIII **IoT and Cloud Technologies**	4	6
Part III		Core Course CC XIV **IoT and Cloud Technologies Lab**	4	6
Part III		Core Course CC XV **Artificial Intelligence Applications**	4	6
Part III		Elective Course VII (Generic/Discipline Specific) **Information Security**	3	5
Part III		Elective Course VIII (General /DisciplineSpecific) **Media Analytics**	3	5
Part IV		Professional Competency Skill	2	2
Part V		Extension Activity	1	-
TOTAL			**21**	**30**
Total Credit : 140				

Consolidated Semester wise and Component wise Credit Distributions

Part	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	5	4	4	2	23
Part V	-	-	-	-	-	1	01
Total	23	23	24	23	26	21	140

Note: *Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. Part IV and V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.*

Overall Subjects and Credit Summary

Subject	Category	Papers	Total Credits	Marks	Total Marks
Language I (Tamil)	Part I	4	12	100	400
Language II (English)	Part II	4	12	100	400
Core **Theory**	Part III	8	36	100	800
Core **Practical**	Part III	6	28	100	600
Core **Elective**	Part III	8	24	100	800
Skill Enhancement Course **(SEC)**	Part IV	7	13	100	700
Foundation Course	Part IV	1	02	100	100
Core **Project**	Part III	1	04	100	100
Extension Activity	Part V	1	01	100	100
EVS & Value Education	Part IV	2	04	100	100
Professional Competency Skills	Part IV	1	02	100	100
Summer Internship / Industrial Visit	Part IV	1	02	100	100
Total	**-**	**44**	**140**	**-**	**4400**

THIRUVALLUVARUNIVERSITY

B.Sc. Data Science

Under CBCS (with effect from 2024-2027)

FIRST YEAR –SEMESTER- I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Python Programming for Data Science	**CC-I**	5	-	-	1	5	25	75	100

Learning Objectives

1. To develop a foundational understanding of Python by learning its features, syntax, and basic programming constructs, and to apply computational thinking for problem-solving with input/output operations and function usage.
2. To master standard input/output functions, control flow mechanisms through decision-making and branching, and to implement modular programming with an emphasis on recursive functions and loop control.
3. To proficiently manipulate various data structures like strings, sets, lists, tuples, and dictionaries, and to perform file operations, applying comprehensive methods and functions for effective data management.
4. To grasp and apply the principles of object-oriented programming, including classes, objects, inheritance, and operator overloading, and to manage errors and exceptions using Python's handling mechanisms.
5. To leverage advanced Python libraries such as NumPy for array handling, Pandas for data analysis, and Matplotlib for data visualization, integrating these tools to analyze and represent data effectively.

UNIT	Contents	No. of Hours
I	Introduction-Basic of Computational Thinking- Features of Python - Working with Python - general structure of a typical python program - Characters -Tokens- data types - Operators - expressions - statements - input/output-functions-block and Indentation - Comments - Data Types - Mutable and immutable data types-Operators - precedence and associativity of operators - Expressions - Assignment Statements - Library Functions.	**15**

II	Introduction-Standard Input using input() Function- Standard Output using print() Function - formatting output - illustrative programming examples- The if Statement- if-else Statement - nested if and if-else Statement - if-elif-else ladder- The range() Function - Looping Statement - Nested Loops - Jumping Statement - Extended Version of for and while loops - Functions, Defining Function-invoking/calling a function - Returning values from a function - Passing arguments to a function-Recursive - Modules - Packages	**15**
III	Creating Strings-Accessing individuals characters in a string - modifying and deleting strings - operations on strings - string methods and functions - Sets - Accessing -adding -removing – operations - Lists - accessing - traversing - updating/modifying -operations - methods and functions - Tuples -Accessing and Traversing Elements-Modifying And Deleting Elements-Operations-Methods and Functions - Dictionaries-Creating a Dictionary-Accessing Elements of a Dictionary-Traversing a Dictionary-Updating/Modifying an Element of a Dictionary-Adding New Elements In Dictionary-Deleting an Element From a Dictionary-Operations on Dictionary's - Dictionary Methods and Functions-File - Steps in Process - Opening-Modes-attributes-possible-closing-methods-writing-reading.	**15**
IV	A Look at Procedural Programming-t Object Oriented Programming-Advantages of OOP- Classes and Objects- Inheritance - Operator Overloading - Unary Operators- Binary Arithmetic Operators - Relational Operators - Assignment Operators- Bitwise Operators - Errors and Exceptions - Exception Handling in Python-Working With Python 3.0 Debugger-Concept of Break Points	**15**
V	General Array - Numpy Array - Attributes-Creating-Indexing - Slicing – Iterating – Concatenating – Splitting - Arithmetical Operations - Statistical operations - Data Analysis using Pandas Library - Data Visualization using Matplotlib Library	**15**
	TOTAL HOURS	**75**
	Course Outcomes	**Programme Outcomes**
CO1	Students will be able to apply the fundamentals of Python programming, including its syntax and basic constructs, to develop simple programs that solve problems using computational thinking and function-based modular design.	PO1, PO2
CO2	Students will demonstrate the ability to use standard input/output	PO1, PO2

	functions and implement complex control structures such as decision-making, branching, and looping to create programs that can process data and automate tasks.	
CO3	Students will gain proficiency in manipulating various Python data structures and performing file operations, enabling them to manage and organize data effectively for real-world applications	PO1, PO2
CO4	Students will understand and apply object-oriented programming concepts to build scalable and maintainable code, and they will be able to handle errors and exceptions to create robust Python applications.	PO1, PO2
CO5	Students will be skilled in using advanced Python libraries like NumPy, Pandas, and Matplotlib for data analysis and visualization, preparing them to tackle data-driven challenges in the field of data science.	PO1, PO2

Textbooks	
1	R.S.Salaria, "Programming for Problem Solving with Python", Khanna Publishers, Second Edition: 2023 (Chapters 2-22)
2	Lacey, N. "Python by Example: Learning to Program in 150 Challenges". Cambridge University Press, 2019. ISBN: 9781108716833.

Reference Books	
1	Saurabh Chandarakar, Dr.Nilesh Bhaskarrao Bahadure, "Programming Techniques Using Python", BPB Publications 2022
2	Charles Dierbach, "Introduction to Computer Science using Python" Wiley 2017
3	Reema Thareja, "Python Programming Using Problem Solving Approach" Oxford University Press 2019
4	E. Balagurusamy, "Problem Solving and Python Programming", McGraw Hills Education 2018

Web Resources	
1	https://www.programiz.com/python-programming
2	https://www.guru99.com/python-tutorials.html
3	https://www.w3schools.com/python/python_intro.asp,
4	https://www.geeksforgeeks.org/python-programming-language/

5.	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	PO2	H	M	PSO1	H	K1, K3
CO2	PO1	PO2	H	M	PSO2	M	K2, K3
CO3	PO1	PO2	H	M	PSO1	H	K2, K3
CO4	PO1	PO2	H	M	PSO2	H	K2, K3
CO5	PO1	PO2	H	M	PSO2	M	K2, K3

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5–Evaluate, K6 – Create

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	Python Programming lab	**CCII**	-	-	5	I	5	25	75	100

Learning Objectives	
1. Students will learn to develop algorithms by writing programs that perform calculations, such as factorials, which require understanding the step-by-step procedure to solve a problem. 2. Students will master Python syntax and structures, including input/output functions, control structures like conditional statements and loops, and the use of indentation and comments for code readability. 3. Students will implement and manipulate Python's built-in data structures and develop algorithms to perform tasks such as string reversal and simulating banking operations. 4. Students will design classes with attributes and methods, learning to encapsulate data and functionality, and use object-oriented principles to model real-world entities. 5. Students will apply data science techniques using Python libraries such as NumPy, Pandas, and Matplotlib to analyze and visualize data, and integrate these skills to solve complex data-driven problems.	

LAB EXERCISES	**Required Hours**
1. Write a Python program to calculate the factorial of a number provided by the user. 2. Create a Python script that takes user input and prints a formatted receipt of a shopping list, including prices and total cost. 3. Write a Python function to reverse a string without using built-in functions. 4. Develop a Python program to simulate a simple banking system using lists and dictionaries to manage accounts and transactions. 5. Design a Python class representing a Book with attributes like title, author, and methods for displaying book information. 6. Implement a Python program that handles division by zero and other potential exceptions when performing arithmetic operations. 7. Use NumPy to create two arrays and perform element-wise addition, subtraction, and multiplication. 8. Load a CSV file using Pandas, perform basic data cleaning, and calculate summary statistics. 9. Generate a scatter plot using Matplotlib to visualize the relationship between two variables in a dataset. 10. Create a complete data analysis pipeline from data loading, cleaning,	**75**

analysis, to visualization, integrating NumPy, Pandas, and Matplotlib. 11. As a capstone project, develop a small Python application that incorporates concepts learned throughout the course, such as a simple data dashboard or a personal finance tracker.	
TOTAL HOURS	**75**

	Course Outcomes	**Programme Outcomes**
CO1	Students will demonstrate the ability to apply computational thinking and Python programming skills to solve problems, such as calculating factorials, which involves understanding algorithmic logic and the use of loops or recursion	PO1, PO2
CO2	Students will develop proficiency in Python's input/output functions and data structures. They will be able to create user-interactive scripts, manipulate strings, and manage complex data types like lists and dictionaries to simulate real-world systems.	PO1, PO2
CO3	Students will understand and apply object-oriented programming principles by designing classes with attributes and methods, enabling them to model real-world entities and relationships in software.	PO1, PO2
CO4	Students will gain the ability to write robust programs that can handle exceptions and errors gracefully, ensuring their code can manage unexpected inputs or situations without crashing	PO1, PO2
CO5	Students will acquire the skills to perform data analysis and visualization using Python's data science libraries, such as NumPy, Pandas, and Matplotlib, and integrate these tools to create comprehensive data analysis pipelines.	PO1, PO2

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	PO2	H	M	PSO1	H	K1, K3
CO2	PO1	PO2	H	M	PSO2	M	K2, K3

CO3	PO1	PO2	H	M	PSO1	H	K1, K3
CO4	PO1	PO2	H	M	PSO2	H	K2, K3
CO5	PO1	PO2	H	M	PSO2	M	K2, K3

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5– Evaluate, K6 – Create)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	FUNDAMENTALS OF INFORMATION TECHNOLOGY	**SEC–I NME**	2	-	-	I	2	25	75	100

Learning Objectives

1. Understand the fundamental concepts and history of computers.
2. Gain knowledge of the main components and organization of computer architecture.
3. Learn the principles of data representation in computing.
4. Acquire an understanding of various input and output devices and their roles in a computer system.
5. Explore the classification of software and the basics of operating systems.

UNIT	Contents	No. of Hours
I	**Introduction to Computer Concepts:** What is a computer - Definition of Computer - Importance of computers - Computer history and development - Classification of Computers - Benefits and Limitations of Computers - Components of a PC system - How does a Computer Work? Hardware - Software - Popularity of Personal Computers - Uses of Computers.	**6**
II	**Computer Architecture:** Input/Output Unit - Central Processing Unit - Memory Unit- ALU Organisation – Control Unit Organization - Memory System - Random Access Memory - External/Auxiliary Memory - High Speed Memories.	**6**
III	**Data Representation:** Logic Gates/Circuits - Bits and Bytes - Number System for Data Representation - Conversion of Numbers - Coding Schemes - Decimal Representation in Computers - Alphanumeric Representation - Computation Data Representation - Fixed Point Representation - Arithmetic Addition - Decimal Fixed Point Representation - Floating Point Representation - Error Detection and Correction Codes.	**6**
IV	**Input/Output Devices:** Motherboard - Input devices - Output devices - storage devices - power supply - display adapters. **Storage Media**: Floppy disks and hard disks - storage capacities.	**6**

V	**Software Concepts:** Classification of Software - Operating Systems - Concept of Programming Computer - Types of Computer Languages - Language Translators - Software Tools - System Software Utilites - Windows - A Graphical User Interface - General Purpose Application Software - Special Purpose Application Software. **Operating System:** Introduction to Operating System - Services - Components - Types - Classification.	**6**
	TOTAL HOURS	**30**

	Course Outcomes	**Programme Outcomes**
CO1	Students will be able to define a computer, explain its importance, classify different types of computers, and identify the components and functions of a PC system.	PO1, PO4
CO2	Students will be able to describe the functions of the CPU, memory units, and I/O units, and understand the organization of ALU and control units.	PO1, PO4
CO3	Students will be able to explain logic gates, number systems, coding schemes, and perform conversions between different number systems and data representations.	PO1, PO4
CO4	Students will be able to identify and describe the function of motherboards, input devices, output devices, storage devices, power supplies, and display adapters.	PO1, PO4
CO5	Students will be able to differentiate between types of software, understand the concept of operating systems, and recognize the components and types of operating systems.	PO1, PO2

Textbooks

1	S. K Bansal, “Fundamental of Information Technology”, APH Publishing 2018
2	Anoop Mathew, S. Kavitha Murugeshan, “ Fundamental of Information Technology”, Majestic Books, 2009

Reference Books

1	Bhardwaj Sushil Puneet Kumar, “Fundamental of Information Technology”
2	GG WILKINSON, “Fundamentals of Information Technology”, Wiley-Blackwell
3	A Ravichandran , “Fundamentals of Information Technology”, Khanna Book

	Publishing
Web Resources	
1.	https://testbook.com/learn/computer-fundamentals
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html
3.	https://www.javatpoint.com/computer-fundamentals-tutorial
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6		**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	PO4	M	PSO1	H	K1,K2
CO2	PO1	PO4	M	PSO1	M	K2
CO3	PO1	PO4	H	PSO2	H	K2
CO4	PO1	PO4	H	PSO1	H	K1,K2
CO5	PO1	PO4	H	PSO2	M	K2

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5– Evaluate, K6 – Create)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	PROBLEM SOLVING TECHNIQUES	**FC**	2	-	-	I	2	25	75	100

Learning Objectives

1. Understand the fundamental principles of programming and structured problem-solving approaches.
2. Develop skills in creating and implementing basic algorithms for fundamental computational tasks.
3. Learn to construct and implement algorithms for mathematical computations and basic data conversions.
4. Gain an understanding of factoring methods and their application in computational problems.
5. Acquire knowledge of array manipulation techniques and various sorting and searching algorithms.

UNIT	Contents	No. of Hours
I	**Introduction to Programming and Problem Solving:** Introduction to Programming - Introduction to Problem Solving - Approaches to Problem Solving - Structure to Problem Solving - Algorithms - Algorithm to Program.	**6**
II	**Fundamental Algorithms:** Exchanging the Values of Two Variables - Counting - Summation of a set of Numbers - Factorial Computation	**6**
III	**Fundamental Algorithms:** Sine Function Computation - Generation of the Fibonacci Sequence - Reversing the Digit of an Integer - Base Conversion - Character to Number Conversation	**6**
IV	**Factoring Methods:** Finding the Square Root of a Number - The Smallest - Divisor of an Integer - The Greatest Common Divisor of Two Integers-Generating Prime Numbers	**6**
V	**Array Techniques:** Array Order Reversal-Array Counting or Histogramming - Finding the Maximum Number in a Set-Removal of Duplicates from an Ordered Array-Partitioning an Array-Finding the kth Smallest Element-Longest Monotone Subsequence Merging, **Sorting and Searching:** The two way Merge- Sorting by Selection-Sorting by Exchange-Sorting by Insertion-Sorting by Diminishing	**6**

	Increment-Sorting by Partitioning-Binary Search-Hash Searching	
	TOTAL HOURS	**30**
	Course Outcomes	**Programme Outcomes**
CO1	Students will be able to design and develop basic algorithms and convert them into simple programs.	PO1, PO4
CO2	Students will be able to write and execute programs that perform value exchanges, counting operations, summations, and factorial computations.	PO1, PO4
CO3	Students will be able to create and run programs that compute sine functions, generate Fibonacci sequences, reverse digits, convert bases, and transform characters to numbers.	PO1, PO4
CO4	Students will be able to develop and implement algorithms to find the square root, the smallest divisor, the greatest common divisor, and to generate prime numbers.	PO1, PO4
CO5	Students will be able to implement and optimize array operations, sorting methods, and search techniques, such as binary search and hash searching, in programming tasks.	PO1, PO2
Textbooks		
1	R.S.Salaria, “Programming for Problem Solving with Python”, Khanna Publishers, Second Edition: 2023 (for Unit 1)	
2	R.G.Dromey, How to Solve it by Computer, Prentice-Hall International, 2008 (for Units II to V)	
Web Resources		
1	https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm	
2	http://www.nptel.iitm.ac.in/video.php?subjectId=106102067	
3	http://utubersity.com/?page_id=876	

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6		**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	PO2	M	PSO1	H	K1,K2
CO2	PO1	PO2	M	PSO1	M	K2
CO3	PO1	PO2	H	PSO2	H	K2
CO4	PO1	PO2	H	PSO1	H	K1,K2
CO5	PO1	PO4	H	PSO2	M	K2

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5– Evaluate, K6 – Create)

FIRST YEAR –SEMESTER- II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	DATA STRUCTURES AND ALGORITHMS	CC III	5	-	-	II	5	25	75	100

Learning Objectives

1. Understand the fundamental concepts, types, and operations of data structures, focusing on arrays, stacks, queues, and linked lists.
2. Gain knowledge of tree and graph data structures, including their representations, traversal algorithms, and applications.
3. Learn and understand various searching and sorting algorithms, including their implementation and efficiency.
4. Understand the principles of the greedy method and dynamic programming, and their application in solving optimization problems.
5. Learn the backtracking technique and its application in solving combinatorial and optimization problems.

UNIT	Contents	No. of Hours
I	**Arrays and ordered Lists:** Introduction to data structure and their importance Types of data structure - Array Representations - Basic concepts, operations and implementations of stacks and queues - singly linked list - Doubly linked list - Implementations and applications	**18**
II	**Trees and Graphs:** Trees – Binary Trees – Binary Tree - Traversal (preorder, inorder, postorder) – Application of trees - Representation of Graphs – Graph traversal algorithms – graph Traversals - Minimum Cost Spanning Trees – Shortest Path Problems - Application of graphs	**18**
III	**Searching and Sorting:** Sorting – Bubble Sort - Insertion Sort - Quick Sort - Merge Sort - Selection Sort - Searching – Linear search - Binary search.	**18**
IV	**Greedy Method and Dynamic programming:** General method - all pairs shortest path problem - Traveling salesperson problem -	**18**

	Reliability design - **Greedy Method**: Knapsack problem – Optimal binary search trees - 0/1 Knapsack problem.	
V	**Backtracking** General Method – 8-Queen‟s – Sum of Subsets – Graph Colouring – Hamiltonian Cycles – **Branch And Bound**: General Method – Travelling Sales Person Problem	**18**
	TOTAL HOURS	**90**

	Course Outcomes	**Programme Outcomes**
CO1	Students will be able to implement and manipulate basic data structures, such as arrays, stacks, queues, and linked lists, and apply them to solve practical problems.	PO1, PO3
CO2	Students will be able to perform binary tree traversals, represent and traverse graphs, and apply algorithms to solve minimum cost spanning tree and shortest path problems.	PO1, PO3
CO3	Students will be able to implement and analyze the performance of different sorting algorithms (Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Selection Sort) and searching algorithms (Linear Search, Binary Search).	PO1, PO3
CO4	Students will be able to apply the greedy method and dynamic programming techniques to solve problems such as the all-pairs shortest path, traveling salesperson problem, and the knapsack problem.	PO1, PO3
CO5	Students will be able to implement backtracking algorithms to solve problems such as the 8-Queens problem, sum of subsets, graph coloring, Hamiltonian cycles, and apply branch-and-bound techniques to the traveling salesperson problem.	PO1, PO3,PO6

Textbooks

1	Seymour Lipshutz, Schaum‟s Outlines - Data Structures with C, Tata McGraw Hill Publications, 2011.
2	Ellis Horowitz and SartajSahni, Fundamentals of Computer Algorithms, Galgotia Publications Pvt., Ltd., 2010
3	Dr. K. Nagesware Rao, Dr. Shaik Akbar, ImmadiMurali Krishna, Problem Solving and Python Programming, 2018

Reference Books	
1	Gregory L.Heileman, Data Structures, Algorithms and Object-Oriented Programming, McGraw Hill International Edition, Singapore, 1996
2	A.V.Aho, J.D. Ullman, J.E.Hopcraft, Data Structures and Algorithms, Addison Wesley Publication, 2000
3	Ellis Horowitz and Sartaj Sahni, Sanguthevar Raja sekaran , Fundamentals of Computer Algorithms, Galgotia Publications Pvt.Ltd., 2010
Web Resources	
1	https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2	https://www.programiz.com/dsa
3	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	PO3	M	H	PSO1	H	K1
CO2	PO1	PO6	H	M	PSO1	M	K1,K2
CO3	PO1	PO4	H	H	PSO2	H	K1,K2
CO4	PO1	PO5	H	M	PSO1	H	K1,K2
CO5	PO1 PO3	PO6	H	H	PSO2	M	K2,K3

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5– Evaluate, K6 – Create)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	DATA STRUCTURES AND ALGORITHMS LAB	**CC IV**	-	-	5	II	5	25	75	100

Learning Objectives	
1. Understand and implement fundamental operations for stack and queue data structures. 2. Learn and execute various tree traversal methods such as preorder, inorder, and postorder. 3. Understand and implement linear and binary search algorithms to locate elements within an array 4. Learn and apply different sorting algorithms, including Merge Sort and Quick Sort, to order a set of elements efficiently. 5. Understand and implement dynamic programming, greedy methods, and backtracking to solve complex problems such as the Knapsack problem, Traveling Salesman problem, and N Queen problem.	
LIST OF PROGRAMS	**Required Hour**
1. Perform stack operations 2. Perform queue operations 3. Perform tree traversal operations 4. Search an element in an array using linear search. 5. Search an element in an array using binary search 6. Sort the given set of elements using Merge Sort. 7. Sort the given set of elements using Quick sort. 8. Search the Kth smallest element using Selection Sort 9. Find the Optimal solution for the given Knapsack Problem using Greedy Method. 10. Find all pairs shortest path for the given Graph using Dynamic Programming method 11. Find the Single source shortest path for the given Travelling Salesman problem using Dynamic Programming method 12. Find all possible solution for an N Queen problem using backtracking method 13. Find all possible Hamiltonian Cycle for the given graph using backtracking method	**75**

	TOTAL HOURS	**75**
	Course Outcomes	**Programme Outcomes**
CO1	Students will be able to create, manipulate, and utilize stack and queue data structures in various programming scenarios.	PO3 PO1 PO3 PO1
CO2	Students will be able to perform and demonstrate different tree traversal techniques on binary trees, ensuring they can navigate and process tree data structures effectively.	PO1, PO3
CO3	Students will be able to implement linear and binary search algorithms to efficiently locate elements within an array and evaluate their performance.	PO1, PO3
CO4	Students will be able to write and execute sorting algorithms like Merge Sort, Quick Sort etc., analyzing their time complexity and optimizing them for different datasets.	PO1, PO3
CO5	Students will be able to apply dynamic programming, greedy methods, and backtracking algorithms to solve optimization problems such as the Knapsack problem, Traveling Salesman problem, and N Queen problem, demonstrating an ability to tackle complex computational challenges.	PO1, PO3,PO6

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	M	PSO1	H	K2,K3
CO2	PO3	H	PSO1	M	K2,K3
CO3	PO1	H	PSO2	H	K2,K3
CO4	PO3	H	PSO1	H	K2,K3
CO5	PO1	H	PSO2	M	K2,K3

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5– Evaluate, K6 – Create)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	OFFICE AUTOMATION	**SEC-2**	2	-	-	II	2	25	75	100

Learning Objectives

1. Understand the fundamental concepts, history, and evolution of office automation tools, including basic principles of cloud computing and collaboration within Office 365 Suite or Google Workspace.
2. Develop proficiency in creating, formatting, and enhancing documents using advanced features in Microsoft Word or Google Docs, with a focus on collaborative editing and document security.
3. Learn the basics of spreadsheets, data analysis tools, and advanced functions in Microsoft Excel, with an emphasis on data visualization and macro programming.
4. Gain skills in designing and delivering impactful presentations using Microsoft PowerPoint, including the use of themes, animations, transitions, and multimedia elements.
5. Understand and apply effective communication and collaboration strategies using Microsoft Teams and Outlook, including managing teams, chats, meetings, calls, and email management.

UNIT	Contents	No. of Hours
I	Introduction to Office Automation - Overview of Office Automation- History and Evolution of Office Tools - Introduction to Office 365 Suite/Google Workspace- Basic Principles of Cloud Computing and Collaboration	**6**
II	Word Processing (Microsoft Word/Google Doc) - Creating and Formatting Documents - Advanced Features: Tables, References, and Mail Merge - Collaborative Editing and Sharing - Document Security and Permissions	**6**
III	Data Management with Microsoft Excel - Spreadsheet Basics: Cells, Rows, Columns, and Formulas - Data Analysis Tools: PivotTables, Charts, and Conditional Formatting - Advanced Functions and Macros - Data Visualization Techniques	**6**
IV	Effective Presentations with Microsoft PowerPoint - Designing Impactful Presentations - Utilizing Themes, Animations, and Transitions - Incorporating Multimedia Elements - Presentation Best	**6**

	Practices and Tips	
V	Collaboration and Communication with Microsoft Teams and Outlook - Setting Up and Managing Teams - Effective Communication: Chats, Meetings, and Calls - Email Management with Outlook	**6**
	TOTAL HOURS	**30**
	Course Outcomes	**Programme Outcomes**
CO1	Students will be able to demonstrate an understanding of office automation concepts and effectively use Office 365 Suite or Google Workspace for basic cloud-based collaboration tasks.	PO1
CO2	Students will be able to create and format complex documents, utilize advanced features such as tables, references, and mail merge, and manage document sharing and security effectively.	PO1
CO3	Students will be able to perform data management tasks, use data analysis tools like PivotTables and charts, implement advanced Excel functions, and create macros for automation.	PO3
CO4	Students will be able to design and deliver professional presentations that incorporate themes, animations, transitions, and multimedia elements, adhering to best practices and presentation tips.	PO4
CO5	Students will be able to set up and manage teams, conduct effective communications via chats, meetings, and calls, and manage emails proficiently using Microsoft Teams and Outlook.	PO5
Textbooks		
1	Max Clark (2024), The Microsoft Office 365 Bible, Amazon.Com Services LLC	
2	Thaddeus, S (2024), Office Automation Software with AI Tools, Wisdom Indian Publications.	
Web Resources		
1	https://www.tutorialspoint.com/computer_fundamentals/index.htm	
2	https://www.tutorialspoint.com/basics_of_computers/index.htm	
3	https://www.tutorialspoint.com/word/index.htm	

4	https://www.tutorialspoint.com/excel/index.htm
5	https://www.tutorialspoint.com/powerpoint/index.htm

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	M	PSO1	H	K1,K2,K3
CO2	PO3	H	PSO2	M	K1,K2,K3
CO3	PO4	H	PSO2	H	K1,K2,K3
CO4	PO3	H	PSO1	H	K1,K2,K3
CO5	PO5	H	PSO1	M	K1,K2,K3

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5– Evaluate, K6 – Create)

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	QUANTITATIVE APTITUDE	SEC-2	2	-	-	II	2	25	75	100

Learning Objectives

1. Understand and solve problems involving simple equations, ratios, proportions, and variations.
2. Develop skills in converting between percentages, decimals, and fractions, and solve problems related to percentages and averages.
3. Understand the concepts of profit, loss, and discounts, and their relationships to cost price and selling price.
4. Learn to compute simple and compound interest and solve quadratic equations.
5. Understand and solve problems related to time and work, and time and distance, including scenarios involving trains, boats, and streams.

UNIT	Contents	No. of Hours
I	**Simple equations, Ratio, Proportion, Variation** Simple equations - Definition of Linear Equations - Formation of simple equations Problems on Ages - Ratio and proportion - Definition of Ratio - Properties of Ratios Comparison of Ratios - Problems on Ratios- Compound Ratio - Problems on Proportion	**6**
II	**Percentages and Averages** Percentages– Introduction - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions Problems on percentages.	**6**
III	**Profit and loss Problems** Profit and Loss percentage- Relation between Cost Price and Selling price Discount and Marked Price- Two different articles sold at same Cost Price Two different articles sold at same Selling Price – Gain percentage and Loss percentage on Selling Price.	**6**
IV	**Simple interest and Compound interest** Simple Interest- Problems on interest and amount -Problems when	**6**

	rate of interest and time period are numerically equal - Compound Interest - Definition and formula for amount in Compound interest. **Quadratic equations** General form of Quadratic equations -Finding the roots of Quadratic equations Nature of the roots - Relation between the roots	
V	**Time and work**: Basic concepts – examples Time and Distance: Definition – Average speed – distance covered is same, different – stoppage time per hour for a train – time taken with two difference modes of transport problems on Trains- Boats and streams.	**6**
	TOTAL HOURS	**30**

	Course Outcomes	**Programme Outcomes**
CO1	Students will be able to form and solve linear equations, compare and compute ratios, and solve practical problems involving proportions and variations.	PO1
CO2	Students will be able to accurately convert between percentages, decimals, and fractions, and solve various real-world problems involving percentages and averages.	PO3
CO3	Students will be able to calculate profit and loss percentages, understand the impact of discounts and marked prices, and solve related problems involving multiple articles.	PO4
CO4	Students will be able to calculate simple and compound interest, find the roots of quadratic equations, and analyze the nature of the roots.	PO3
CO5	Students will be able to apply basic concepts to solve problems involving time, work, and distance, including average speed, stoppage time, and different modes of transport.	PO5

Textbooks	
1	Dr. Aggarwal RS, Quantitative Aptitude. New Delhi: S. Chand & Company, 2015
2	Abhijit Guha, Quantitative Aptitude for Competitive Examinations. 3rd edition. New Delhi: Tata Mc-Graw Hill Co., 2005

Web Resources	
1	https://www.tutorialspoint.com/computer_fundamentals/index.htm
2	https://www.tutorialspoint.com/basics_of_computers/index.htm

3	https://www.tutorialspoint.com/word/index.htm
4	https://www.tutorialspoint.com/excel/index.htm
5	https://www.tutorialspoint.com/powerpoint/index.htm

Mapping with Programme Outcomes:

Course Outcome	**PO Addressed** PO1 to PO6	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO6	**Correlation Level** L/ M/ H	**Cognitive Level** K1 to K6
CO1	PO1	M	PSO1	H	K1,K2,K3
CO2	PO3	H	PSO2	M	K1,K2,K3
CO3	PO4	H	PSO2	H	K1,K2,K3
CO4	PO3	H	PSO1	H	K1,K2,K3
CO5	PO5	H	PSO1	M	K1,K2,K3

(L – Low, M – Medium, H – High; K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze,K5– Evaluate, K6 – Create)

ANNEXURE I

S. No	Generic Electives	S. No	Discipline Specific
1	Mathematics for Cyber Security	1	Data Structure
2	Discrete Mathematics – I	2	Fundamentals of Crime Law and Compliance
3	Discrete Mathematics – II	3	Database Management System
4	Numerical Methods - I	4	Information Security and Audit
5	Numerical Methods - II	5	Big Data Analytics
6	Mathematical Statistics – I	6	Cyber Law and Intellectual Property Rights
7	Mathematical Statistics – II	7	Firewall and Internet Security
8	Electronic Science	8	Artificial Neural Networks
9	Nano Technology	9	Data Communication and Computer Networks
10	Optimization Technique / Operational Research	10	Marketing Analytics
11	Introduction to Linear Algebra	11	Financial Analytics
12	Graph Theory and Its Application	12	Analytics for Service Industry
13	Digital Logic Fundamentals	13	Distributed Computing
14	Microprocessor & Micro Controller	14	Information Security
SKILL ENHANCEMENT COURSE			

S. No	List of Subjects
1	Problem Solving Techniques
2	PHP Programming
3	Web Design and Development
4	Fundamentals of Operating System
5	Biometrics
6	Forms of Cyber Crime
7	Intrusion Detection and Prevention System
8	Open Source software Technologies
9	Multimedia System
10	Robotics and its application