B.Sc. Artificial Intelligence & Data Science

Syllabus

AFFILIATED COLLEGES

Program Code: 28K

2025 – 2026 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC, Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

Programme Educational Objectives (PEOs)	
The B.Sc. Artificial Intelligence and Data Science program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PEO2	Identity, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences.
PEO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health, safety, and the cultural, societal, and environmental considerations.

Programme Specific Outcomes (PSOs)	
After the successful completion of B.Sc. Artificial Intelligence and Data Science program the students are expected to	
PSO1	Graduates should be able to evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains for Artificial Intelligence and Data Science
PSO2	Apply the technical and critical thinking skills in the discipline of artificial Intelligence and Data Science to find solutions for complex problems.
PSO3	Develop and Create, select, apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve wicked societal problems
PSO4	Demonstrate the ability to create innovative solutions from idea to product, applying scientific methods and tools
PSO5	Provide innovative ideas to instigate new business ventures in the hospitality industry

Programme Outcomes (POs)	
On successful completion of the B.Sc. Artificial Intelligence and Data Science	
PO1	Exhibit good **domain knowledge** and completes the assigned tasks effectively and efficiently in par with the expected quality standards.
PO2	Apply **analytical and critical thinking** to identify, formulate, analyze and solve complex problems in order to reach authenticated conclusions
PO3	**Design and develop research based solutions** for complex problems with specified needs through appropriate consideration for the public health, safety, cultural, societal and environmental concerns.
PO4	Establish the ability to **Listen, read, proficiently communicate and articulate complex ideas** with respect to the needs and abilities of diverse audiences.
PO5	**Deliver innovative ideas to instigate new business ventures** and possess the qualities of a good entrepreneur.
PO6	Acquire the qualities of a **good leader and engage in efficient decision making.**
PO7	Graduates will be able to undertake any responsibility as an **individual/member of multidisciplinary teams and have an understanding of team leadership**
PO8	Function as s**ocially responsible individual** with ethical values and accountable to ethically validate any actions or decisions before proceeding and actively contribute to the societal concerns.
PO9	Identify and **address own educational needs i**n a changing world in ways sufficient to maintain the competence and to allow them to contribute to the advancement of knowledge
PO10	**Demonstrate knowledge and understanding of management principles a**nd apply these to one own work to manage projects and in multidisciplinary environment.

BHARATHIAR UNIVERSITY::COIMBATORE 641 046

B. Sc. <u>Artificial Intelligence and Data Science</u> (CBCS PATTERN)
(*For the students admitted from the academic year **2025-2026** and onwards*)

Scheme of Examination

Part	Title of the Course	Hours/ Week	Duration in Hours	CIA	CEE	Total	Credits
			Examination	**Maximum Marks**			
	Semester I						
I	Language - I	6	3	25	75	100	4
II	English - I	4	3	25	75	100	4
III	Core 1: Fundamentals of Computer Programming	5	3	25	75	100	4
III	Core 2: Data Structures	5	3	25	75	100	4
III	Core Lab 1: Computer Programming Lab	4	3	20	30	50	2
III	Allied 1: Linear Algebra and Neural Networks	4	3	25	75	100	4
IV	Environmental Studies*	2	3	-	50	50	2
	Total	**30**		**145**	**455**	**600**	**24**
	Semester II						
I	Language – II	6	3	25	75	100	4
II	English – II	4	3	25	25	50	2
III	Core 3: Introduction to Python Programming	6	3	25	75	100	4
III	Core Lab 2: Python Programming Lab	5	3	20	30	50	2
III	Core Lab 3: Office Automation and Internet	3	3	20	30	50	2
III	Allied 2: Optimization Techniques	4	3	25	75	100	4
IV	Value Education – Human Rights*	2	3	-	50	50	2
IV	Naan Mudhalvan Skill Course			25	25	50	2
	Total	**30**		**165**	**385**	**550**	**22**
	Semester III						
I	Language – III	6	3	25	75	100	4
II	English – III	4	3	25	75	100	4
III	Core 4: Java Programming	5	3	25	75	100	4
III	Core 5: Foundation of Artificial Intelligence	4	3	25	75	100	4
III	Core Lab 4: Java Programming Lab	3	3	20	30	50	2
III	Allied 3: Operating System Design	4	3	25	75	100	4
III	Skill based Subject 1: Data Analytics	3	3	25	25	50	2
IV	Tamil** / Advanced Tamil* (OR) Non-major elective - I (Yoga for Human Excellence)* / Women's Rights*	1	3	-	50	50	1
IV	Naan Mudhalvan Skill Course ***			25	25	50	2
IV	Health and Wellness****			100	-	100	1
	Total	**30**		**295**	**505**	**800**	**28**

	Semester IV						
I	Language – IV	6	3	25	75	100	4
II	English - IV	4	3	25	75	100	4
III	Core 6: Cognitive Science and Analysis	4	3	25	75	100	4
III	Core 7: Database Design and Management	4	3	25	75	100	4
III	Core Lab 5: Database Lab	3	3	20	30	50	2
III	Allied 4: Data and Information Security	4	3	25	75	100	4
III	Skill based Subject 2 Lab : Capstone Project Work Phase I	3	3	20	30	50	2
IV	Tamil**/Advanced Tamil* (OR) Non-major elective -II (General Awareness*)	2	3	-	50	50	2
IV	Naan Mudhalvan Skill Course ***		-	25	25	50	2
	Total	**30**		**190**	**510**	**700**	**28**

	Semester V						
III	Core 8: Ethics of Artificial Intelligence	6	3	25	75	100	4
III	Core 9: Fundamentals of Data Science	6	3	25	75	100	4
III	Core Lab 6: Data Science Lab	6	3	20	30	50	2
III	Elective – I: Big Data Analytics / Cyber Security / Deep Learning	6	3	25	75	100	3
III	Skill based Subject 3 Lab : Capstone Project Work Phase II	6	3	20	30	50	2
IV	Naan Mudhalvan–Skill Course ***			25	25	50	2
	Total	**30**		**140**	**310**	**450**	**17**

	Semester VI						
III	Core 10: Robotic Process Automation	5	3	25	75	100	4
III	Core 11: Project Work Lab %%	5	3	25	75	100	4
III	Core Practical –VII : Programming in UI Path Automation Lab	5	3	20	30	50	2
III	Elective – II : Ethical Hacking / Digital Forensics Science / Natural Language Processing	6	3	25	75	100	3
III	Elective – III : Internet of Things / Data Visualization / Social Network Analysis	6	3	25	75	100	3
III	Skill Based Subject 4 : Machine Learning	3	3	25	25	50	2
V	Extension Activities**	-	-	50	-	50	2
	Naan Mudhalvan Skill Course ***			25	25	50	2
	Total	**30**		**220**	**380**	**600**	**22**
	Grand Total	**180**		**1155**	**2545**	**3700**	**141**

Guidelines for Evaluation : # Govt. - (Non-Autonomous Colleges), $ Aided – (Non-Autonomous Colleges), @ Self-Financing (Non –Autonomous).

Evaluation of the candidates shall be made through internal and external marks.

Paper Type	Total Marks	Internal		External		Overall Passing Minimum for Total Marks (Internal+ External)
		Maximum Marks	Passing Minimum for Internal	Maximum Marks	Passing Minimum for External	
Core and Allied Theory Paper	100	25	10	75	30	40
Skilled Based Subject Theory Paper	50	25	10	25	10	20
Foundation Course Theory Paper	50	-	-	50	20	20
Health and Wellness	100	100	40	-	-	40
Core Practical Paper and Skill Based Subject Lab Paper	50	20	8	30	12	20
Capstone Project Work Lab	50	20	8	30	12	20
Project Work Lab	100	25	10	75	30	40

INTERNAL MARKS BREAK UP

Core Paper, Allied Subject and Skilled Based Subject (Theory)

Components	CIA I	CIA II	Model	Attendance	Assignment or Seminar	Total
Marks	5	5	10	2	3	25

Practical Paper & Skill Based Subject Lab

Components	Observation	Record	Model Practical	Total
Program 1 and Program 2	5	5	10	20

Project

Components	Topic Selection	First and Second Review	Mock Viva Presentation	Report	Total
Capstone Project Work Lab	5	5	5	5	20
Project Work Lab	5	10	5	5	25

Internal Examination Question Paper Pattern

Core Paper, Allied Subject and Skilled Based Subject (Theory)   **Duration: 2 Hours**

Blooms Classification	Knowledge Level	Section	Type	No. of Questions to be answered	Marks
Remember, Understand	K1,K2	A	Objective type, questions, fill in the blanks, true or false, expand the following	All questions	4 X 1 = 4
Understand, Apply	K2,K3	B	Paragraph about 3 pages	All question either or pattern unit wise	5 X 2 = 10
Apply, Analyze	K3,K4	C	Essay type about 5 pages	2 out of 5 questions	2 X 8 = 16
				Total	**30**

UNIVERSITY EXTERNAL MARKS BREAK UP

Practical Paper & Skill Based Subject Lab Paper

Components	Max. Marks	Aim & Algorithm	Keying	Output	Record	Total	Passing Minimum External
Program 1	10	4	4	2	10	30	12
Program 2	10	4	4	2			

Project

Components	Report	Presentation	Viva-voce	Total	Passing Minimum External
Capstone Project Work Lab	15	10	5	30	12
Project Work Lab	40	20	15	75	40

University Examination Question Paper Pattern

Core Paper & Allied Paper (Theory)   **Duration: 3 Hours**

Blooms Classification	Knowledge Level	Section	Type	No. of Questions to be answered	Marks
Remember, Understand	K1,K2	A	Objective type questions, fill in the blanks, true or false, expand the following	All questions	10 X 1 = 10
Understand, Apply	K2,K3	B	Paragraph about 3 pages	Either or Pattern (Unit Wise)	5 X 5 = 25
Apply, Analyze	K3,K4	C	Essay type about 5 pages	Either or Pattern (Unit Wise)	5 X 8 = 40
				Total	**75**

Skill Based Subject Paper (Theory)   **Duration: 3 Hours**

Blooms Classification	Knowledge Level	Section	Type	No. of Questions to be answered	Marks
Remember, Understand	K1,K2	A	Objective type questions	All questions	4 X 1 = 4
Understand, Apply	K2,K3	B	Paragraph about 2 pages	Either or Pattern (Unit Wise)	5 X 2 = 10
Apply, Analyze	K3,K4	C	Essay type about 4 pages	2 out of 5 questions (Unit Wise)	2 X 8 = 16
				Total	**25**

Foundation Course Paper (Theory)   **Duration: 3 Hours**

Section	Type	No. of Questions to be answered	Marks
A	Essay type about 5 pages	5 out of 10 questions	5 X 10 = 50
		Total	**50**

Note

*	No Continuous Internal Assessment (CIA), University Examinations Only.
**	No University Examinations, Continuous Internal Assessment (CIA) Only.
***	Naan Mudhalvan – Skill courses- external marks (CEE) will be assessed by industry and internal will be offered by respective course teacher.
****	No University Examinations, Continuous Internal Assessment (CIA) Only will be handled by Department of Physical Education (PD)
*****	Summer Internship / Industrial Training during the Summer Vacation in II Year, IV Semester for 30 hours. The capstone project report to be prepared and it should be submitted during viva-voce. (Refer Project Guidelines)

First Semester

Course Code		Fundamentals of Computer Programming	L	P	C
Core/Elective/Supportive		Core: 1	5	0	4
Pre - requisite		• Basic knowledge of C concepts and C++ Programming • Basic knowledge in ProcedureOriented Programming concepts	**Syllabus version**		**2025-26 Onwards**

Course Objectives

The main objectives of this course are to:
1. To impart knowledge about Computer fundamentals
2. To understand the concepts and techniques in C Programming
3. To equip and indulge themselves in problem solving using C
4. To introduce he concepts of Object Oriented Programming Paradigm in C++

Course Outcomes

1	Learn about the Computer fundamentals and the Problem solving and understand the basic concepts of C and C++ programming	K1
2	Demonstrate the various basic programming constructs like decision making statements. Looping statements and functions	K2
3	Analyze the object oriented concepts like overloading, inheritance, polymorphism, virtual functions , constructors and destructors	K3
4	Compare the various file stream classes; file types, usage of templates and exception handling mechanisms, pros and cons of procedure oriented language with the concepts of programming language	K4
5	Develop programs incorporating the programming constructs of object oriented programming concepts	K5,K6

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	Introduction to C	15 Hours

Overview of C - Introduction - Character set - C tokens - keyword & Identifiers - Constants - Variables - Data types - Declaration of variables - Assigning values to variables - Defining Symbolic Constants - Arithmetic, Relational, Logical, Assignment, Conditional, Bitwise, Special, Increment and Decrement operators - Arithmetic Expressions - Evaluation of expression - precedence of arithmetic operators - Type conversion in expression – operator precedence & associativity - Mathematical functions - Reading & Writing a character - Formatted input and output.

Unit II	Decision Making , Looping and Arrays	15 Hours

Decision Making and Branching: Introduction – if, if….else, nesting of if …else statements- else if ladder – The switch statement, The ?: Operator – The goto Statement. Decision Making and Looping: Introduction- The while statement- the do statement – the for statement-jumps in loops. Arrays – Character Arrays and Strings

Unit III	C++	15 Hours

Introduction to C++ - key concepts of Object-Oriented Programming –Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Functionsin C++ - inline functions – Function Overloading. Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.

Unit IV	Inheritance	15 Hours
Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.		
Unit V	Pointers & Files	13 Hours
Pointers – Declaration – Pointer to Class, Object – this pointer – Pointers to derived classes and Baseclasses – Arrays – Characteristics – array of classes. Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling– Miscellaneous functions.		
Unit VI	Contemporary Issues	2 Hours
Problem Solving through C Programming – Online Coding		
	Total Lecture Hours	75 Hours

Text Book(s)

1. E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008

2. Ashok N Kamthane, Object-Oriented Programming with Ansi and Turbo C++, Pearson Education, 2003.

Reference Books

1. Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson, 2002.

2. E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998

3. Maria Litvin& Gray Litvin, C++ for you, Vikas publication, 2002.

4. John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

1. **https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**

2. **https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L
CO5	S	M	L	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Computer Programming Lab		L	T	P	C
Core/Elective/Supportive		**Core Lab : 1**		**-**	**-**	**4**	**2**
Pre - requisite		• Basic knowledge of Procedure Oriented Programming concepts • Basic knowledge in C Programming		**Syllabus version**		**2025-26 Onwards**	

Course Objectives

• To introduce he concepts of Object-Oriented Programming Paradigm and programming constructs of C++

Course Outcomes

1	Apply the various basic programming constructs like decision making statements. Looping statements, functions, concepts like overloading, inheritance, polymorphism,virtual functions , constructors and destructors	**K1,K3**
2	Illustrate the concept of Virtual Classes, inline functions and friend functions	**K2,K4**
3	Compare the various file stream classes; file types, usage of templates and exception handling mechanisms.	**K5**
4	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

1. Write a C program to find the sum, average, standard deviation for a given set of numbers.

2. Write a C program to generate n prime numbers.

3. Write a C program to generate Fibonacci series.

4. Write a C program to sort the given set of numbers in ascending order.

5. Write a C program to count the number of Vowels in the given sentence.

6. Write a C++ Program to create class, which consists of EMPLOYEE Detail like E_Number, E_Name,
   Department, Basic, Salary, Grade. Write a member function to get and display them.

7. Write a C++ Program to create a class SHAPE which consists of two virtual functions

8. Write a C++ Program using function overloading to read two matrices of different Data Types Such as integers and floating point numbers.

9. Write a C++ Program to create a File and to display the contents of that file with line numbers.

10. Write a C++ Program to merge two files into a single file.

	Total Lecture Hours	**36 hours**

Text Book(s)

1.E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008

2.Ashok N Kamthane, Object-Oriented Programming with Ansi And Turbo C++, Pearson Education, 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. Introduction to Programming in C – NPTEL

2. Problem solving through Programming in C - SWAYAM

3. C for Everyone : Programming Fundamentals – Course

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	L	L	L	L	L	L
CO2	S	S	M	L	L	L	L	L	L	L
CO3	S	S	M	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Data Structures	L	P	C
Core/Elective/Supportive		Core: 2	5	0	4
Pre - requisite		Basic understanding of Data storage, retrieval and algorithms.	Syllabus version	2025-26 Onwards	

Course Objectives

To understand the concepts of ADTs
1. To design linear data structures – lists, stacks, and queues
2. To understand sorting, searching and hashing algorithms
3. To apply Tree and Graph structures

Course Outcomes

1	Understand the concept of abstract data types	K1
2	Analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications	K2
3	Demonstrate the concept of trees and its applications	K3
4	Design, implement and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting	K4
5	Enhance the knowledge to solve problems as graph problems and implement efficient graph algorithms to solve them	K5,K6

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	Abstract Data Types	15 Hours

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance namespaces – shallow and deep copying. Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms.

Unit II	Linear Structures	15 Hours

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues

Unit III	Sorting and Searching	15 Hours

Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency.

Unit IV	Tree Structures	15 Hours

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi-way search trees.

Unit V	Graph Structures	13 Hours

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees.

Unit VI	Contemporary Issues	2 Hours

Expert lectures, online seminars - webinars

	Total Lecture Hours	75 Hours

Text Book(s)
1. Ellis Horowitz, Sartaj Shani, Data Structures, Galgotia Publication.
2. Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, Computer Algorithms, Galgotia Publication.
3. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", John Wiley & Sons Inc., 2013
4. Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" Springer Edition 2015.
5. Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.

Reference Books
1. Jean-Paul,Tremblay & Paul G.Sorenson , An Introduction to Data structures with Applications Tata McGraw Hill Company 2008, 2ndEdition.
2. Samanta.D , Classic Data Structure Prentice Hall of India Pvt Ltd 2007, 9th Edition
3. Seymour Lipschutz, Data Structures McGraw Hill Publications, 2014, 1st Edition
4. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
6. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	M	S	M	M	M
CO2	S	S	S	M	M	M	M	M	M	M
CO3	S	S	S	M	S	M	M	M	S	S
CO4	S	S	S	M	S	S	S	S	M	M

*S-Strong; M-Medium; L-Low

Course Code		Linear Algebra and Neural Networks	L	T	P	C
Core/Elective/Supportive		**Allied :1**	**4**			**4**
Pre - requisite		Basic knowledge in Mathematics	**Syllabus version**		**2025-26 Onwards**	

Course Objectives	

1. To introduce the computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, and vector spaces
2. To introduce the concepts of neural networks and fuzzy systems
3. To explain the basic mathematical elements of the theory of fuzzy sets.

Course Outcomes		
1	Explain the concept/theory in linear algebra, to develop dynamic and graphical views to the related issues of the chosen topics as outlined in course content and to formally prove theorems.	**K1**
2	Recognize the basic applications of the chosen topics and their importance in the modern science.	**K2**
3	Develop simple mathematical models and apply basic linear algebra techniques learned from the chosen topics to solve simple problems	**K3**
4	Report and communicate effectively with others and present mathematical results in a logical and coherent fashion	**K4**
5	Analyze the applications of fuzzy logic and neural network for various applications.	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	**Matrix**	**12**

Introduction-Determination-Inverse of a Matrix-Rank of a Matrix-Eigen Value Problem-Transpose-Properties of Transpose- Solving Simultaneous linear equations by matrix method.

Unit II	**System of Simultaneous Linear Algebraic Equation**	**12**

Gauss Elimination Method-Gauss Jordan Method-Simple Problems-Gauss Seidel Method-Simple Problems.

Unit III	**Numerical Differentiation & Integration**	**12**

Numerical Differentiation: Newton's Forward Difference-Newton's Backward Difference Formula. **Numerical Integration**: Trapezoidal Rule-Simpson's Rule.

Unit IV	**Graph Theory**	**12**

Graph Theory: Basic Terminology-Paths, Cycle & Connectivity-Subgraphs and Types of Graphs-Representation of Graphs in Computer Memory. **Trees**: Properties of Trees and Binary Trees-Traversing Binary Trees and Computer Representation of General Trees

Unit V	**Fundamentals of Neural Networks**	**12**

Basic concepts of neural networks – Human brain- Model of an Artificial neuron- Neural network architecture: Single layer Feedforward network - Multilayer Feedforward network – Recurrent neural network – Characteristics of neural networks – Learning Methods- Taxonomy of neural network Architecture-History of neural network research

	Total Lecture Hours	**60**

Text Book(s)
1. Navanitham, P.A., "Business Mathematics & Statistics", Jai Publishers, Trichy (Unit I)
2. Venkataraman M. K., "Numerical Methods in Science & Engineering", National Publishing Company, Chennai. (Unit II & III)
3. Sharma J.K., "Discrete Mathematics",Second Edition, MacMillan Publishers India Limited, Chennai, 2005 (Unit IV)
4. Rajasekaran S. and Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic, and Genetic Algorithms : Synthesis And Applications" Prentice Hall of India (Unit V)

Reference Book(s)
1. Fuzzy logic & Neural Networks/ Chennakesava R. Alavala/ New Age International, 2008
2. Neural Networks for control, Millon W. T, Sutton R.S and Werbos P. J, MIT Press 1992
3. Fuzzy sets Fuzzy logic, Klir, G. J anfd Yuan B.B Prentice Hall oif India Pvt. Ltd.,, New Delhi
4. Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reinfrank M., Narosa Publications House, New Delhi 1996

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	

Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Second Semester

Course Code		Introduction to Python Programming	L	T	P	C
Core/Elective/Supportive		Core : 3	6	0	-	4
Pre - requisite		• Basic knowledge of Python Programming. • Knowledge in Object Oriented Programming Concepts.	Syllabus version		2025-26 Onwards	
Course Objectives						
1. To know the basics of algorithmic problem solving with read and write simple Python programs. 2. To develop Python programs with conditionals and loops. 3. To define Python functions and call them. 4. To use Python data structures - lists, tuples, dictionaries and fix input/output with files in Python.						
Expected Course Outcomes						
1	Develop algorithmic solutions to simple computational problems					K1
2	Read, write, execute by hand simple Python programs. Structure simple Python programs for solving problems.					K2
3	Decompose a Python program into functions.					K3
4	Represent compound data using Python lists, tuples, dictionaries. Read and write data from/to files in Python Programs					K3
5	Judge the pros and cons of Python					K4
K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create						

Unit I		Algorithmic Problem Solving	18
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).			
Unit II		Data, Expressions, Statements	18
Python interpreter and interactive mode, values and types: int, float, boolean, string and list; variables, expressions, statements, tuple assignment, precedence of operators, comments, modules and functions, function definition and use, flow of execution, parameters and arguments.			
Unit III		Control Flow, Functions	18
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else). Iteration: state, while, for, break, continue, pass. Fruitful functions: return values, parameters, local and global scope, function composition, recursion. Strings: string slices, immutability, string functions and methods, string module, Lists as arrays.			
Unit IV		Lists, Tuples, Dictionaries	18
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters. Tuples: tuple assignment, tuple as return value, Dictionaries: operations and methods, advanced list processing - list comprehension.			
Unit V		Files, Modules, Packages	18
Files and exception: text files, reading and writing files, format operator, command line arguments, errors and exceptions, handling exceptions, modules, packages.			
		Total Lecture Hours	**90**

Text Book(s)
1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Book(s)
1. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	http://greenteapress.com/wp/think-python/	

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

 *S-Strong; M-Medium; L-Low

Course Code		Programming Lab - Python Programming	L	T	P	C
Core/Elective/Supportive		**Core Lab: 2**	**-**	**-**	**5**	**2**
Pre - requisite		• Basic knowledge of Programming Constructs • Knowledge on Object Oriented Programming Concepts	**Syllabus version**		**2025-26 Onwards**	

Course Objectives

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples and dictionaries.
5. Read and write data from/to files in Python.

Course Outcomes

1	Write, test, and debug simple Python programs. Read and write data from/to files in Python	**K2**
2	Implement Python programs with conditionals and loops.	**K3**
3	Develop Python programs step-wise by defining functions and calling them.	**K4**
4	Use Python lists, tuples, dictionaries for representing compound data.	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

PROGRAM 1	
Compute the GCD of two numbers	
PROGRAM 2	
Find the square root of a number (Newton's method)	
PROGRAM 3	
Exponentiation (power of a number)	
PROGRAM 4	
Find the maximum of a list of numbers	
PROGRAM 5	
Linear search and Binary search	
PROGRAM 6	
Selection sort, Insertion sort	
PROGRAM 7	
Merge sort	
PROGRAM 8	
First n prime numbers	
PROGRAM 9	
Multiply matrices	
PROGRAM 10	
Programs that take command line arguments (word count)	

		Total Lecture Hours	36 Hours
		Text Book(s)	
1	Mark Summerfield. —Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.		
		Reference Book(s)	
1	Martin C. Brown, —PYTHON: The Complete Reference‖, McGraw-Hill, 2001		
Course Designed by :			

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	L	L	L	L	L	L
CO2	S	S	S	L	L	L	L	L	L	L
CO3	S	S	S	L	L	L	L	L	L	L
CO4	M	M	S	S	M	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Office Automation and Internet	L	T	P	C
Core/Elective/Supportive		Core Lab: 3	-	0	3	2
Pre-requisite		• Basic knowledge in Computers	Syllabus version		2025-26 Onwards	

Course Objectives	
1. Introduce the fundamentals of Internet and the Web functions.	
2. Impart knowledge and essential skills necessary to use the internet and its various components.	
3. Find, evaluate, and use online information resources.	
4. Use Google Apps for education effectively.	

	Expected Course Outcomes	
1	Apply the predefined procedures to create Gmail account, check and receive messages	K3
2	Apply the predefined procedures to perform various basic operations on internet	K3
3	Utilize various Google applications like docs, Google classroom, Google drive, Google forms, Google meet and slides	K3

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

PROGRAM - 1	3
Prepare your resume in word and assume that you are studying in final year of your graduation and are eagerly looking for a job. Visit any job portal and upload your resume.	
PROGRAM - 2	**3**
Create a flowchart for any program use proper shapes like ellipse, arrows, rectangle, parallelogram and grouping to group all the parts of the flowchart into one single object.	
PROGRAM - 3	**3**
Create a simple mathematical calculations using formulas in excel sheet.	
PROGRAM - 4	**3**
Prepare students mark list for your class and calculate Total, Average, Result and Ranking by using arithmetic, logical functions and sorting using excel sheet.	
PROGRAM - 5	**3**
Create different types of charts for a range in students mark list using excel sheet.	
PROGRAM -6	**3**
Create a power-point presentation with minimum 10 slides The first slide must contain the topic of the presentation and name of the presentation. a. At least one table,5 bullets,5 numbers, font size, font face, font color. b. Use word art to write the heading for each slides. Insert at least one clip-art, one picture, one audio and one video. c. Use custom animation option to animate the text, move left to right one line at a time and Use proper transition for the slides. d. Last slide must contain thank you.	
PROGRAM -7	**3**
Open your inbox in the Gmail account created, check the mail received from your peer from other college inviting you for his college fest, and download the invitation. Reply to the mail with a thank you note for the invite and forward the mail to other friends.	
PROGRAM -8	**3**
Create your own Google classroom and invite all your friends through email id. Post study material in Google classroom using Google drive. Create a separate folder for every subject and upload all unit wise E-Content Materials.	

PROGRAM -9	3
Create and share a folder in Google Drive using 'share a link' option and set the permission to access that folder by your friends only.	
PROGRAM -10	**3**
Create poster for Department Seminar or Conference using any open source tools.	
Total Lecture Hours	**30 Hours**

Text Book(s)

1	Ian Lamont, Google Drive & Docs in 30 Minutes, 2nd Edition.

Reference Book(s)

1	Sherry Kinkoph Gunter, My Google Apps, 2014.

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	L	L	L	L
CO2	S	M	L	L	L	L	L	L	L	L
CO3	S	S	M	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Optimization Techniques		L	T	P	C
Core/Elective/Supportive		Allied: 2		4	0	0	4
Pre - requisite		Basic Knowledge in Optimization		Syllabus version		2025-26 Onwards	

Course Objectives	
The objective of this course is to enable the student to	

1. Formulate and solve linear programming problems (LPP)
2. Evaluate Integer Programming Problems, Transportation and Assignment Problems.
3. Obtain solution to network problems using CPM and PERT techniques.
4. Able to optimize the function subject to the constraints.
5. Identify and solve problems under game theory.

Course Outcomes		
1	Demonstrate and Formulate and solve linear programming problems (LPP)	K1
2	Evaluate Integer Transportation and Assignment Problems	K2
3	Obtain solution to network problems using CPM and PERT techniques	K3
4	Apply the strategies of game theory and to make better decisions while solving problems	K4
5	Identify and solve problems under replacement models	K5
K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create		

Unit I	Introduction To Operation Research	12
	Introduction of Operations Research - Linear programming- Mathematical Formulation- Graphical Method to solve LPP-Simplex Method.	
Unit II	Transportation and Assignment Problems	12
	Transportation problems: Introduction- Finding Initial Basic Feasible solutions- moving Towards optimality (non- degenerate only) – Maximization in transportation problem- Unbalanced transportation problem. Assignment problem: Introduction –Hungarian Assignment method – Maximization in Assignment problem – Unbalanced Assignment problem- Travelling Salesman Problem.	
Unit III	Project Scheduling Hours	12
	Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM. (Simple Problems Only).	
Unit IV	Game Theory	12
	Game theory: Concept of Pure and Mixed strategies – solving 2 x 2 matrices with and without saddle point. Graphical solution - mx2 and 2xn games- Solving games by Dominance Property.	

UNIT V	Replacement Theory	12
	Theory of Replacement – Introduction - Replacement models –Replacement of items that deteriorates gradually (value of money does not change with time)	
	Total Lecture Hours	**60 Hours**

Text Book(s)

1. P. K. Gupta, Man Mohan, Kanti Swarup: "Operations Research", Sultan Chand, 2008.

Reference Book(s)

1. Sundaresan V, Ganapathy K.S, Ganesan K, Resource Management Technique- Lakshmi Publications, 2003.
2. J. K. Sharma: Operations Research Theory & Applications, Macmillan India Limited, Fifth edition.2013.

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Third

Semester

Course Code		Java Programming		L	T	P	C
Core/Elective/Supportive		**Core : 4**		**4**	**0**	**0**	**4**
Pre - requisite		• Knowledge in Basics of Object Oriented Programming		**Syllabus version**		**2025-26 Onwards**	

Course Objectives	
1. To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of JAVA	

Course Outcomes		
1	Recite the history of JAVA and its evolution	**K1**
2	Explain the various programming language constructs, object oriented concepts like overloading, inheritance, polymorphism, Interfaces, threads, exception handling and packages	**K2**
3	Illustrate the concepts of Applets, files and the concept of stream classes.	**K3**
4	Outline the benefits and applications of objects oriented programming concepts and defend how JAVA differs from other programming languages	**K3**
5	Judge the pros and cons of other object oriented language with the concepts of JAVA	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	**Introduction**	**12**
Java Features – comparison of Java with C and C++ - Java and Internet – Java Environment – Java Program structure – Java Tokens – Implementing a Java Program – Java Virtual Machine – Constants – Variables – Data Types – Scope of Variables – Type casting – Operators and expressions – Decision Making, Branching and Looping		

Unit II	**Classes and Arrays**	**12**
Defining a class – Constructors – Methods – overloading – static Members – Nesting of Methods – Overriding methods – Final Classes – Abstract Class – Visibility control – Arrays – creating an array – Two Dimensional arrays – Strings – String Arrays – String Methods – String Buffer Class – Vectors – Wrapper Classes.		

Unit III	**Inheritance, Interfaces and Packages**	**12**
Defining a subclass – Subclass constructor – Multilevel inheritance – Hierarchical Inheritance – Defining Interfaces – Extending Interfaces – Implementing Interfaces – Java APF Packages – creating a package – Accessing and Using a package – Adding a class to a package – Hiding Classes		

Unit IV	**Multithreading Exception Handling**	**12**
Extending the Thread class – Thread Life cycle – Thread Exception – Thread priority – Synchronization – Runnable Interface – Exceptions – Throwing own Exceptions – Concepts of streams – stream classes – Byte Stream Classes – Character stream Classes – Using Streams – Using file Class –Other Stream Classes.		

Unit V	**Applet Programming**	**12**
Difference between Application and Applets – Applet Life cycle – creating an Executable Applet – Designing a Web Page – Adding Applet to HTML File – Passing Parameters to Applets		
	Total Lecture Hours	**60 Hours**

Text Book(s)	
1	E. Balagurusamy, "Programming with Java – A primer", Second Edition, Tata McGraw Hill Publishing Company, Delhi, 2002.

Reference Book(s)	
1	Herbert Schildt, "The complete Reference – Java 2", Fifth Edition, Tata McGraw Hill Publishing Company, Delhi, 2002.
2	The Complete Reference Java 2 - Patrick Naughton & Hebert Schildt, 3rd Edition, TMH
3	Programming with Java – John R. Hubbard, 2nd Edition, TMH.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

1. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
2. https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Java Programming Lab	L	T	P	C
Core/Elective/Supportive		Core Lab : 4	0	0	3	2
Pre - requisite		• Basic knowledge of Programming • Knowledge on Object Oriented Programming Concepts	**Syllabus version**		**2025-26 Onwards**	

Course Objectives	
To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of JAVA	

Course Outcomes		
1	Apply the various basic programming constructs of JAVA like decision making statements. Looping statements, overloading, inheritance, polymorphism, constructors and destructors	**K3**
2	Illustrate the concepts of threading and multi-threading	**K4**
3	Design programs using various file stream classes; file types, and frames	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

PROGRAM - 1		
Write a Java Applications to extract a portion of a character string and print the extracted string.		
PROGRAM - 2		
Write a Java Program to implement the concept of multiple inheritance using Interfaces.		
PROGRAM - 3		
Write a Java Program to create an Exception called payout-of-bounds and throw the exception		
PROGRAM - 4		
Write a Java Program to implement the concept of multithreading with the use of any three multiplication tables and assign three different priorities to them.		
PROGRAM - 5		
Write a Java Program to draw several shapes in the created windows		
PROGRAM -6		
Write a Java Program to demonstrate the Multiple Selection List-box.		
PROGRAM -7		
Write a Java Program to create a frame with three text fields for name, age and qualification and a text field for multiple line for address		
PROGRAM -8		
Write a Java Program to create Menu Bars and pull down menus.		
PROGRAM -9		
Write a Java Program to create frames which respond to the mouse clicks.		
PROGRAM -10		
Write a Java Program to draw circle, square, ellipse and rectangle at the mouse click positions.		
	Total Hours	**30 Hours**

	Text Book(s)
1	Programming with Java – A Primer - E. Balagurusamy, 3rd Edition, TMH.
	Reference Book(s)
2	The Complete Reference Java 2 - Patrick Naughton& Hebert Schildt, 3rd Edition, TMH
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	L	L	L	L	L	L
CO2	S	S	S	L	L	L	L	L	L	L
CO3	S	S	S	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Foundation of Artificial Intelligence	L	T	P	C
Core/Elective/Supportive		Core : 5	4	0	0	4
Pre - requisite		None	Syllabus version		2025-26 Onwards	

Course Objectives

The objective of this course is to enable the students to
1. Understand the basic concepts of intelligent agents
2. Develop general-purpose problem solving agents, logical reasoning agents and agents that reason under uncertainty.
3. Employ AI techniques to solve some of today's real world problems.

Course Outcomes

1	Understand autonomous agents that make effective decisions in fully informed, partially observable and adversarial settings	K1
2	Choose appropriate algorithms for solving given AI problems	K2
3	Design and implement logical reasoning agents	K6
4	Demonstrate agents that can reason under uncertainty	K2
5	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K4

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit I	Intelligent Agents	12

Introduction to AI –Agents and Environments –Concept of rationality –Nature of environments –Structure of agents Problem solving agents –search algorithms –uninformed search strategies

Unit II	Problem Solving	12

Heuristic search strategies –heuristic functions. Local search and optimization problems –local search in continuous space –search with non-deterministic actions –search in partially observable environments –online search agents and unknown environments.

Unit III	Game Playing and CSP	12

Game theory –optimal decisions in games –alpha-beta search –monte-carlo tree search – stochastic games –partially observable games. Constraint satisfaction problems –constraint propagation –backtracking search for CSP –local search for CSP –structure of CSP.

Unit IV	Logical Agents	12

Knowledge-based agents –propositional logic –propositional theorem proving – propositional model checking –agents based on propositional logic. First-order logic –syntax and semantics –knowledge representation and engineering –inferences in first-order logic –forward chaining –backward chaining –resolution.

Unit V	Knowledge Representation and Planning	12

Ontological engineering –categories and objects –events –mental objects and modal logic – reasoning systems for categories –reasoning with default information. Classical planning – algorithms for classical planning –heuristics for planning –hierarchical planning –non-deterministic domains –time, schedule, and resources –analysis.

	Total Lecture Hours	**60 Hours**

Text Book(s)
1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.   2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007   3. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
Reference Book(s)
1. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006   2. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)   3. Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases -by Dennis Rothman, 2018
Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Operating System Design		L	T	P	C
Core/Elective/Supportive		Allied : 3		4	0	0	4
Pre - requisite		Students Should have the basic knowledge in computer.		Syllabus version		2025-26 Onwards	

Course Objectives	
1.	To understand the structure and functions of OS
2.	To learn about Processes, Threads and Scheduling algorithms
3.	To understand the principles of concurrency and Deadlocks
4.	To learn various memory management schemes
5.	To study I/O management and File systems.

Course Outcomes		
1	Outline the basic services and functionalities of operating systems	K1
2	Analyze various scheduling algorithms and understand the different deadlock, prevention and avoidance schemes	K2, K3
3	Illustrate the different memory management schemes	K4
4	Outline the functionality of file systems	K5
5	Compare and contrast Linux, Windows and mobile operating systems	K6
K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create		

Unit I	Introduction to Operating Systems	12
Computer System Overview: Basic elements – Instruction execution – Interrupts – Memory hierarchy – Cache memory – Direct memory access – Multiprocessor and multicore organization		
Unit II	Operating Systems Overview	12
Operating System Overview: Objectives and functions – Evolution of operating system, Computer system organization, Operating System Structure and Operations: System calls – System programs, Operating-System Design and Implementation, Operating-System Debugging.		
Unit III	Process Management	12
Processes: Process concept – Process scheduling – Operations on processes – Interprocess communication. Threads: Overview – Multithreading models – Thread issues. CPU Scheduling: FCFS, SJF, Priority, Round robin scheduling. Process synchronization – Critical section problem – Mutex locks – Semaphores, Deadlocks – Avoidance – Prevention – Detection and Recovery.		
Unit IV	Memory Management	12
Main Memory: Contiguous memory allocation – Segmentation – Paging. Virtual Memory: Demand paging – Page replacement algorithms – Allocation of Frames – Thrashing.		
Unit V	Storage Management	12
Mass Storage Structure: Overview – Disk scheduling and management. File System Storage: File concepts – Directory and disk structure – Sharing and protection. File System Implementation: File system structure – Directory structure – Allocation methods – Free space management.		
Total Lecture Hours		60 Hours

Text Book(s)
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc, 2012.
2. Neil Smyth, "iPhone iOS 4 Development Essentials - Xcode", 4th Edition, Payload media,2011.

Reference Book(s)
1. Ramez Elmasri, A Gil Carrick, David Levine, "Operating Systems A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. Achyut S Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3. Andrew S Tanenbaum, "Modern Operating Systems", 2nd Edition, Pearson Education, 2004.
4. Harvey M Deitel, "Operating Systems", 3rd Edition, Pearson Education, 2004.
5. Daniel P Bovet, Marco Cesati, "Understanding the Linux Kernel", 3rd edition, O'Reilly,2005

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1		
2		

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	M	M	M	M	L
CO2	S	S	S	S	S	M	M	M	S	L
CO3	S	M	M	M	S	M	S	S	S	L
CO4	S	S	S	M	S	S	S	M	M	M
CO5	S	S	S	M	S	S	S	M	M	M

*S-Strong; M-Medium; L-Low

Course Code		Data Analytics		L	T	P	C
Core/Elective/Supportive		**Skill based Subject : 1**		**3**	**0**	**0**	**2**
Pre - requisite		**None**		Syllabus version		2025-26 Onwards	

Course Objectives
1. To study the basic inferential statistics and sampling distribution.
2. To understand the concept of estimation of parameters using fundamental tests and testing of hypotheses.
3. To understand the techniques of analysis of variance.
4. To gain knowledge in predictive analytics techniques.
5. To perform a case study with any available sample data sets.

Expected Course Outcomes		
1	Understand and critically apply the concepts and methods of analytics	**K2**
2	Analyze the concept of sampling	**K4**
3	Demonstrate the skills to perform various tests in the given data	**K5**
4	Apply the knowledge to derive hypotheses for given data	**K3**
5	Perform statistical analytics on a data set	**K6**
K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create		

UNIT I	Introduction	9
Introduction Data Analytics – Data Analysis Vs Data Analytics – Data Analytics – Types - Data Analytics – Framework – Data Analytics – Tool - R language - Understanding R -features - Installing R and RStudio – Packages and Library.		
UNIT II	**Importing and Exporting Files**	**9**
Importing and Exporting Files: CSV File – JSON File – txt File –Excel File – Xml File - Command Line Vs. Scripts. - Data Pre-Processing – Missing Value – Omitting Null Values – Data Transformation – Data Selection – Data Integration.		
UNIT III	**Data Manipulation**	**9**
Command Line Vs. Scripts Data Manipulation: Slicing - Subscripts and Indices – Data Subset – Dplyr Package: Select Function - Filter Function - Mutate Function - Arrange Function.		
UNIT IV	**Data Summarization**	**9**
Data Summarization & Visualization - Mean – Median – Mode - Variablity Measures - Variance – Range - IQR – Standard Deviation – Sum of Squares –Identifying Outliers using IQR.		
UNIT V	**Case Studies**	**9**
Data Analytics Case Studies – Marketing – Logistic Management – Insurance – Behavioural Analytics – Data Analytics on Diamond Dataset.		
	Total Lecture Hours	**45 Hours**

Text Book(s)
1. V. Bhuvaneswari, "Data Analytics with R Step by Step", Scitech Publisher, ISBN – 978-81-929131-2-4, Edition 2016.
2. Roger D.Peng, "R Programming for Data Science", Lean Publishing, 2014.
3. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing, ISBN- 978-1-78216-328-2, 2013.
4. Sholom Weiss, et.al, "The Text Mining Handbook: Advanced Approaches in Analysing Unstructured Data", Springer, Paperback 2010.
5. Emmanuel Paradis, "R for Beginners", 2005.

Reference Book(s)
1. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
3. David Spiegelhalter, "The Art of Statistics: Learning from Data", Pelican Books, 2020.
4. Peter Bruce, Andrew Bruce, and Peter Gedek, "Practical Statistics for Data Scientists", Second Edition, O'Reilly Publishers, 2020.
5. Charles R. Severance, "Python for Everybody: Exploring Data in Python 3", Shroff Publishers, 2017.
6. Bradley Efron and Trevor Hastie, "Computer Age Statistical Inference", Cambridge University Press, 2016.

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1		
2		

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	M	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Fourth Semester

Course Code		Cognitive Science and Analytics	L	T	P	C
Core/Elective/Supportive		Core : 6	4	0	0	4
Pre - requisite		None	Syllabus Version		2025-26 Onwards	

Course Objectives	
1. To explain cognitive computing and design principles.	
2. To distinguish between NLP and cognitive computing.	
3. To apply advanced analytics to cognitive computing.	
4. To discuss application of cognitive computing in business.	
5. To illustrate various applications of cognitive computing.	

Course Outcomes		
1	Apply cognitive computing and design principles.	K3
2	Understand the concept NLP and cognitive computing.	K2
3	Analyze advanced analytics to cognitive computing.	K4
4	Discuss application of cognitive computing in business.	K5

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit I	Foundation	12

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition.

Unit II	Design Principles	12

Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.

Unit III	NLP in Cognitive System	12

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems.

Unit IV	Big Data Vs Cognitive Computing	12

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.

Unit V	Cognitive Computing in Business	10

Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future.

Unit VI	Contemporary Issues	2

Expert lectures, online seminars - webinars

Total Lecture Hours	60 Hours

Text Book(s)
1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics" Wiley, 2015.   2. Vijay Raghvan, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications", by Elsevier publications, North Holland Publication, 1st Edition, 2016.   3. Bernadette Sharp (Author), Florence Sedes (Author), Wieslaw Lubaszewski (Author), Cognitive Approach to Natural Language Processing Hardcover, First Edition May 2017.
Reference Book(s)
1. Arun Kumar Sangaiah, Arunkumar Thangavelu, et al., Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and Communications Technologies 1st edition 2018   2. Min Chen and Kai Hwang, Big-Data Analytics for Cloud, IoT and Cognitive Computing Wiley Publication, 1st Edition, 2017.   3. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1		
2		
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Database Design and Management	L	T	P	C
Core/Elective/Supportive		Core : 7	4	0	0	4
Pre - requisite		None	Syllabus version		2025-26 Onwards	

Course Objectives
1. To introduce database development life cycle and conceptual modelling
2. To learn SQL for data definition, manipulation and querying a database
3. To learn relational database design using conceptual mapping and normalization
4. To learn transaction concepts and serializability of schedules
5. To learn data model and querying in object-relational and No-SQL databases

	Expected Course Outcomes	
1	Understand the database development life cycle and apply conceptual modeling	K2
2	Apply SQL and programming in SQL to create, manipulate and query the database	K2
3	Apply the conceptual-to-relational mapping and normalization to design relational database	K3
4	Determine the serializability of any non-serial schedule using concurrency techniques	K3
K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create		

Unit I	**Conceptual Data Modeling**	12
Database environment –Database system development lifecycle –Requirements collection –Database design --Entity-Relationship model –Enhanced-ER model –UML class diagrams.		
Unit II	**Relational Model and SQL**	12
Relational model concepts --Integrity constraints --SQL Data manipulation –SQL Data definition –Views --SQL programming.		
Unit III	**Relational Database Design and Normalization**	12
ER and EER-to-Relational mapping –Update anomalies –Functional dependencies-Inference rules –Minimal cover –Properties of relational decomposition –Normalization upto BCNF.		
Unit IV	**Transaction Management**	12
Transaction concepts –properties –Schedules –Serializability –Concurrency Control –Two-phase locking techniques.		
Unit V	**Object Relational and No-SQL Databases**	10
Mapping EER to ODB schema –Object identifier –reference types –row types –UDTs –Subtypes and super types –user-defined routines –Collection types –Object Query Language.		
Unit VI	**Contemporary Issues**	2
Expert lectures, online seminars - webinars		
	Total Lecture Hours	**60 Hours**

Text Book(s)
1. Thomas M. Connolly, Carolyn E. Begg, Database Systems –A Practical Approach to Design, Implementation and Management, Sixth Edition, Global Edition, Pearson Education, 2015.
2.Ramez Elmasri, Shamkant B. Navathe, Fundamental of Database Systems, 7th Edition, Pearson, 2017.

Reference Book(s)	
1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, "DATABASE MODELING AND DESIGN -Logical Design", Fifth Edition, Morgan Kaufmann Publishers, 2011. 2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012 3. Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011. 4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson. 5. S Sumathi, S Esakkirajan, " Fundamentals of Relational Database Management Systems ", (Studies in Computational Intelligence), Springer-Verlag, 2007. 6. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.	
Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1 https://www.tutorialspoint.com/oracle_sql/index.html	
Course Designed by : Dr. M.VIJAYAKUMAR, Assistant Professor, School of Computer Science, VET Institute of Arts and Science (Co-Education) College, Erode	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	M	M	M	L
CO2	S	S	S	M	S	M	M	M	M	L
CO3	S	S	S	S	S	S	S	S	M	M
CO4	S	S	S	S	S	M	S	S	M	L

 *S-Strong; M-Medium; L-Low

Course Code		Database Lab		L	T	P	C
Core/Elective/Supportive		Core Lab : 5		0	0	3	2
Pre - requisite		None		Syllabus version		2025-26 Onwards	
Course Objectives							

Course Objectives

1. To understand the database development life cycle
2. To learn database design using conceptual modelling, Normalization
3. To implement database using Data definition, Querying using SQL manipulation and SQL programming
4. To implement database applications using IDE/RAD tools
5. To learn querying Object-relational databases

Expected Course Outcomes

1	Understand the database development life cycle	K2
2	Design relational database using conceptual-to-relational mapping, Normalization	K3
3	Apply SQL for creation, manipulation and retrieval of data	K4
4	Develop a database applications for real-time problems	K6

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

List of Programs

1. Database Development Life cycle: Problem definition and Requirement analysis Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) –top-down approach .Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming -Stored Procedures/Functions -Constraints and security using Triggers
6. Database design using Normalization –bottom-up approach
7. Develop database applications.
8. Create a table for Employee details with Employee Number as primary key and following fields:
   Name, Designation, Gender, Age, Date of Joining and Salary. Insert at least ten rows and perform various queries using any one Comparison, Logical, Set, Sorting and Grouping operators.
9. Write a PL/SQL to update the rate field by 20% more than the current rate in inventory table which has the following fields: Prono, ProName and Rate. After updating the table a new field (Alter) called for Number of item and place for values for the new field without using PL/SQL block.
10. Querying the Object-relational database using Objet Query language.

	Total Lecture Hours	**30 Hours**

Text Book(s)

1	E-Book : Bill Pribyl, Steven Feuerstein, "Oracle PL/SQL Programming", O'Reilly Media, Inc., 6th Edition, February 2014.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	
2	
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	M	L	S	M	M	L
CO3	S	S	S	L	M	M	S	M	S	L
CO3	S	S	S	M	S	M	S	S	S	M
CO4	S	S	S	M	S	M	S	S	M	M
CO5	S	S	S	S	S	S	S	S	S	M

*S-Strong; M-Medium; L-Low

Course Code		Data and Information Security	L	T	P	C
Core/Elective/Supportive		**Allied : 4**	**4**	**0**	**0**	**4**
Pre - requisite		**None**	**Syllabus version**		**2025-26 Onwards**	

	Course Objectives	
	1. To understand the basics of number theory and security	
	2. To understand and analyze the principles of different encryption techniques	
	3. To understand the security threats and attacks	
	4. To understand and evaluate the need for different security aspects in real time applications	
	5. To learn the different applications of information security	

	Expected Course Outcomes	
1	Understand the fundamentals of security and the significance of number theory in computer security.	**K2**
2	Learn the public key cryptographic standards and authentication scheme	**K3**
3	Apply the Security Frameworks for Real Time Applications	**K5**
4	Develop appropriate security algorithms understanding the possible threats	**K4**
K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create		

Unit I	**Fundamentals of Security**	**12**
	Computer Security Concepts - Threats, Attacks and Assets – Security Functional Requirements – Fundamental Security Design Principles – Attack Surfaces and Attack Trees. Computer Security Strategy– Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCD and Euclidean Algorithm, Chinese Remainder Theorem.	
Unit II	**Encryption Techniques and Key Management**	**12**
	Symmetric Encryption Principles – Data Encryption Standard – Advanced Encryption Standard – Stream Ciphers and RC4 - Cipher Block Modes Operation – Digital Signatures - Key Distributions - Public Key Cryptosystem: RSA, Elliptic Curve Cryptography - Key Exchange Algorithms: Diffie Hellmen and ELGamal Key Exchange.	
Unit III	**Authentication, Integrity and Access Control**	**12**
	Authentication: Security Hash Function – HMAC – Electronic User Authentication Principles, Password Based Authentication, Token Based and Remote Authentication; Internet Authentication Applications: Kerberos X.509 – Public Key Infrastructure.	
Unit IV	**Access Control**	**12**
	Access Control: Access Control Principles - Subjects, Objects and Access Rights - Discretionary Access Control - Example: UNIX File Access Control – Role Based Access Control - Attribute-Based Access Control - Identity, Credential and Access Management - Trust Frameworks.	
Unit V	**Security**	**10**
	System Security: Firewall, Viruses, Worms, Ransomeware, Keylogger, Greyware, IDS, DDoS Network Security: SSL – TLs – HTTPS –IP Security; OS Security-Application Security - Linux/Unix Security - Windows Security - Virtualization Security- Wireless Security.	
Unit VI	**Contemporary Issues**	**2**
	Expert lectures, online seminars - webinars	
	Total Lecture Hours	**60 Hours**

Text Book(s)
1. William Stallings, "Cryptography and Network Security Principles and Practice", Fifth Edition, 2011, Pearson Education International
2. William Stallings and Lawrie Brown, "Computer Security Principles and Practice", Third Edition,2015, Pearson Education International

Reference Book(s)
1. Tim Mather, Subra Kumaraswamy and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 2009, Oreilly
2. Mikhail Gloukhovtsev, "IoT Security: Challenges, Solutions & Future Prospects", 2018, Knowledge Sharing Article, Dell Inc.
3. Pradip KumarDas, Hrudaya Kumar Tripathy, Shafiz Affendi Mohd yusuf, Privacy and Security Issues in Big Data, An Analytical View on Business Intelligence. Springer 2021.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

1	
2	

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Capstone Project Work	L	T	P	C
Core/Elective/Supportive		Skill Based Subject 2 Lab	0	0	3	2
Pre - requisite		• Students should have a good understanding of software engineering • Student should possess strong analytical skills • Strong coding skills in any one programming	**Syllabus version**		**2025-26 Onwards**	

Course Objectives		

- To understand and select the task based on their core skills.
- To get the knowledge about analytical skill for solving the selected task.
- To get confidence for implementing the task and solving the real time problems.

Expected Course Outcomes		

On the successful completion of the course, student will be able to:

1	Illustrate a real world problem and identify the list of project requirements	**K3**
2	Judge the features of the project including forms, databases and reports	**K5**
2	Design code to meet the input requirements and to achieve the required output	**K6**
3	Compose a project report incorporating the features of the project	**K6**

K1 – Remember K2 – Understand K3 – Apply K4 - Analyze K5 – Evaluate K6 - Create

Aim of the project work		

1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied.

2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts.

3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 50 marks at the last day of the practical session.

2. Out of 50 marks, 20 marks for CIA, 30 marks for CEE (20 marks for project report and 10 Marks for Viva Voce.)

Project Work Format

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done by

STUDENT NAME

REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of
<Name of the Degree>
of Bharathiar University, Coimbatore-46.

College Logo

Signature of the Guide   Signature of the HOD

Submitted for the Viva-Voce Examination held on _____

Internal Examiner   External Examiner

Month – Year

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Acknowledgement
Contents
Synopsis

1. Introduction

 1.1 Organization Profile

 1.2 System Specification

  1.2.1 Hardware Configuration

  1.2.2 Software Specification

2. System Study

 2.1 Existing System

 2.1.1 Drawbacks

 2.2 Proposed System

 2.2.1 Features

3. System Design and Development

 3.1 File Design

3.2 Input Design

3.3 Output Design

3.4 Database Design

3.5 System Development

 3.5.1 Description of Modules (Detailed explanation about the project work)

4 Software Testing and Implementation

Conclusion

Bibliography

Appendices

 A. Data Flow Diagram

 B. Table Structure

 C. Sample Coding

 D. Sample Input

 E. Sample Output

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	L	L	L	L	L
CO2	S	S	S	S	S	L	L	L	L	L
CO3	S	S	S	S	S	M	M	L	L	L
CO4	S	S	S	S	S	M	M	L	L	L

*S-Strong; M-Medium; L-Low

Fifth

Semester

Course Code		Ethics of Artificial Intelligence	L	T	P	C
Core/Elective/Supportive		**Core : 8**	**6**	**0**	**0**	**4**
Pre - requisite		**None**	**Syllabus version**		**2025-26 Onwards**	

Course Objectives	

1. To understand the need for ensuring ethics in AI
2. To understand ethical issues with the development of AI agents
3. To apply the ethical considerations in different AI applications
4. To evaluate the relation of ethics with nature
5. To overcome the risk for Human rights and other fundamental values.

Course Outcomes		
1	Understand the ethical issues in the development of AI agents	**K2**
2	Learn the ethical considerations of AI with perspectives on ethical values	**K1**
3	Apply the ethical policies in AI based applications and Robot development	**K3**
4	To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights.	**K4**
5	Overcome the evil genesis in the concepts of AI	**K5**
K1 – Remember K2 – Understand K3 – Apply K4 - Analyze K5 – Evaluate K6 - Create		

Unit I		**Ethics of AI**	**18**

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities.

Unit II		**Framework and Models**	**18**

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral.

Unit III		**Concepts and Issues**	**18**

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder.

Unit IV		**Perspectives and Approaches**	**18**

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents.

Unit V		**Cases and Application**	**15**

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics.

Unit VI		**Contemporary Issues**	**3**
		Total Lecture Hours	**90 Hours**

Text Book(s)	
1. Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", Springer, 2017	
2. Markus D. Dubber, Frank Pasquale, Sunit Das, "The Oxford Handbook of Ethics of AI", Oxford	
University Press Edited book, 2020	
3. S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press Edited Book, 2020	

Reference Book(s)	
1. N. Bostrom and E. Yudkowsky. "The ethics of artificial intelligence". In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.	
2. Wallach, W., & Allen, C, "Moral machines: ceaching robots right from wrong", Oxford University Press, 2008.	

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	
2	

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Fundamentals of Data Science	L	T	P	C
Core/Elective/Supportive		Core : 9	6	0	0	4
Pre - requisite		None	Syllabus version		2025-26 Onwards	

Course Objectives	
1. To acquire skills in data preparatory and preprocessing steps	
2. To understand the mathematical skills in statistics	
3. To learn the tools and packages in Python for data science	
4. To gain understanding in classification and Regression Model	
5. To acquire knowledge in data interpretation and visualization techniques	

Course Outcomes		
1	Apply the skills of data inspecting and cleansing	K2
2	Determine the relationship between data dependencies using statistics	K2
3	Understand the can handle data using primary tools used for data science	K2
4	Represent the useful information using mathematical skills	K2
5	Apply the knowledge for data describing and visualization using tools	K3

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit I	Introduction	18

Need for data science –benefits and uses –facets of data –data science process –setting the research goal –retrieving data –cleansing, integrating and transforming data –exploratory data analysis –build the models –presenting and building applications.

Unit II	Frequency Data Distributions	18

Frequency distributions –Outliers –relative frequency distributions –cumulative frequency distributions –frequency distributions for nominal data –interpreting distributions –graphs – averages –mode –median –mean –averages for qualitative and ranked data.

Unit III	Normal Data Distributions	18

Normal distributions –z scores –normal curve problems –finding proportions –finding scores – more about z scores –correlation –scatter plots –correlation coefficient for quantitative data – computational formula for correlation coefficient.

Unit IV	Python for Data Handling	18

Basics of Numpy arrays, aggregations, computations on arrays, comparisons, structured arrays, Data manipulation, data indexing and selection, operating on data, missing data, hierarchical indexing, combining datasets –aggregation and grouping, pivot tables.

Unit V	Python for Data Visualization	15

Visualization with matplotlib, line plots, scatter plots, visualizing errors, density and contour plots, histograms, binnings, and density, three dimensional plotting, geographic data.

Unit VI	Contemporary Issues	3
	Total Lecture Hours	**90 Hours**

Text Book(s)	
1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.	
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.	
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.	

Reference Book(s)	
1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.	

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1		

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Data Science Lab	L	T	P	C
Core/elective/Supportive		Core Lab : 6	0	0	6	4
Pre - requisite		None	Syllabus version		2025-26 Onwards	

Course Objectives

1. Understand the Programming Language.
2. To prepare data for data analysis through understanding its distribution.
3. Exposure on data processing using excel
4. To acquire knowledge in plotting using visualization tools.
5. To understand and implement classification and regression model.

Course Outcomes

1	Understand the basic concepts and techniques of Machine Learning.	K2
2	Explain the regression methods, classification methods, clustering methods.	K1
3	Apply the inference and learning algorithms for the hidden Markov model.	K3
4	Demonstrate Dimensionality reduction Techniques	K4
5	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	K5

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

List of Programs

1. Study of Basic function in Excel

2. Working with Range Names and Tables

3. Cleaning Data with Text Functions

4. Cleaning Data containing Data Values

5. Working with VLOOKUP functions and Pivot Table.

6. Demonstration of Data Visualization in Excel.

7. Importing Data from External Source Using Excel

8. Creating a data model

9. Create a dashboard for a given requirement

10. Implement a data analytics for the real time data set

	Total Lecture Hours	**36 Hours**

Text Book(s)

Reference Book(s)

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	L	L	L	L
CO2	S	M	M	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Big Data Analytics	L	T	P	C
Core/elective/Supportive		Elective : I	6	0	0	4
Pre - requisite		None	Syllabus version		2025-26 Onwards	
Course Objectives						

Course Objectives

1. To understand about big data.
2. To learn and use NoSQL big data management.
3. To work with map reduce applications
4. To understand the usage of Hadoop related tools for Big Data Analytics

Course Outcomes		
1	Understand and critically apply the concepts and methods of big data analytics	**K2**
2	Analyze about the various methodologies.	**K4**
3	Apply modeling uncertainty and statistical inference	**K3**
4	Evaluate the performance of analytical frameworks	**K5**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit I	**Introduction**	18

Introduction – Data – Information – Data Terminologies – Database – Data Mining – Data Warehouse – Data Evolution Roadmap – Big Data – Definition – Type of Data – Numeric – Categorical – Graphical – High Dimensional Data .

Unit II	**Data Classification**	18

Data Classification – Hot Data – Cold Data – Warm Data – Thick Data – Thin Data - Classification of digital Data: Structured, Semi-Structured and Un-Structured- Data Sources - Time Series – Transactional Data – Biological Data – Spatial Data – Social Network Data

Unit III	**Big Data**	17

Big Data: Digital Data-an Imprint: Evolution of Big Data – What is Big Data – Sources of Big Data. Characteristics of Big Data 6Vs – Big Data Myths - Data Discovery-Traditional Approach.

Unit IV	**Big Data Technology**	17

Big Data Technology: Big Data Technology Process – Big Data Exploration - Data Augmentation – Operational Analysis – 360 View of Customers – Security and Intelligence.

Unit V	**Use Cases**	17

Big Data Use Cases –- Big Data Roles Data Scientist , Data Architect, Data Analyst – Skills – Case Study : Big Data – Customer Insights – Behavioural Analysis – Big Data Industry Applications - Marketing – Retails – Insurance – Risk and Security – Health care.

Unit VI	**Contemporary Issues**	3

Total Lecture Hours	**90 Hours**
Course Designed by :	

Text Book(s)
1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. V. Bhuvaneswari, T. Devi, "Big Data Analytics: Scitech Publisher , 2018
4. Han Hu, Yonggang Wen, Tat-Seng, Chua, Xuelong Li,"Toward Scalable Systems for Big Data Analytics: A Technology Tutorial", IEEE, 2014.

Reference Book(s)
1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	
2	

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	M	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Cyber Security	L	T	P	C
Core/Elective/Supportive		**Elective : I**	**6**	**0**	**0**	**4**
Pre - requisite		**None**	**Syllabus version**		**2025-26 Onwards**	

Course Objectives	
1. To understand the fundamental functioning of Cyber security	
2. To understand the different protective mechanism in varied Cyber space	

Course Outcomes		
1	Understand the basics of Cyber security	**K2**
2	Apply the appropriate security over internet and mobile devices	**K3**
3	Understand the legal frame work of Cyber security and different security threats	**K3**
4	Analyze and adopt the required firewall and security	**K4**
5	Examine the method and procedure for cryptography and apply it	**K5**
K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create		

Unit I	Introduction	17
	History of Internet – Overview of Cyber Security – The Security Environment – Threats: Cyber Crime, Warfare, terrorism and Espionage. Vulnerabilities: vulnerabilities in software, System administration, Network Architectures, Open Access Data, Weak Authentication.	
Unit II	**Cyber space**	**17**
	Cyber space – web browsing and browser security – Email security, firewall in browsers, security certificate – basic security for HTTP applications and services. Password security – guidelines to choose a password – two steps authentication – WiFi security. Securing social media – social media secure networking – smart phone security – Android, IoS	
Unit III	**Cyber Intrusion**	**18**
	Cyber Intrusion, Abuse of Privileges, Unauthorized Access, Malware infection, Intrusion detection and Prevention Techniques: Network based and host based, Anti-Malware software. Cyber Security Regulations – Government and Private organizations in Cyberspace – Cyber Security Standards – National Cyber Security Policy	
Unit IV	**Cryptography Basics**	**18**
	Introduction to Cryptography, Classifications of Cryptography: Symmetric key and Asymmetric key Cryptography, Applications of Cryptography. Firewalls- Types of Firewalls, VPN Security Security Protocols: - Application Layer security - PGP and S/MIME, ransport Layer security – SSL and TLS, Network Layer Security -IPSec.	
Unit V	**Introduction to Cyber Forensics**	**18**
	Introduction to Cyber Forensics, Preliminary Investigations procedure and methods, Conducting disk-based analysis, Tracing Internet access, Tracing memory.	
Unit VI	**Contemporary Issues**	**3**
	Total Lecture Hours	**90 Hours**

Text Book(s)
1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", 4th Edition, Vikas Publishing House, 2011.
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill, 2013.

Reference Book(s)
1. William Stallings, "Cryptography and Network Security Principles and Practices",7th Edition, Pearson, 2017.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", Wiley Publications, 2003.
3. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1		
2		

Course Designed by :

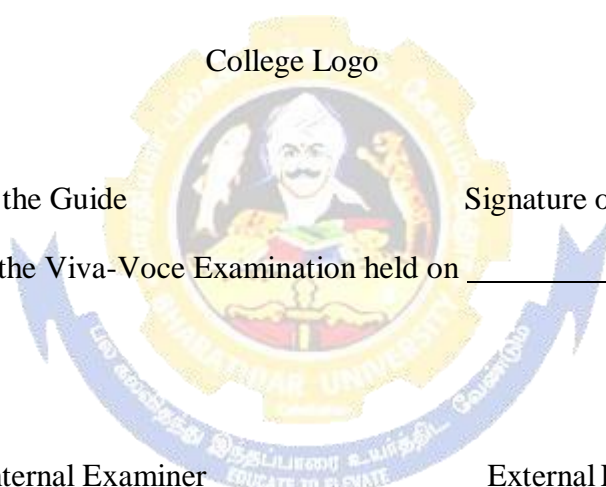|	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

  *S-Strong; M-Medium; L-Low

Course Code		Deep Learning	L	T	P	C
Core/elective/Supportive		Elective - I	6	0	0	4
Pre - requisite		None	Syllabus version		2025-26 Onwards	

Course Objectives

1. To understand the basics of deep neural networks
2. To understand CNN of architectures of deep neural networks
3. To understand the concepts of Artificial Neural Networks
4. To learn the basics of Data science in Deep learning
5. To learn about applications of deep learning in AI and Data Science

Course Outcomes

1	Understand the basic concepts and techniques of Deep Learning.	K2
2	Analyze deep learning algorithms for data science	K4
3	Apply the deep learning architectures	K3
4	Create deep learning algorithms for variety applications	K6

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit I	Basics of Deep Learning	18

Linear Algebra: Scalars -- Vectors -- Matrices and tensors. Probability Distributions -- Gradient-based Optimization.

Unit II	Deep Learning Models	18

Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs – Visualization.

Unit III	Convolutional Neural Networks	17

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions.

Unit IV	Deep Learning Algorithms for AI	17

Artificial Neural Networks – Linear Associative Networks – Perceptron -The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines.

Unit V	Applications of Deep Learning	17

Detection in chest X-ray images -object detection and classification -RGB and depth image fusion - NLP tasks - dimensionality estimation - time series forecasting.

Unit VI	Contemporary Issues	3
	Total Lecture Hours	90 Hours

Text Book(s)
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning'', MIT Press, 2016
2. Stone, James. (2019). Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, Sebtel Press, United States, 2019
3. Vance, William , Data Science: A Comprehensive Beginners Guide to Learn the Realms of Data Science (Hardcover - 2020), Joiningthedotstv Limited

Reference Book(s)
1. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), Deep Learning Applications, Volume 3,Springer Publications 2022
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer International Punlishing, 2018.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Capstone Project Work Phase II	L	T	P	C
Core/elective/Supportive		Skill Based Subject Lab : 3	0	0	6	2
Pre - requisite		• Students should have completed Capstone Project Work Phase – I • Strong coding skills in any one programming paper	Syllabus version		2025-26 Onwards	

Course Objectives

- To understand and select the task based on their core skills.
- To get the knowledge about analytical skill for solving the selected task.
- To get confidence for implementing the task and solving the real time problems.

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Select appropriate input, output, form and table design	K3
2	Design code to meet the input requirements and to achieve the required output	K6
3	Compose a project report incorporating the features of the project	K6

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Aim of the project work

1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied.

2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts.

 3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 75 marks at the last day of the practical session.

2. Out of 75 marks, 45 marks for project report and 30 Marks for Viva Voce.

Project Work Format

<div style="text-align:center">

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done by

STUDENT NAME

REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of

<Name of the Degree>

of Bharathiar University, Coimbatore-46.

College Logo

</div>

Signature of the Guide   Signature of the HOD

Submitted for the Viva-Voce Examination held on _____

Internal Examiner   External Examiner

<div style="text-align:center">

Month – Year

</div>

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1. Introduction

1.1 Organization Profile

1.2 System Specification

      1.2.1 Hardware Configuration

      1.2.2 Software Specification

2. System Study

    2.1 Existing System

    2.1.1 Drawbacks

2.2 Proposed System

      2.2.1 Features

3. System Design and Development

    3.1 File Design

    3.2 Input Design

    3.3 Output Design

    3.4 Database Design

    3.5 System Development

      3.5.1 Description of Modules (Detailed explanation about the project work)

4 Software Testing and Implementation

Conclusion

Bibliography

Appendices

    A. Data Flow Diagram

    B. Table Structure

    C. Sample Coding

    D. Sample Input

    E. Sample Output

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	L	L	L	L	L
CO2	S	S	S	S	S	M	M	L	L	L
CO3	S	S	S	S	S	M	M	L	L	L

*S-Strong; M-Medium; L-Low

Sixth

Semester

Course Code		Robotic Process Automation	L	T	P	C
Core/Elective/Supportive		Core : 10	5	0	0	4
Pre - requisite		None	**Syllabus**		**2025-26 Onwards**	

	Course Objectives
•	To introduce the fundamental concepts and techniques of natural language processing (NLP)

	Expected Course Outcomes	
1	Understand the fundamental concepts and techniques of natural language processing (NLP)	**K2**
2	Understanding of the models and algorithms in the field of NLP.	**K2**
3	Demonstrate the computational properties of natural languages and the commonly used algorithms for processing linguistic information.	**K2**
4	Understanding semantics and pragmatics of languages for processing	**K2**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	Robotic Process Automation (RPA)	18
	Robotic Process Automation (RPA): Fundamentals of RPA – Programming basics from RPA perspective – Applying RPA – RPA development methodology – Architecture of RPA – RPA and emerging ecosystem.	
Unit II	Automation and RPA	18
	Basics of RPA - RPA Benefits - Processes that can be automated – Types of Robots. Automation and RPA Concepts: Business models for implementing RPA – Centre of Excellence - Types and their applications – Building an RPA team - Approach for implementing RPA initiatives.	
Unit III	Understanding the Automation Cycle	18
	Automation stages and the role of a Business Manager - Guidelines for tracking the implementation success – Metrics /Parameters to be considered for gauging success- Choosing the right licensing option.	
Unit IV	UiPath Studio	17
	Introduction - Automation debugging – Automation library – Activities Packages – Basic automation tasks - Text and image automation. Setting up the UiPath environment -– Introduction to UiPath - The User Interface - Keyboard Shortcuts	
Unit V	Data persistence in RPA	16
	Tables in RPA - Data Manipulation in excel - Extracting Data from PDF – Using anchors in PDF.	
Unit VI	Contemporary Issues	3
	Total Lecture Hours	**75 Hours**

Text Book(s)	
	1. Robotic Process Automation using UiPath StudioX: A Citizen Developer's Guide to Hyper automation Paperback June 2021 by Adeel Javed, Anum Sundrani, Nadia Malik, Sidney Madison Prescott.
	2. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath Paperback March 2018 by Alok Mani Tripathi

Reference URL (s)
1. https://www.uipath.com/landing/academic-studio-download
2. https://www.uipath.com/rpa/robotic-process-automation
3. https://www.uipath.com/rpa/academy

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1		
2		

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Programming in UI Path Automation Lab		L	T	P	C
Core/elective/Supportive		Core Lab : 7		0	0	5	2
Pre - requisite		Basics in Flowchart, Algorithm		Syllabus		2025-26 Onwards	

Course Objectives

- To get a knowledge in dissecting the myths from the facts and realize the true benefits of RPA

Course Outcomes

1	Understand business functionalities in Robotics Process Automation	K2
2	Implement RPA functions across the Organizations to boost revenues	K3
3	Demonstrate the basics of robotic process automation using UI Path.	K2
4	Manage RPA solutions to ensure lasting results	K2

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

LIST OF PROGRAMS

1. Robotic Process Automation – Introduction, Working
2. UiPath – Basics, Installation and Understanding User Interface Components
3. Keyboard Shortcuts & Customization.
4. Visual workflow automation straightforward and intuitive
5. UiPath is providing automated workflow design, Which can be used without programming knowledge
6. Recording are important functionality of UiPath studio, enables us to capture user's action on the screen and translate them into sequences.
7. Excel Automation
8. Email Automation

Total Lecture Hours	30 Hours

Text Book(s)

Reference Book(s)

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1		
2		

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	L	L	L	L	L	L	L
CO2	S	M	M	L	L	L	L	L	L	L
CO3	S	S	M	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Project Work Lab		L	T	P	C
Core/Elective/Supportive		Core - 11		0	0	5	4
Pre - requisite		Students should have the strong knowledge in any one of the programming languages in this course.		Syllabus version		2025-26 Onwards	

Course Objectives
- To understand and select the task based on their core skills.   - To get the knowledge about analytical skill for solving the selected task.   - To get confidence for implementing the task and solving the real time problems.   - Express technical and behavioral ideas and thought in oral settings.   - Prepare and conduct oral presentations

Course Outcomes

On the successful completion of the course, student will be able to:

1	Formulate a real world problem and develop its requirements develop a design solution for a set of requirements	K3
2	Test and validate the conformance of the developed prototype against the original requirements of the problem	K5
3	Work as a responsible member and possibly a leader of a team in developing software solutions	K3
4	Express technical ideas, strategies and methodologies in written form. Self-learn new tools, algorithms and techniques that contribute to the software solution of the project	K1-K4
5	Generate alternative solutions, compare them and select the optimum one	K6

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create
Aim of the project work

1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied.

2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts.

3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 100 marks at the last day of the practical session.
1. Out of 100 marks, 25 marks for CIA and 75 for CEE (45 evaluation of project report + 30 Viva Voce).

Project Work Format

<div align="center">

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done by

STUDENT NAME

REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of
<Name of the Degree>
of Bharathiar University, Coimbatore-46.

College Logo

</div>

Signature of the Guide   Signature of the HOD
Submitted for the Viva-Voce Examination held on _____

Internal Examiner   External Examiner
<div align="center">Month – Year</div>

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        2.2.1 Features

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      3.1 File Design

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      3.3 Output Design

      3.4 Database Design

      3.5 System Development

            3.5.1 Description of Modules (Detailed explanation about the project work)

4. Testing and Implementation

5. Conclusion Bibliography Appendices

      A. Data Flow Diagram

      B. Table Structure

      C. Sample Coding

      D. Sample Input

      E. Sample Output

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	L	L	L	L	L
CO2	S	S	S	S	M	L	L	L	L	L
CO3	S	S	S	S	M	M	M	L	L	L
CO4	S	S	S	S	M	M	M	L	L	L
CO5	S	S	S	S	M	M	M	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Ethical Hacking	L	T	P	C
Core/Elective/Supportive		Elective : II	6	0	0	3
Pre - requisite		None	Syllabus version		2025-26 Onwards	
Course Objectives						

Course Objectives

- To introduce the concepts of security and carious kinds of attacks
- To explain about system hacking and penetration testing

	Expected Course Outcomes	
1	Explain the importance of security and various types of attacks	**K2**
2	Understand the concepts of scanning and system hacking	**K2**
3	Explain about penetration testing and its methodology	**K2**
4	Identify the various programming languages used by security professional	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introduction To Hacking**	18

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Footprinting – Information Gathering Methodology – Footprinting Tools –DNS Information Tools-Meta Search Engines.

UNIT II	**Scanning And Enumeration**	18

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction toEnumeration – Enumeration Techniques and Procedure.

UNIT III	**System Hacking**	18

Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing –Password Cracking Tools – Password Cracking Countermeasures - Keyloggers and Spyware.

UNIT IV	**Programming For Security Professionals**	18

HTML–Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities Countermeasures

UNIT V	**Penetration Testing**	18

Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing– Tools – Choosing Different Types of Pen-Test Tools.

Total Lecture Hours	**90 Hours**

	Text Book(s)
1	EC-Council, ―Ethical Hacking and Countermeasures: Attack Phases‖, Cengage Learning,2010.
2	Jon Erickson, ―Hacking, 2nd Edition: The Art of Exploitation‖, No Starch Press Inc., 2008.
3	Michael T. Simpson, Kent Backman, James E. Corley, ―Hands-On Ethical Hacking andNetwork Defense‖, Cengage Learning, 2013.
	Reference Book(s)
1	Patrick Engebretson, ―The Basics of Hacking and Penetration Testing – Ethical Hackingand Penetration Testing Made Easy‖, Second Edition, Elsevier, 2013.
2	RafayBoloch, ―Ethical Hacking and Penetration Testing Guide‖, CRC Press, 2014

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Digital Forensics Science	L	T	P	C
Core/elective/Supportive		Elective : II	6	0	0	3
Pre - requisite		None	**Syllabus version**		**2025-26 Onwards**	

Course Objectives

1. To introduce the principle and concepts of digital forensic
2. To detail about the various investigation procedures like data acquisition and evidence gathering

Course Outcomes

1	Explain the principles of network ,mobile and cyber forensic science	K2
2	Illustrate the cyber-crime investigation procedures	K2
3	Apply the cyber-crime techniques to data acquisition and evidence collection	K3
4	Analyzing the digital evidences and arriving at conclusions	K4
5	Examine the Volatile and Non-volatile Digital Evidence	K4

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	Basics of Digital Forensics	18

Digital Forensics- Introduction, Objective and Methodology, Rules of Digital Forensics, Good Forensic Practices, Principles of Digital Evidence. Overview of types of Computer Forensics – Network Forensics, Mobile Forensics, Social Media Forensics and E-mailForensics. Services offered by Digital Forensics.

Unit II	Cyber Crime Investigation	18

Introduction to Cyber Crime Investigation, Procedure for Search and seizure of digital evidences in cyber-crime incident- Forensics Investigation Process- Acquisition, Duplication & Preservation of evidences, Examination and Analysis of evidences, Storing of Evidences, Documentation and Reporting, Maintaining the Chain of Custody.

Unit III	Data Acquisition and Evidence Gathering	18

Data Acquisition of live system, Shutdown Systems and Remote systems, servers. E-mail Investigations, Password Cracking. Seizing and preserving mobile devices. Data Acquisition and Evidence Gathering from Social Media. Challenges and issues in cyber-crime investigation.

Unit IV	Analysis of Digital Evidences	18

Search and Seizure of Volatile and Non-volatile Digital Evidence, Imaging and Hashing of Digital Evidences, Introduction to Deleted File Recovery, Steganography and Steganalysis, Data Recovery Tools and Procedures, Duplication and Preservation of Digital Evidences, Recover Internet Usage Data, Recover Swap files/Temporary Files/Cache Files. Importance of Log Analysis in forensic analysis.

Unit V	Windows and Linux Forensics	18
Windows Systems Artifacts: File Systems, Registry, Event logs, Shortcut files, Executables. Alternate Data Streams (ADS), Hidden files, Slack Space, Disk Encryption, Windows registry, startup tasks, jump lists, Volume Shadow. Forensic Analysis of the Registry – Use of registry viewers, Reg edit. Extracting USB related artifacts and examination of protected storages.		

Total Lecture Hours	90 Hours

	Text Book(s)
1	Nina Godbole and SunitBelapore; "Cyber Security: Understanding CyberCrimes, Computer Forensics and Legal Perspectives", Wiley Publications,2011.
2	Bill Nelson, Amelia Phillips and Christopher Steuart; "Guide to ComputerForensics and Investigations" – 3rd Edition, Cengage, 2010 BBS.
3	Shon Harris; "All in One CISSP Guide, Exam Guide Sixth Edition",McGraw Hill, 2013.
	Reference Book(s)
1	LNJN National Institute of Criminology and Forensic Science, "A ForensicGuide for Crime Investigators – Standard Operating Procedures", LNJNNICFS, 2016.
2	Peter Hipson; "Mastering Windows XP Registry", Sybex, 2002.
3	Harlan Carvey; "Windows Forensic Analysis Toolkit", Syngress, 2012.
4	Anthony Reyes, Jack Wiles; "The Best Damn Cybercrime and DigitalForensic Book", Syngress, USA, 2007.
5	Cory Altheide and HalanCarvey; "Digital Forensics with Open SourceTools", Syngress Publication.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Natural Language Processing	L	T	P	C
Core/elective/Supportive		Elective : III	6	0	0	3
Pre - requisite		None	Syllabus version		2025-26 Onwards	
Course Objectives						

- To introduce the fundamental concepts and techniques of natural language processing (NLP)

Expected Course Outcomes		
1	Understand the fundamental concepts and techniques of natural language processing (NLP)	**K2**
2	Understanding of the models and algorithms in the field of NLP.	**K2**
3	Demonstrate the computational properties of natural languages and the commonly used algorithms for processing linguistic information.	**K2**
4	Understanding semantics and pragmatics of languages for processing	**K2**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	Introduction to NLP	18
Introduction: application of NLP techniques and key issues- MT grammer checkers- dictation – document generation- NL interfaces- Natural language processing key issues- the different analysis level used for NLP: morpho-lexical-syntactic-semantic-pragmatic-markup(TEI, UNICODE)-finite state automata- Recursive and augmented transition networks- open problems		
UNIT II	Lexical Level	18
Lexical level: error tolerant lexical processing(spelling error correction)-transducers for the design of morphologic analyzers features-towards syntax: part-of-speech tagging(BRILL,HMM)- efficient representations for linguistic resources(lexica, grammars,….) tries and finite state automata.		
UNIT III	Syntactic Level	18
Syntactic level: grammars(eg.formal/Chomsky hierarchy,DCSGs,systematic case, unification, stochastic)- parsing (top-down ,bottom up,char(early algorithm),CYK algorithm)- automated estimation of probabilistic model parameters(inside-outside algorithm)- data oriented parsing- grammar formalisms and treebanks- efficient patsing for context-free grammars(CFGs)-statistcial parsing and probabilistic CFGs(PCFGs)-lexicilizedPCFGse.		
UNIT IV	Semantic Level	18
Semantic level: logical forms- ambiguity resolution- semantic network and parsers- procedural semantics- montague semantics- vector space approaches- distributional semantics-lexical semantics and word sense disambiguation-compositional semantics semantic role labeling and sematic parsing		
UNIT V	Pragmatic LEvel	18
Pragmatic level: knowledge representation- reasoning- plan/goal recognition –speech acts/intentions – belief models- discourse- reference. Natural language generation:content determination – sentence planning- surfacerealization, subjectivity and sentiment analysis.		
Total Lecture Hours		**90 Hours**

	Text Book(s)	
1	Daniel J and James H. Martin,‖speech and language processing‖ an introduction to natural language processing, computational linguistcs& speech recognition‖prentice hall,2009.	
	Reference Book(s)	
1	Lan H Written and Elbef,MarkA.Hall,‖data mining: practical machine learning tools and techiniques‖,Morgan Kaufmann,2013	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L

 *S-Strong; M-Medium; L-Low

Course Code		Internet of Things(IoT)		L	T	P	C
Core/Elective/Supportive		**Elective : III**		**6**	**0**	**0**	**3**
Pre - requisite		**None**		**Syllabus version**		**2025-26 Onwards**	

Course Objectives
• To explain about the definition and usage of Internet of things
• To explain the key components of IoT system

**Expected Course Outcomes**
1	Explain the definition and usage of the term ―Internet of Things‖ in different contexts	**K2**
2	Understand the key components that make up an IoT system	**K2**
3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack	**K3**
4	Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis	**K3**
5	Discover where the IoT concept fits within the broader ICT industry and possible future trends	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	**Introduction to IoT**	**18**
\multicolumn{3}{l}{Introduction – Definition and Characteristics of IoT, Physical Design of IoT; Things in IOT, Logical Design of IoT; IoT Functional Blocks, IoT Communication APIs, IoT Enabling Technologies; WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Systems		
Unit II	**IoT Hardware**	**18**
IoT Hardware, Devices and Platforms – Basics of Arduino Hardware, The Arduino IDE, Basic Arduino Programming, Basics of Raspberry pi; Introduction to Raspberry pi, Programming with Raspberry pi, IoT Platforms, IoT Sensors and actuators		
Unit III	**IoT Protocols**	**18**
IoT Protocols – IoT Data link Protocols, Network Layer Routing Protocols, Network Layer Encapsulation Protocols, Session Layer Protocols, IoT Security Protocols, Service Discovery Protocols, Infrastructure Protocols.		
Unit IV	**IoT Programming**	**18**
IoT Programming – Arduino Programming: Serial Communications – Getting Input from Sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication,		
Unit V	**Domain Specific IoT**	**15**
Domain Specific IoT – Home automation, smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, industry and Health & Life style sensors, Case Studies: A Case Study of Internet of Things Using Wireless Sensor Networks and Smart Phone}		
Unit VI	**Contemporary Issues**	**3**
\multicolumn{2}{c}{**Total Lecture Hours**}	**90 Hours**

	Text Book(s)
1	Vijay Madisetti and ArshdeepBahga, ―Internet of Things (A Hands-on-Approach)‖, 1ˢᵗ Edition, VPT, 2014.
	ReferenceBook(s)
1	Margolis, Michael. ―ArduinoCooKbook: Receipestobegin, Expand and Enhance Your Projects‖. O'Reilly Media Inc.2011.
2	Monk, Simon. Raspberry Pi Cookbook: Software and hardware problems and Solutions. O'Reilly Media,Inc. 2016.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

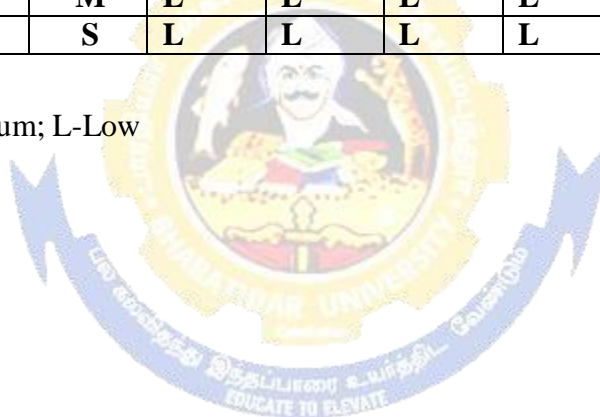|	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

 *S-Strong; M-Medium; L-Low

Course Code		Data Visualization	L	T	P	C
Core/Elective/Supportive		**Elective : III**	**6**	**0**	**0**	**3**
Pre - requisite		None	**Syllabus version**		**2025-26 Onwards**	

Course Objectives			

- To introduce the concept of Data Visualization
- To explain the various techniques in Data Visualization

Expected Course Outcomes		
1	Understand the basics of data visualization	**K2**
2	Understand the importance of data visualization and the design and use of many visual components	**K2**
3	Explain the process of data visualization	**K2**
4	Explain the basics of interactive data visualization techniques visualization-based issues.	**K2**
5	Understand the concept of various types of visulaization	**K2**
K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create		

Unit I	**Introduction**	**18**
Introduction- context of data visualization- definition methodology, visualization design objectives. Key factors-purpose, visualization function and tone, visualization design options- data representation, data presenation,seven stages of data visualization,widgets,data visualization tools.		
Unit II	**Visualizing data methods**	**18**
Visualizing data methods- mapping, time series- connections and correlations-scatter plot maps- trees, hierachies and recursion- networks naadgraphs, info graphics		
Unit III	**Visualizing data process**	**18**
Visualizing data process- acquiring data, where to find data, tools of acquiring data from the internet, locating file for use with processing, loading text data, dealing with files and folders, lisiting files in a folder, asynchronous image downloads, advanced web techniques, using a database, dealing with large number of files.		
Unit IV	**Interactive data visualization**	**18**
Interactive data visualization-drawing with data,scales-axes-updates,transaction and mode-interactivity- layouts-geomapping- exporting frame work-T3 lstabio		
Unit V	**Security data visualization**	**15**
Security data visualization-port scan visualization-vulnerability assessment and exploitation- firewall log visualization- instruction detection log visualization- attacking and defending visualization systems- creating security visualization system		
Unit VI	**Contemporary Issues**	**3**
	Total Lecture Hours	**90 Hours**

Text Book(s)	
1	Scott Murray,"interactive data visualization for the web ",O"Reilly media,inc,2013.

Reference Book(s)	
1	Ben fry,"visualizing data",O"Reilly media,inc,2007
2	Greg conti,"security data visualization:","graphical techniques for network analysis",No starch press inc,2007
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Social Network Analysis		L	T	P	C
Core/Elective/Supportive		**Elective : III**		**6**	**0**	**0**	**3**
Pre - requisite		**None**		**Syllabus version**		**2022-23 Onwards**	

Course Objectives
• To explain the methodologies used in social network analysis

Expected Course Outcomes		
1	Understand a broad range of network concepts and theories.	**K2**
2	Appreciate how network analysis can contribute to increasing knowledge about diverse aspects of society.	**K2**
3	Use a relational approach to answer questions of interest to them (i.e. be able to apply 'network thinking').	**K3**
4	Analyse social network data using various software packages.	**K3**
5	Present results from social network analysis, both orally and in writing.	**K5**
K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create		

Unit I	**Clustering and Classification**	**15**
Supervised Learning – Decision tree - Naïve Bayesian Text Classification - Support Vector Machines - Ensemble of Classifiers – Unsupervised Learning – K-means Clustering – Hierarchical Clustering – Partially Supervised Learning – Markov Models – Probability-Based Clustering – Vector Space Model		

Unit II	**Social Media Mining**	**12**
Data Mining Essentials –Data Mining Algorithms - Web Content Mining –Latent semantic Indexing – Automatic Topic Extraction – Opinion Mining and Sentiment Analysis – Document Sentiment Classification		

Unit III	**Extraction and Mining Communities in Web Social Networks**	**15**
Extracting evolution of Web Community from a Series of Web Archive – Detecting Communities in Social Networks – Definition of Community – Evaluating Communities – Methods for Community Detection & Mining – Applications of Community Mining Algorithms – Tools for Detecting Communities – Social Network Infrastructure and Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities		

Unit IV	**Human behavior analysis and privacy issues**	**15**
Understanding and Predicting Human Behavior for Social Communities – Use Data Management, Inference and Distribution – Enabling New Human Experiences – Reality Mining – Context Awareness – Privacy in Online Social Networks – Trust in Online Environment – Trust Models Based on Subjective Logic – Trust Network Analysis – Trust Transitivity Analysis – Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons – Attack Spectrum and Countermeasures.		

Unit V	**Visualization And Applications Of Social Networks**	**15**
Visualizing Online Social Networks – Visualizing Social Networks with Matrix-Based Representations – Node- Link Diagrams – Hybrid Representations – Applications – Covert Networks – Community Welfare – Collaboration Networks – Co-Citation Networks.		

Unit VI	Contemporary Issues	3
	Total Lecture Hours	**90 Hours**

	Text Book(s)	
1	Peter Mika, ―Social networks and the Semantic Web‖, Springer, 2007.	
2	BorkoFurht, ―Handbook of Social Network Technologies and Applications‖, Springer, 2010.	

	Reference Book(s)	
1	Bing Liu, ―Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (DataCentric Systems and Applications)‖, Springer; Second Edition, 2011.	
2	Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, ‖Social Media Mining‖, Cambridge University Press, 2014.	
3	GuandongXu, Yanchun Zhang and Lin Li, ―Web Mining and Social Networking Techniques and applications‖, Springer, 2011	
4	Dion Goh and Schubert Foo, ―Social information retrieval systems: emerging technologies and Applications for searching the Web effectively‖, Idea Group, 2007.	

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Machine Learning		L	T	P	C
Core/elective/Supportive		**Skill Based Subject : 3**		**3**	**0**	**0**	**2**
Pre - requisite		**None**		**Syllabus version**		**2025-26 Onwards**	

Course Objectives

1. To understand the basics of Machine Learning (ML)
2. To understand the methods of Machine Learning
3. To know about the implementation aspects of machine learning
4. To understand the concepts of Data Analytics and Machine Learning
5. To understand and implement use cases of ML

Course Outcomes

1	Understand the basics of ML	**K2**
2	Demonstrate various ML techniques using standard packages	**K3**
3	Explore knowledge on Machine learning and Data Analytics	**K6**
4	Apply ML to various real time applications	**K4**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit I	**Machine Learning Basics**	**9**

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

Unit II	**Machine Learning Methods**	**9**

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization.

Unit III	**Machine Learning in Practice**	**9**

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries.

Unit IV	**Machine Learning and Data Analytics**	**9**

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

Unit V	**Applications of Machine Learning**	**7**

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

Unit VI	**Contemporary Issues**	**3**

	Total Lecture Hours	**45 Hours**

Text Book(s)
1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
2. John D. Kelleher, Brain Mac Namee, Aoife D' Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press,2015

Reference Book(s)
1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low