B.Sc. Artificial Intelligence andMachine Learning

SYLLABUS

AFFILIATED COLLEGES

Program Code :

2026 – 2027 and 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

BHARATHIAR UNIVERSITY::COIMBATORE 641046

B. Sc. Artificial Intelligence and Machine Learning (CBCS PATTERN)

(*For the students admitted during the academic year **2026 – 2027** and onwards*)

Scheme of Examination

Part	Title of the Course	Hours/ Week	Examination				Credits
			Duration In Hours	Maximum Marks			
				CIA	CEE	Total	
	Semester I						
I	Language-I	6	3	25	75	100	4
II	English-I	4	3	25	75	100	4
III	Core 1: Object Oriented Programming in C++	5	3	25	75	100	4
III	Core 2: Data Structures	5	3	25	75	100	4
III	Core Lab1: Programming Lab – C++	4	3	20	30	50	2
III	Allied 1: Discrete Mathematics	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
	Naan Mudhalvan –Skill Course Effective English	2		25	25	50	2
III	Core 3 : Java Programming	5	3	25	75	100	4
III	Core Lab 2: Programming Lab–Java	4	3	20	30	50	2
III	Core Lab3: Internet Basics Lab	3	3	20	30	50	2
III	Allied 2: Applied Mathematics	4	3	25	75	100	4
IV	Value Education–Human Rights*	2	3	-	50	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 : Programming in Python	3	3	25	75	100	4
III	Core 5 : Fuzzy logic and Neural Networks	3	3	25	75	100	4
III	**Core Lab 4 : Python Programming & SQL Lab**	3	3	20	30	50	2
III	**Allied 3 : Database Management System with SQL**	4	3	25	75	100	4
III	Skill Based Subject 1: Internet of Things	3	3	30	45	75	2
IV	Naan Mudhalvan Course	2		25	25	50	2
IV	Health and Wellness**	1		100@	-	100	1
IV	Tamil**/Advanced Tamil*(OR) Non-major elective-I (Yoga for Human Excellence)*/ Women's Rights*	1	3	-	50	50	1
	Total	**30**		**300**	**525**	**825**	**28**
	Semester IV						

I	Language–IV	6	3	25	75	100	4
II	English – IV	4	3	25	75	100	4
III	Core 6 : Artificial Intelligence & Knowledge Representation	3	3	25	75	100	4
III	Core 7: R Programming	3	3	25	75	100	4
III	Core Lab5: R Programming Lab	3	3	20	30	50	2
III	Allied 4 : Machine Learning–Basics	4	3	25	75	50	4
III	Skill based Subject 2 Lab: Capstone Project Work (Based on AI & Machine Learning)	3	3	20	30	50	2
IV	Naan Mudhalvan - Skill Course	2		25	25	50	2
IV	Tamil**/Advanced Tamil* (OR) Non-Major Elective-II (General Awareness*)	2	3	-	50	50	2
V	**Disaster Management**	1	-	50	-	50	1
III	Internship Training (During the vacation of Fourth Semester)	-	-	-	-	-	-
	Total	**30**		**240**	**510**	**750**	**28**
	Semester V						
III	Core 8 : Machine Learning Techniques	6	3	25	75	100	4
III	Core 9 : Deep Learning	6	3	25	75	100	4
III	Core Lab6 : Machine Learning Lab	6	3	20	30	50	2
III	Elective- I Business Data Analytics/Social Network Analysis / Software Agents	6	3	25	75	100	3
IV	**Skill Based Subject 3 Capstone Project Work Phase II (Based on AI & Machine Learning)**	4	3	20	30	50	2
IV	Naan Mudhalvan - Skill course	2		25	25	50	2
III	Internship Training - Viva Voce Examination		3	30	45	75	3
	Total	**30**		**170**	**355**	**525**	**20**
	Semester VI						
III	Core 10 : Natural Language Processing	5	3	25	75	100	4
III	Core Paper 11 : Project Work Lab%%	5	-	25	75	100	4
III	Core Practical –7 : Natural Language Processing Lab	5	3	20	30	50	2
III	Elective–II: Artificial Neural Networks and Fuzzy Systems/Web Application Security/Fundamentals of Robotics	5	3	25	75	100	3
III	Elective–III : Embedded Systems / Principles of Secure Coding / Open Source Software	5	3	25	75	100	3
III	**Skill Based Subject 4:EthicalHacking**	3	3	30	45	75	2
	Naan Mudhalvan- Skill Course	2		25	25	50	2
V	Extension Activities**		-	50	-	50	2
	Total	**30**		**225**	**400**	**575**	**22**
	Grand Total	**180**		**1245**	**2630**	**3875**	**144**

- ***No Continuous Internal Assessment (CIA), University Examinations Only.
- ****No University Examinations, Continuous Internal Assessment (CIA) Only.

[@]Split for CIA Marks 100

PART	DESCRIPTION	MARKS
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
	TOTAL	100

First Semester

Course Code		Object Oriented Programming inC++	L	T	P	C
Core/elective/Supportive		Core : 1	5	0	0	4
Pre-requisite		• Basic knowledge of Procedure Oriented Programming concepts • Basic knowledge in C Programming	Syllabus version		2023-26 Batch	

Course Objectives

To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of C++

Expected Course Outcomes

1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects	K1
2	Demonstrate the various basic programming constructs like decision making statements. Looping statements and functions	K2
3	Explain the object oriented concepts like overloading, inheritance, polymorphism, virtual functions, constructors and destructors	K3
4	Explain the various file stream classes; file types,usage of templates and exception handling mechanisms.	K3
5	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	K5
6	Develop programs incorporating the programming constructs of object oriented programming concepts	K5

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

UNIT–I	INTRODUCTION	12 Hours

Introduction to C++- key concepts of Object-Oriented Programming–Advantages– Object Oriented Languages–I/O in C++- C++ Declarations. Control Structures:-Decision Making and Statements: If

...else,jump, goto,break,continue,Switchcase statements-Loops in C++:for,while,do-functionsinC++-inline functions–Function Overloading.

UNIT II	CLASSES AND OBJECTS	12 Hours

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-III	OPERATOR OVERLOADING	12 Hours
Operator Overloading: Overloading unary, binary operators–Overloading Friend functions–type conversion–Inheritance: Types of Inheritance–Single,Multilevel,Multiple,Hierarchal,Hybrid,Multipath inheritance–Virtual base Classes–Abstract Classes.		
UNIT-IV	**POINTERS**	**12 Hours**
Pointers–Declaration–Pointer to Class, Object–this pointer–Pointers to derived classes and Base classes–Arrays–Characteristics–array of classes–Memory models–new and delete operators– Dynamic object–Binding, Polymorphism and Virtual Functions.		
UNIT-V	**FILE STREAM CLASSES**	**12 Hours**
Files–File stream classes–file modes–Sequential Read/Write operations–Binary and ASCII Files –Random Access Operation–Templates–Exception Handling-String–Declaring and Initializing string objects–String Attributes–Miscellaneous functions.		
Total Lecture Hours		**60 Hours**

Text Book(s)

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

REFERENCE BOOKS:

1	E.Balagurusamy,Object-Oriented Programming with C++,TMH,1998
2	Maria Litvin & Gray Litvin, C++for you,Vikas publication,2002.
3	John R Hubbard,Programming with C,2nd Edition,TMH publication,2002.
4	
	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**
CO6	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

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

Course Code		Programming in Lab C++	L	T	P	C
Core/elective/Supportive		Core Lab : 1	-	-	4	4
Pre-requisite		• Basic knowledge of Procedure Oriented Programming concepts • Basic knowledge in C Programming	Syllabus version		2023-26 Batch	

Course Objectives

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

Expected 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	K3
2	Illustrate the concept of Virtual Classes, inline functions and friend functions	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

PROGRAM-1		**3**

Write a C++ Program to create a class to implement the data structure STACK. Write a constructor to initialize the TOP of the STACK. Write a member function PUSH () to insert an element and member function POP () to delete an element check for overflow and underflow conditions.

PROGRAM-2		**3**

Write a C++ Program to create a class ARITHMETIC which consists of a FLOAT and an INTEGER variable. Write member functions ADD (), SUB (), MUL (), DIV () to perform addition, subtraction, multiplication, division respectively. Write a member function to get and display values.

PROGRAM-3		**3**

Write a C++ Program to read an integer number and find the sum of all the digits until it reduces to a single digit using constructors, destructors and inline member functions.

PROGRAM-4		**3**

Write a C++ Program to create a class FLOAT that contains one float data member. Overload all the four Arithmetic operators so that they operate on the object FLOAT.

PROGRAM-5		**3**

Write a C++ Program to create a class STRING. Write a Member Function to initialize, get and display stings. Overload the operators ++ and == to concatenate two Strings and to compare two strings respectively.		
PROGRAM-6		**4**
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. Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending on the grade.		
PROGRAM-7		**5**
Write a C++ Program to create a class SHAPE which consists of two VIRTUAL FUNCTIONS Calculate_Area () and Calculate_Perimeter () to calculate area and perimeter of various figures. Derive Three classes SQUARE,RECTANGLE,TRIANGE from class Shape and Calculate Area and Perimeter of each class separately and display the result.		
PROGRAM-8		**3**
Write a C++ Program to create two classes each class consists of two private variables, a integer and afloat variable. Write member functions to get and display them. Write a FRIEND Function common to both classes, which takes the object of above two classes as arguments and the integer and float values Of both objects separately and display the result.		
PROGRAM-9		**3**
Write a C++ Program using Function Overloading to read two Matrices of different Data Types such as integers and floating point numbers. Find out the sum of the above two matrices separately and display the sum Of these arrays individually.		
PROGRAM-10		**5**
Write a C++ Program to check whether the given string is a palindrome or not using Pointers.		
PROGRAM-11		**5**
Write a C++ Program to create a File and to display the contents of that file with line numbers.		
PROGRAM-12		**5**
Write a C++ Program to merge two files into a single file.		
	Total Hours	**45 Hours**

Text Book(s)

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

Reference Book(s)

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

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	T	P	C
Core/elective/Supportive		Core : 2	5	0	-	4
Pre-requisite		• Basic knowledge of Programming Constructs	Syllabus version		2023-26 Batch	

Course Objectives

- To introduce the concept of data structures and the types of data structures
- To demonstrate how various data structures can be implemented and used in various applications

Expected Course Outcomes

1	Define the concept of Data structure and list the various classifications of data structures.	K1
2	Demonstrate how arrays,stacks,queues,linked lists,trees,heaps,Graphs and Hash Tables are represented in the main memory and various operations are performed on Those data structures.	K2
3	Illustrate the various file organizations like Sequential, Random and Linked organizations.	K2
4	Discover the real time applications of the various data structures	K3
5	Design algorithms for various sorting and searching techniques	K4

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

UNIT I	INTRODUCTION	12 Hours

Introduction: Introduction of Algorithms, Analyzing Algorithms. Arrays: Sparse Matrices-Representation of Arrays. Stacks and Queues. Fundamentals-Evaluation of Expression Infix to Postfix Conversion –Multiple Stacks and Queues

UNIT II	LINKED LIST	12HourS

Linked List: Singly Linked List - Linked Stacks and Queues - Polynomial Addition - More on

Linked Lists –Sparse Matrices- Doubly Linked List and Dynamic-Storage Management-Garbage Collection and Compaction.

UNIT III	NON LINEAR DATA STRUCTURES	12 Hours

Trees: Basic Terminology-Binary Trees-Binary Tree Representations-Binary Trees-Traversal-More on Binary Trees-Threaded Binary Trees-Binary Tree Representation of Trees- Counting Binary Trees.

Graphs: Terminology and Representations-Traversals, Connected Components and Spanning Trees, Shortest Paths and Transitive Closure

UNIT IV	EXTERNAL – SORTING	12 Hours
External Sorting: Storage Devices -Sorting with Disks: K-Way Merging - Sorting with Tapes Symbol Tables: Static Tree Tables – Dynamic Tree Tables- Hash Tables: Hashing Functions-Overflow Handling.		
UNIT V	**INTERNAL - SORTING**	**12 Hours**
Internal Sorting: Insertion Sort- Quick Sort-2Way Merge Sort-Heap Sort-Shell Sort-Sorting on Several Keys. Files: Files, Queries and Sequential organizations-Index Techniques-File Organizations.		
	Total Lecture Hours	**60 Hours**

Text Book(s)

1	Ellis Horowitz,Sartaj Shani,Data Structures,Galgotia Publication.	

Reference Book(s)

1	Ellis Horowitz, Sartaj Shani,Sanguthevar Rajasekaran,Computer Algorithms, Galgotia 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**	**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		Discrete Mathematics	L	T	P	C
Core/elective/Supportive		Allied : 1	4	-	-	4
Pre-requisite		Basic knowledge in Mathematics	Syllabus version		2025-26 Batch	

Course Objectives

- Introduce students to the techniques, algorithms, and reasoning processes involved in the study of discrete mathematical structures.
- Introduce students to set theory, inductive reasoning, elementary and advanced counting techniques, equivalence relations, recurrence relations, graphs, and trees.
- Introduce students to prove mathematical statements by means of inductive reasoning

Expected CourseOutcomes

1	Understand discrete mathematical preliminaries and apply discrete mathematics inform a representation of various computing constructs	K1
2	Demonstrate an understanding of relations, functions, Combinatorics and lattices	K2
3	Apply the techniques of discrete structures and logical reasoning to solve a variety of problems and write an argument using logical notation	K3
4	Analyze and construct mathematical arguments that relate to the study of discrete structures	K3
5	Develop and model problems with the concepts and techniques of discrete mathematics.	K5

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

UNIT I	MATHEMATICAL LOGIC	15

Proposition–Logical Operators–Truth Tables–Laws of Logic–Equivalences–Rules of interface–validity Arguments–Consistency of Specifications–Propositional Calculus– Quantifiers and universe of discourse

UNIT II	PROOF TECHNIQUES	19

Introduction–Methods of proving theorems–Direct Proofs, Proof by Contraposition, Vacuous and trivial proofs, Proofs by contradiction–Mistakes in Proofs–Mathematical induction–Strong Mathematical induction–Strong mathematical induction and well ordering–Program Correctness.

UNIT III	COMBINATORICS	14

Basics of Counting–The Pigeon hole principle–Permutations and Combinations with and without repetition, Permutations with indistinguishable elements– distributions of objects–Generating Permutations and combinations in lexicographic order.

UNIT IV	RECURRENCE RELATIONS	14

Some Recurrence Relation Models–Solution of linear homogeneous recurrence relations with constant coefficients–solution of linear non- homogeneous recurrence relations by the method of Characteristic roots–Divide and conquer recurrence relations.

UNIT V	LATTICES	13

Lattices as partially ordered set–Properties of Lattices–Lattices as algebraic system–Sub lattices– Direct Product and Homomorphism–Some special lattices		
	Total LectureHours	**75**
Text Book(s)		
1	Kenneth H. Rosen,-Discrete Mathematics and its applications‖,McGrawHill,2011.	
2	Judith L. Gersting,-Mathematical Structures for Computer Science‖, W.H>Free man and Company,2014.	
3	TremblayJ.P.andManoharR.,-Discrete and Combinatorial Mathamatics–An Introduction‖, AddisonWesley,2009	
Reference Book(s)		
1	DoerrAlanandLevasseurK.,-Applied Discrete Structures for Computer Science‖,Galgotia Publications,2002.	
2	BenardKolman,RobertC.BusbyandSharanRoss,—Discrete Mathematical Structures‖, Pearson Education,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	**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		Java Programming	L	T	P	C
Core/elective/Supportive		Core : 3	5	0	-	4
Pre-requisite		• Basic knowledge ofProgramming Constructs. • Knowledge on Object Oriented Programming Concepts.	Syllabus version		2023-26 Batch	

Course Objectives

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

Expected 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	Fundamentals of OOP	16

Fundamentals of Object-Oriented Programming: Object-Oriented Paradigm – Basic Concepts of Object-Oriented Programming– Benefits of Object-Oriented Programming–Application of Object-Oriented Programming. Java Evolution: History–Features–How Java differs from C and C++ – Java and Internet–Java and www–Web Browsers. Overview of Java: simple Java program–Structure– Java Tokens–Statements–Java Virtual Machine.

UNIT II	Variables & Control Structures	15

Constants, Variables, Data Types-Operators and Expressions–Decision Making and Branching: if, if...else, nested if, switch?: Operator- Decision Making and Looping: while, do, for–Jumps in Loops -Labeled Loops–Classes, Objects and Methods.

UNIT III	Arrays & Classes	14

Arrays, Strings and Vectors–Interfaces: Multiple Inheritance–Packages: Putting Classes together–Multithreaded Programming.

UNIT IV	Error Handling & Graphics	13

Managing Errors and Exceptions–Applet Programming–Graphics Programming.

UNIT V	I/O Streams	17
Managing Input/Output Files in Java: Concepts of Streams-Stream Classes–Byte Stream classes– Character stream classes–Using streams–I/O Classes–File Class–I/O exceptions–Creation of Files –Reading/Writing characters, Byte-Handling Primitive Data Types–Random Access Files.		
	Total Lecture Hours	**75**
Text Book(s)		
1	Programming with Java–A Primer-E.Balagurusamy,3rd Edition,TMH.	
Reference Book(s)		
1	The Complete Reference Java 2-PatrickNaughton&HebertSchildt,3rdEdition,TMH	
2	Programming with Java–JohnR.Hubbard,2ndEdition,TMH.	
	Related Online Contents(MOOC,SWAYAM,NPTEL,Websitesetc)	
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		Programming Lab - JAVA	L	T	P	C
Core/elective/Supportive		Core Lab : 2	-	-	4	2
Pre-requisite		• Basic knowledge of Programming Constructs • Knowledge on Object Oriented Programming Concepts	Syllabus version		2023-26 Batch	

Course Objectives

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

Expected 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	**3**
Write a Java Applications to extract a portion of a character string and print the extracted string.	
PROGRAM 2	**3**
Write a Java Program to implement the concept of multiple inheritance using Interfaces.	
PROGRAM 3	**3**
Write a Java Program to create an Exception called payout-of-bounds and throw the exception	
PROGRAM 4	**3**
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	**6**
Write a Java Program to draw several shapes in the created windows	
PROGRAM 6	**6**

Write a Java Program to create a frame with four text fields name, street, city and pin code with suitable tables. Also add a button called my details. When the button is click edits corresponding Values are to be appeared in the text fields.	
PROGRAM 7	**6**
Write a Java Program to demonstrate the Multiple Selection List-box.	
PROGRAM 8	**6**
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 9	**6**
Write a Java Program to create Menu Bars and pull down menus.	
PROGRAM 10	**6**
Write a Java Program to create frames which respond to the mouse clicks. For each events with mouse such as mouse up, mouse down, etc., the corresponding message to be displayed.	
PROGRAM 11	**6**
Write a Java Program to draw circle, square, ellipse and rectangle at the mouse click positions.	
PROGRAM 12	**6**
Write a Java Program which open an existing file and append text to that file.	
Total Lecture Hours	**60**

Text Book(s)

1	Programming with Java–A Primer-E.Balagurusamy,3rd Edition, TMH.

Reference Book(s)

1	The Complete Reference Java 2-PatrickNaughton&HebertSchildt,3rdEdition,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

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

Course Code		Internet Basics Laboratory	L	T	P	C
Core/elective/Supportive		Core Lab : 3	-	0	3	2
Pre-requisite		• Basic knowledge in Computers	Syllabus		2023-26 Batch	

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	**2**
Create an email account in Gmail. Using the account created compose a mail to invite other college students for your college fest, enclose the invitation as attachment and send the mail to at least 50 recipients. Use CC and BCC options accordingly	
PROGRAM-2	**2**
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-3	**2**
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-4	**2**
Create a meeting using Google calendar and share meeting id to the attendees. Transfer the ownership to the Manager once the meeting id is generated.	
PROGRAM-5	**2**
Create a label and upload bulk contacts using import option in Google Contacts	
PROGRAM-6	**2**
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-7	**2**

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-8	**2**
Create one-page story in your mother tongue by using voice recognition facility of Google Docs	
PROGRAM-9	**2**
Create a registration form for your Department Seminar or Conference using Google Forms.	
PROGRAM-10	**2**
Create a question paper with multiple choice types of questions for a subject of your choice, using Google Forms.	
PROGRAM-11	**2**
Create a meet using Google Calendar and record the meet using Google Meet. Create a Google slides for a topic and share the same with your friends.	
PROGRAM-12	**4**
Create template for a seminar certificate using Google Slides.	
PROGRAM-13	
Create a sheet to illustrate simple mathematical calculations using Google Sheets. Create student‘s internal mark statement and share the Google sheets via link.	**4**
Total Lecture Hours	**30**

Text Book(s)

1	IanLamont,GoogleDrive&Docsin30Minutes,2nd Edition.

Reference Book(s)

1	SherryKinkophGunter,MyGoogleApps,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**

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

Course Code		Applied Mathematics	L	T	P	C
Core/elective/Supportive		Allied : 2	4	0	0	4
Pre-requisite		Basic Knowledge in Mathematics	Syllabus version	2025-26 Batch		

Course Objectives

To introduce the concepts of Numbers, Quantification, sets, logical reasoning, probability and calculus

Expected Course Outcomes

1	Demonstrate the concepts of Numbers, Quantification, sets, logical reasoning, probability and calculus	**K2**
2	Apply the learned concepts to solve various mathematical problems related to the domain	**K3**
3	Apply various laws related to logarithms and sets to solve various mathematical problems	**K4**
4	Solve problems related to permutation, combinations, mathematical and logical reasoning and calculus.	**K5**

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

UNIT I	Numbers and Numerical Applications	15

Numbers, Quantification and Numerical Applications-Prime Numbers, Encryptions using Prime Numbers-Binary Numbers-Complex Numbers (Preliminary idea only)-Indices, Logarithm and Antilogarithm-Laws and properties of logarithms-Simple applications of logarithm and antilogarithm

UNIT II	Algebra	16

Algebra - Sets- Types of sets-Venn diagram-De Morgan's laws-Problem solving using Venn diagram 4-Relations and types of relations-Introduction of Sequences, Series-Arithmetic and Geometric progression-Relationship between AM and GM

UNIT III	Relations	16

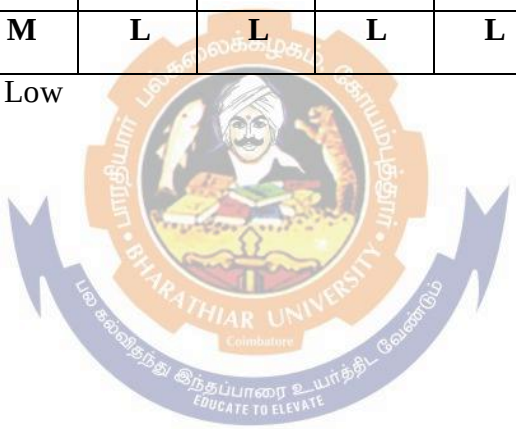
Definition and properties of binary relations – Representing Relations – Closures of Relations – Composition of Relations – Equivalence Relations – Partitions and Covering of sets – Partial Orderings–n-array Relations and their applications.

UNIT IV	Functions	14

Calculus - Introducing functions - Domain and Range of a function-Types of functions (Polynomial function; Rational function; Composite function; Logarithm function; Exponential function ; Modulus function; Greatest Integer function, Sig num function – Graphical representation of functions-Concept of limits and continuity of a function-Instantaneous rates of change-Differentiation as a process of finding derivative – Derivatives of algebraic functions using Chain rule –Tangent line and equations of tangents.		
UNIT V	**Probability**	**14**
Probability - Random experiment, sample space, events, mutually exclusive events - Independent and Dependent Events - Law of Total Probability - Bayes'Theorem.		
	Total Lecture Hours	**75**
Text Book(s)		
1	Applied Mathematics–DanSimpson,BurningEyebooks	
Reference Book(s)		
2	Applied Mathematics-Dr.HariArora,PublishingDateIs2019.PublisherIsS.k.Kataria&Sons	
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		Python Programming	L	T	P	C
Core/elective/Supportive		Core : 4	4	0	0	4
Pre-requisite		• Knowledge in Basics of ObjectOriented Programming	Syllabus		2023-26 Batch	

Course Objectives

To introduce the concepts of the various programming constructs of Python programming

Expected Course Outcomes

1	Apply the various basic programming constructs like operators, expressions, decision making statements and Looping statements	K2
2	Summarize the concept of lists, tuples, functions and error handling	K2
3	Apply the concept of Decision making statements, looping constructs, functions for solving basic programs	K3
4	Analyze the concepts of Lists, tuples and error handling mechanisms	K4
5	Evaluate a program incorporating all the python language constructs	K5

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

UNIT I	BASICS	10

Python-Variables-Executing Python from the Command Line-Editing Python Files-Python Reserved Words- Basic Syntax-Comments-Standard Data Types–Relational Operators-Logical

Operators-Bit Wise Operators-Simple Input and Output.

UNIT II	CONTROL STATEMENTS, LISTS, TUPLES	10

CONTROL STATEMENTS: Control Flow and Syntax-Indenting-if Statement-statements and expressions-string operations-Boolean Expressions-while Loop-break and continue-for Loop.

LISTS: List-list slices- list methods-list loop–mutability–aliasing-cloning lists-list parameters**.**
TUPLES: Tuple assignment, tuple as return value-Sets–Dictionaries.

UNIT III	FUNCTIONS:	10

Definition-Passing parameters to a Function-Built-in functions-Variable Number of Arguments-Scope–Type conversion-Type coercion-Passing Functions to a Function–Mapping Functions in a Dictionary–Lambda-Modules-Standard Modules–sys–math–time-dir–help Function.

UNIT IV	ERROR HANDLING:	10

Run Time Errors-Exception Model-Exception Hierarchy-Handling Multiple Exceptions-Data Streams-Access Modes Writing-Data to a File Reading-Data From a File-Additional File Methods-Using Pipes as Data Streams-Handling IO Exceptions-Working with Directories.		
UNIT V	**OBJECT ORIENTED FEATURES**:	**10**
Classes Principles of Object Orientation - Creating Classes -Instance Methods - File Organization – Special Methods – Class Variables – Inheritance – Polymorphism – Type Identification –Simple Character Matches - Special Characters – Character Classes – Quantifiers - Dot Character –Greedy Matches – Grouping – Matching at Beginning or End-Match Objects–Substituting-Splitting a String-Compiling Regular Expressions.		
Total Lecture Hours		**50**
Text Book(s)		
1	Mark Summerfield.—Programming in Python 3: A Complete introduction to the Python Language, Addison-WesleyProfessional,2009.	
2	MartinC.Brown,—PYTHON: The Complete Reference‖,McGraw-Hill,2001	
Reference Book(s)		
1	AllenB.Downey,``ThinkPython:HowtoThinkLikeaComputerScientist__,2ndedition, UpdatedforPython3,Shroff/O_ReillyPublishers,2016	
2	GuidovanRossumandFredL.DrakeJr,—AnIntroductiontoPython–Revisedandupdated forPython3.2,NetworkTheoryLtd.,2011.	
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	Python Programming & SQL Lab		L	T	P	C
Core/Elective/ Supportive	Core Lab 4		-	-	4	2
Pre-requisite	Exposure to basic syntax of any programming language	Syllabus Version	2026 – 27 onwards			

Course Objectives:

The main objectives of this course are to:

1. **Apply the basic Python programming constructs and data structures.**
2. **Apply file concepts, create modules and packages**
3. **Analyze data using Python**

Expected Course Outcomes:

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

1.	Solve problems using various control statements, functions and strings in Python	K3
2.	Make use of Python lists, set, tuples, dictionaries to represent compound	K4
3.	Describe the fundamental elements of relational database Management systems	K1,K2
4.	Design relational schema using database design principles	K2,K3
5.	Explain the concepts of transaction processing, basic database Storage structures and access techniques	K2, K3,K4

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

PYTHON PROGRAMMING LAB

EXERCISE 1	**Introduction to Python**	**6**

Programs using expressions and input and output statements. Programs using operators, builtin functions and conditional statements

EXERCISE 2	**Functions**	**6**

Programs using Functions - Programs to find square root, GCD, sum an array of numbers

EXERCISE 3	**Data Structures : Strings and Lists**	**6**

Programs performing all string operations – perform operations on lists-Sorting of elements (Selection and insertion sort)

EXERCISE 4	**Data Structures : Tuples, Dictionaries, Sets**	**6**

Programs using dictionaries and sets–Tuples

EXERCISE 5	**Files, Modules, Packages and Data Analysis**	**6**

SQL LAB

LIST OF EXPERIMENTS **15**

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Creating relational database to set various constraints.
3. PerformingInsertion,Deletion,Modifying,Altering,UpdatingandViewingrecords based on conditions.
4. Working on TCL, DCL commands
5. Creating relationship between the databases.

Total Marks : 30

Text Book(s)

1.TimothyA.Budd, Exploring Python, Mc-GrawHill Education(India) Private Ltd., 2015

2.Ashok Namdev Kamthane, Amit Ashok Kamthane, Programming and Problem Solving with Python , Mc-Graw Hill Education, 2018

Related Online Contents [MOOC, SWAYAM, NPTEL, Web sites etc.]

1.Infosys Foundation Program : Module2

2.https://onlinecourses.nptel.ac.in/noc17_cs33/course

3.http://www.db-book.com

4. http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design

6.http://www.iitg.ernet.in/awekar/teaching/cs344fall11/

7.www.w3schools.com/sql/

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

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

Course Code	Database Management System with SQL	L	T	P	C
Core/Elective/ Supportive	Allied : 3	4	-	-	4
Pre-requisite	Basic Computer Fundamentals	Syllabus Version	2026 – 27 onwards		

Course Objectives:

The main objectives of this course are to:

1. **Understand the significance and fundamentals of database management systems.**
2. **Understand the Database design and query optimization techniques.**
3. **Understand the database security concepts**

Expected Course Outcomes:

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

1.	Describe the fundamental elements of relational database management systems	K1,K2
2.	Design relational schema using database design principles	K2,K3
3.	Explain the concepts of transaction processing, basic database Storage structures and access techniques	K2, K3,K4
4.	Apply indexing techniques to access and generate user reports for a database.	K2,K3
5.	Building Web Applications using Python & SQL.	K4,K5

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

UNIT:1	**INTRODUCTION TO DATABASE ANDRELATIONAL MODEL**	**10Hours**
	Introduction: Database applications, Purpose of database systems, Views of data, Database Development Life cycle, Architecture of DBMS. Overview of query processing. Relational Databases: Relational model, Database schema, Keys, Formal Relational Query Languages	
UNIT:2	**DATABASE DESIGN**	**10 Hours**
	Logical Database Design: Different approaches in Logical design, ER Modeling, ER notations, Steps in ER modeling. Physical database design: Converting ER Model to Relational Database Design, Normalization -Functional Dependency, 1NF,2NF,3NF (optional:multi-valued dependency and 4th Normal form).	
UNIT:3	**QUERYOPTIMIZATION,TRANSACTIONPROCESSING AND CONCURRENCY CONTROL**	**9 Hours**
	I SQL Standards – Data types – Database Objects- DDL-DML-DCL-TCL- Embedded SQL- Static Vs Dynamic SQL. Query Processing and Optimization – Heuristics and Cost Estimates in Query Optimization. Transactions : Concept and purpose, ACID properties and their necessity. Concurrency Control: lock-based protocols, 2-phase locking, Timestamp based protocols. Deadlock handling	
UNIT:4	**STORAGEANDINDEXING**	**9 Hours**
	Storage and File structure : File Organization, RAID. Indexing: Concepts, Clustered and Non-Clustered Indices, B-tree and B+-tree. Basics of Hashing (Static, Dynamic).	

UNIT:5	**DATABASESECURITY**	**10 Hours**
	Data Classification - Threats and risks – Database access Control – Types of Privileges – Statistical Databases. - Distributed Databases – Architecture - Transaction Processing. Data Warehousing and Mining- Classification – Association rules - Clustering- Information Retrieval	
	Total Lecture hours	**48 Hours**

Text Book(s)	
1.	Abraham Silberschatz, Henry Korth, and S.Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill.2011
2.	R.Elmasri and S.Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011
3.	Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 3nd Edition, McGraw Hill, 2003
Reference Books	
1.	Thomas M.Connolly and Carolyn E.Begg, "Database Systems- A Practical Approach To Design, Implementation and Management", Fifth edition, Pearson Education, 2010.
2.	C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1.	https://onlinecourses.nptel.ac.in/noc17_cs33/course
2.	http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design

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

Course Code		Fuzzy Logic and NeuralNetworks	L	T	P	C
Core/elective/Supportive		Core : 5	4	0	0	4
Pre-requisite		• Knowledge in Basics of Object Oriented Programming	Syllabus		2023-26 Batch	

Course Objectives

- To introduce the concepts of neural networks and fuzzy systems
- To explain the basic mathematical elements of the theory of fuzzy sets.

1	Explain the basic concepts of fuzzy sets and fuzzy logic	K2
2	Understanding of the basic mathematical elements of the theory of fuzzy sets.	K2
3	Explain the fundamentals and history of neural networks	K2
4	Outline about the mapping and recurrent networks	K2
5	Analyze the applications of fuzzy logic and neural network for various applications	K3

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

UNIT I	Fuzzy Set Theory and Fuzzy Logic Control	18

Basic concepts of fuzzy sets-Operations on fuzzy sets-Fuzzy relation equations-Fuzzy logic control Fuzzification–Defuzzification-Knowledge base-Decision making logic-Membership functions–Rule base.

UNIT II	Adaptive Fuzzy Systems	18

Performance index – Modification of rule base 0 – Modification of membership functions-Simultaneous modification of rule base and membership functions – Genetic algorithms- Adaptive fuzzy system Neuro fuzzy systems.

UNIT III	Artificial Neural Networks:	18

Introduction-History of neural networks-multilayer perceptions-Back propagation algorithm and its Variants-Different types of learning, examples.

UNIT IV	Mapping and Recurrent Networks:	18

Counter propagation–Self organization Map-Cognitron and Neo cognitron – Hop field Net-Kohonnen Nets-Gross berg Nets-Art-I, Art-II reinforcement learning

UNITV	Case Studies	18

Application of fuzzy logic and neural networks to Measurement-Control-Adaptive Neural Controllers – Signal Processing and Image Processing

	Total Lecture Hours	**90**
Text Book(s)		
1	VallumB.RAndHayagrivaV.RC++,NeuralnetworksandFuzzylogic,BPBPublications,NewDelhi,1996	
Reference Book(s)		
1	Fuzzylogic&NeuralNetworks/ChennakesavaR.Alavala/NewAgeInternational,2008	
2	NeuralNetworksforcontrol,MillonW.T,SuttonR.SandWerbosP.J,MITPress1992	
3	FuzzysetsFuzzylogic,Klir,G.JanfdYuanB.BPrenticeHalloifIndiaPvt.Ltd.,,NewDelhi	
4	NeuralNetworksandFuzzysystems,Kosko..PrenticehallofIndiaPvt.Ltd.,,NewDelhi1994	
5	IntroductiontoFuzzycontrol,DirankovD.HellendoornH,ReinfrankM.,NarosaPublications House,New Delhi1996	
6	IntroductiontoArtificialNeuralsystems,ZuradaJ.MJaicoPublishingHouse,NewDelhi1994	
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		Internet of Things (IoT)	L	T	P	C
Core/elective/Supportive		Skill based Subject : 1	4	0	0	3
Pre-requisite		None	Syllabus version		2023-26 Batch	

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 a teach 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	10

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	10

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, CDAC IoT devices: Ubimote, Wi-Fi mote, BLEMote, WINGZ gateway, Introduction to IoT Platforms, IoT Sensors and actuators

UNIT III	IoT Protocols	9

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	9

IoT Programming–Arduino Programming: Serial Communications–Getting Input from Sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication, Programming with Raspberry pi: Basics of python Programming, Python Packages Of IoT, IoT

Programming with CADC IoT devices.

UNIT V	**Domain Specific IoT**	**9**

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 Phones, Security Analysis of Internet-of-Things: A Case Study of August Smart Lock, Open IoT Platform.

	Total LectureHours	**47**

Text Book(s)

1	VijayMadisettiandArshdeepBahga,–InternetofThings(AHands-on- Approach)‖, 1st Edition, VPT,2014.

Reference Book(s)

1	Margolis, Michael. –ArduinoCooKbook: Receipestobegin, Expandand Enhance Your Projects‖.O'ReillyMediaInc.2011.
2	Monk,Simon.RaspberryPiCookbook:SoftwareandhardwareproblemsandSolutions. O'ReillyMedia,Inc.2016.

	Related Online Contents(MOOC,SWAYAM,NPTEL,Websitesetc)	
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

Fourth Semester

Course Code		Artificial Intelligence and Knowledge Representation	L	T	P	C
Core/elective/Supportive		Core : 6	4	0	0	4
Pre-requisite		None	Syllabus version		2023-26 Batch	

Course Objectives

- To expose the students the fundamental concepts of Artificial Intelligence and its applications.

Expected Course Outcomes

1	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	K2
2	Understanding about the basic concepts of Software agents and representation of knowledge	K2
3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	K2
4	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K3

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

UNIT I	Introduction	10

Introduction–Definition–Future of Artificial Intelligence–Characteristics of Intelligent Agents– Typical Intelligent Agents–Problem Solving Approach to Typical AI Problems.

UNIT II	Problem Solving Methods	10

Problem Solving Methods–Search Strategies–Uninformed–Informed–Heuristics–Local Search Algorithms and Optimization Problems–Searching with Partial Observations– Constraint Satisfaction Problems–Constraint Propagation– Back tracking Search–Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games.

UNIT III	Knowledge Representation	10

Knowledge Representation–First Order Predicate Logic – Prolog Programming–Unification– Forward Chaining – Backward – Chaining – Resolution – Knowledge Representation – Onto logical Engineering–Categories and Objects–Events–Mental Events and Mental Objects– Reasoning Systems for Categories–Reasoning with Default Information.

UNIT IV	Software Agents	10

Software Agents–Architecture for Intelligent Agents– Agent Communication– Negotiation and Bargaining–Argumentation among Agents–Trust and Reputation inMulti-agent Systems.

UNIT V	AI Applications	10

AI Applications–Language Models–Information Retrieval–Information Extraction–Natural Language Processing–Machine Translation–Speech Recognition–Robot–Hardware–Perception – Planning-Moving.		
	Total Lecture Hours	**50**
	Text Book(s)	
1	S.RussellandP.Norvig,–ArtificialIntelligence:AModernApproach‖,PrenticeHall,Third Edition,2009.	
2	I. Bratko,-Prolog:Programmingfor Artificial Intelligence,FourthEdition,Addison-WesleyEducationalPublishersInc.,2011.	
	Reference Book(s)	
1	M.TimJones,-ArtificialIntelligence:ASystemsApproach(ComputerScience),Jonesand BartlettPublishersInc.;FirstEdition,2008.	
2	NilsJ.Nilsson,-TheQuestforArtificialIntelligence,CambridgeUniversityPress,2009.	
3	WilliamF.ClocksinandChristopherSMellish,ProgramminginProlog:UsingtheISO Standard,FifthEdition,Springer,2003.	
4	GerhardWelss,-MultiAgentsSystems,SecondEdition,2013.	
5	DavidL.PooleandAlanK.Mackworth,-ArtificialIntelligence:FoundationsofComputationalAgents,CambridgeUniversityPress,2010.	
6	Implementanapplicationthatstoresbigdatain Hbase/MongoDB/PigUsingHadoop	
	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**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

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

Course Code		R Programming	L	T	P	C
Core/elective/Supportive		Core : 7	4	0	0	3
Pre-requisite		None	Syllabus version		2023-26 Batch	

Course Objectives

- To expose the students of the fundamental concepts of R Programming

Expected Course Outcomes

1	Understand the basics in R programming in terms of constructs, control statements, string functions	K2
2	Understand the use of R for Big Data analytics	K2
3	Apply R programming for Text processing	K3
4	Appreciate and apply the R programming from a statistical perspective	K3

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

UNIT I	Introducing to R	10

Introducing to R–R Data Structures–Help Functions in R–Vectors–Scalars–Declarations–Recycling–Common Vector Operations–Using all and any–Vectorized operations–NA and NULL values–Filtering–Victoriesed if-then else–Vector Element names.(9).

UNIT II	Matrices	10

Creating matrices–Matrix Operations–Applying Functions to Matrix Rows and Columns–Adding and deleting rows and columns-Vector/Matrix Distinction– Avoiding Dimension Reduction– Higher Dimensional arrays–lists–Creating lists–General list operations–Accessing list components and values–applying functions to lists–recursive lists.

UNIT III	Data Frames	10

Creating Data Frames–Matrix-like operations in frames–merging Data frames–Applying functions to Data Frames–Factors and Tables–Factors and levels–Common Functions used with factors–Working with tables–Other factors and table related functions–Control statements–Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values–Functions are objects–Environment and scope issues–Writing Upstairs–Recursion–Replacement functions–Tools for Composing function code–Math and Simulation in R.

UNIT IV	Classes	10

S3 Classes–S4 Classes– Managing your objects–Input/output–accessing key board and monitor–reading and writing files –accessing the internet–StringManipulation–Graphics–Creating Graphs – Customizing Graphs – Saving Graphs to files–Creating Three-Dimensional plots.

UNITV	Interfacing R	10
Interfacing R to other languages–Parallel R–Basic Statistics–Linear Model–Generalized Linear models–Non-linear Models–Time Series and Auto-Correlation–Clustering.		
	Total LectureHours	**50**
Text Book(s)		
1	NormanMatloff,–TheArtofR Programming:ATourofStatisticalSoftwareDesign‖,No StarchPress,2011.	
2	JaredP.Lander,–RforEveryone:AdvancedAnalyticsandGraphics‖,Addison-WesleyData &AnalyticsSeries,2013.	
	ReferenceBook(s)	
1	MarkGardner,–BeginningR–TheStatisticalProgrammingLanguage‖,Wiley,2013.	
2	RobertKnell,–IntroductoryR:ABeginner‘sGuidetoDataVisualisation,StatisticalAnalysisand programminginR‖,AmazonDigitalSouthAsiaServicesInc,2013.RichardCotton(2013).LearningR, O‘ReillyMedia.	
3	GarretGrolemund(2014).Hands-onProgrammingwithR.O‘ReillyMedia,Inc.	
4	RogerD.Peng(2018).RProgrammingforDataScience.LeanPublishing.	
	RelatedOnlineContents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
CourseDesignedby:		

	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		R Programming Lab	L	T	P	C
Core/elective/Supportive		Core Lab : 5	0	0	3	2
Pre-requisite		None	Syllabus version		2023-26 Batch	

Course Objectives

- To expose the students got the fundamental concepts of R Programming

Expected Course Outcomes

1	Understand the basics in R programming in terms of constructs, control statements, string functions	K2
2	Understand the use of R for Big Data analytics	K2
3	Apply R programming for Text processing	K3
4	Appreciate and apply the R programming from a statistical perspective	K3

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

List of Programs

1. R Expressions and Data Structures
2. Manipulation of vectors and matrix
3. Operators on Factors in R
4. Data Frames in R
5. Lists and Operators
6. Working with looping statements.
7. Graphs in R
8. 3D plots in R

Total Lecture Hours	**50**

Text Book(s)

1	S.RussellandP.Norvig,–ArtificialIntelligence:AModernApproach‖,PrenticeHall,Third Edition,2009.
2	I. Bratko,-Prolog:ProgrammingforArtificialIntelligence, FourthEdition,Addison-WesleyEducationalPublishersInc.,2011.

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2	NilsJ.Nilsson,-TheQuestforArtificialIntelligence,CambridgeUniversityPress,2009.

3	WilliamF.ClocksinandChristopherSMellish,ProgramminginProlog:UsingtheISO Standard,FifthEdition,Springer,2003.	
4	GerhardWelss,-MultiAgentsSystems,SecondEdition,2013.	
5	DavidL.PooleandAlanK.Mackworth,-ArtificialIntelligence:FoundationsofComputationalAgents,CambridgeUniversityPress,2010.	
6	Implementanapplicationthatstoresbigdatain Hbase/MongoDB/PigUsingHadoop	
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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		Machine Learning-Basics	L	T	P	C
Core/elective/Supportive		Allied : 4	4	0	0	2
Pre-requisite		None	Syllabus version		2023-26 Batch	

Course Objectives

- To explain about the basics of machine learning

Expected CourseOutcomes

1	Understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.	K2
2	Understanding of the strengths and weaknesses of many popular machine learning approaches.	K2
3	Explain about the concepts of computational learning theory and dimensionality reduction	K2
4	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	K3

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

UNIT I	Introduction to Learning	10

Algorithmic models of learning, Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs for experience. Bayesian, maximum some posterior,and minimum description length frameworks.

UNIT II	ML-Models	10

Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.

UNIT III	Computational Learning	10

Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal component Analysis, feature selection and visualization.

UNIT IV	Unsupervised Learning	10

Unsupervised Learning: Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering, Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge.

UNIT V	Applications in Data Mining	10
Selected applications in data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, humancomputer interaction, semantic web, and Bio informatics and computational biology.		
	Total Lecture Hours	**50**

Text Book(s)

1	Bishop,C.(2006).PatternRecognitionandMachineLearning.Berlin:Springer-Verlag.

Reference Book(s)

1	Russel,S.AndNorving,P.(2003).ArtificialIntelligence:AModernApproach.2nd Edition, NewYork:Prentice-Hall.
2	Baldi,P.,Frasconi,P.,Smyth,P.(2002).Bioinformatics:AMachineLearningApproach. Cambridge,MA:MITPress.
3	Baldi,P.,Frasconi,P.,Smyth,P.(2003).ModelingtheInternetandtheWeb– ProbabilisticMethodsandAlgorithms.NewYork:Wiley.
4	Bishop,C.M.NeuralNetworksforpatternrecognition.NewYork:OxfordUniversitypress(1995).
5	Hastie,T.,Tibshirani,R.,andFriedman,J.(2001).TheelementsofStatisticalLearning – Datamining,Inference,andPrediction,Berlin:Springer-Verlag.
6	Cohen,P.R.(1995)EmpiricalMethodsinArtificialIntelligence.Cambridge,MA:MITPress.
7	Cowell,R.G.,Dawid,A.P.,Lauritzen,S.L.,andSpiegelhalter.D.J.(1999).GraphicalModelsandExpertSyatems.Berlin:Springer.

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	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	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 paper	Syllabus version		2023-26 Batch	

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, data bases 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 and 30 for CEE (20 for evaluation and 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

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Hardware Configuration

Software Specification

2. System Study

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3. System Design and Development

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Input Design

Output Design

Database Design

System Development

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

Course code		INTERNSHIP TRAINING	L	T	P	C
Core/Elective/Supportive			0	0	0	2
Pre-requisite		Basic knowledge in SDLC and managing of software projects	Syllabus Version		2025-26 onwards	

Course Objectives:

The main objectives of this course are to:

1. To gain knowledge in software development environment
2. To know about the managerial aspects of development are.
3. Student is given interns about the industry, the job and the company

INTERNSHIP TRAINING

(During the vacation of Fourth Semester and viva voce examination to be conducted during practical examinations of fifth semester)

1. The aim of the Internship Training is to acquire practical knowledge on the implementation of the programming concepts studied.
2. To observe orientation to the company, its structure, and its products/services.
3. Direct engagement with assigned tasks and projects under the supervision of a mentor.
4. **Reporting and Evaluation:** Regular submission of progress reports and feedback sessions.
5. **Final Report and Presentation:** Completion of a final report summarizing the internship experience and potentially a presentation to showcase their work.

Viva Voce

1 Viva-Voce will be conducted at the end of the Fifth semester by both Internal (Respective Guides) and External Examiners, after duly verifying the training report in the college, for a total of 75 marks [CIA : 30 Marks and CEE : 45 Marks]

2. External Mark Split up (45 marks) :
   - Internship Training Report 25 marks
   - Viva PPT Presentation 10 marks
   - Viva Voce 10 Marks

Fifth Semester

Course Code		Machine Learning Techniques	L	T	P	C
Core/elective/Supportive		Core : 8	6	0	0	4
Pre-requisite		None	Syllabus version		2023-26 Batch	

Course Objectives

- To introduce students to the concepts and techniques of Machine Learning.

Expected Course Outcomes

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

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

UNIT I	Introduction to Machine Learning	10

Introduction – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis –Version Spaces and the Candidate Elimination Algorithm–Linear Discriminants–Perceptron–Linear Separability – Linear Regression.

UNIT II	Machine Learning Models	10

Linear Models–Multi-Layer Perceptron–Going Forwards–Going Backwards: Back Propagation Error – Multi-Layer Perceptron in Practice – Examples of using the MLP–Overview–Deriving Back-Propagation–Radial Basis Functions and Splines–Concepts–RBF Network–Curse of Dimensionality–Interpolations and Basis Functions–Support Vector Machines.

UNIT III	Tree & Probabilistic Model	10

Tree and Probabilistic Models–Learning with Trees–Decision Trees–Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities–Basic Statistics–GaussianMixtureModels–NearestNeighborMethods–UnsupervisedLearning–Kmeans Algorithms–Vector Quantization–Self Organizing Feature Map.

UNIT IV	Dimensionality Reduction and EvolutionaryModels	10

Dimensionality Reduction and Evolutionary Models-Dimensionality Reduction–Linear Discriminant Analysis–Locally Linear Embedding–Iso map–Least Squares Optimization–Evolutionary Learning–Genetic Algorithms–Genetic Offspring–Genetic Operators– Using Genetic Algorithms–Reinforcements Learning–Overview–Getting Lost Example–Markov Decision Process.		
UNIT V	**Graphical Model**	**10**
Graphical Models – Markov Chain Monte Carlo Methods– Sampling – Proposal Distribution –Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields–Hidden Markov Models–Tracking Methods.		
	Total Lecture Hours	**50**
	Text Book(s)	
1	EthemAlpaydin,- introductiontoMachineLearning3e(AdaptiveComputationandMachineLearningSeries),ThirdEdition,MITPress,2014.	
	Reference Book(s)	
1	JasonBell,-Machine Learning– Hands on for Developers and Technical professionals, First Edition,Wiley,2014.	
2	Peter Flach,- Machine Learning : The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridg e UniversityPress,2012.	
	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**	**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		Machine Learning Lab	L	T	P	C
Core/elective/Supportive		Core Lab:6	0	0	6	4
Pre-requisite		None	Syllabus version		2023-26 Batch	

Course Objectives

- To introduce students to the concepts and techniques of Machine Learning.

Expected CourseOutcomes

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

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

List of Programs

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a. CSV file

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriated at a sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a. CSV file. Compute the accuracy of the classifier, considering few test datasets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes / API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Total Lecture Hours	**50**

Text Book(s)

1	Ethem Alpaydin,- Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), ThirdEdition,MITPress,2014.

Reference Book(s)

1	JasonBell,-Machine Learning– Hands on for Developers and Technical professionals,

	FirstEdition,Wiley,2014.	
2	PeterFlach,- Machine Learning : The Art and Science of Algorithms that Make Sense of Data, FirstEdition,Cambridg eUniversityPress,2012.	
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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		Deep Learning	L	T	P	C
Core/elective/Supportive		Core: 9	6	0	0	4
Pre-requisite		None	Syllabus version		2023-26 Batch	

Course Objectives

- To introduce students to the basic concepts and techniques of deep Learning.

Expected CourseOutcomes

1	Understand the basic concepts and techniques of Deep Learning.	K2
2	To understand and apply the Machine learning principles	K2
3	To study the deep learning architectures	K2
4	Explore and create deep learning applications with tens or flow	K3

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

UNIT I	**Introduction to Learning**	**9**

The Neural Network–Limits of Traditional Computing–Machine Learning–Neuron–FF Neural Networks–Types of Neurons –Soft max output layers

UNIT II	**Deep Learning Models**	**9**

Tens or flow–Variables–Operations–Place holders–Sessions–Sharing Variables–Graphs–Visualization

UNIT III	**CNN**	**9**

Convolution Neural Network–Feature Selection–Max Pooling–Filters and Feature Maps– Convolution Layer–Applications

UNIT IV	**RNN**	**9**

Recurrent Neural Network–Memory cells–sequence analysis–word2vec-LSTM—Memory augmented Neural Networks–NTM—Application

UNIT V	**Reinforcement Learning**	**9**

Reinforcement Learning–MDP–Q Learning–Applications

Total LectureHours	**45**

Text Book(s)

1	NikhilBuduma,Nicholas Locascio,-Fundamentals of Deep Learning: Designing NextGenerationMachineIntelligenceAlgorithms‖,O'ReillyMedia,2017.

	ReferenceBook(s)	
1	IanGoodfellow,YoshuaBengio,AaronCourville,‖DeepLearning(Adaptivecomputation andMachineLearningseries‖,MITPress,2017.	
	Related Online Contents(MOOC,SWAYAM,NPTEL,Websites etc)	
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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		Business Data Analytics	L	T	P	C
Core/elective/Supportive		Elective: I	6	0	0	4
Pre-requisite		None	Syllabus		2023-26 Batch	

Course Objectives

- To introduce the fundamental concepts of Business data analytics and associated methodologies

Expected Course Outcomes

1	Understand and critically apply the concepts and methods of business analytics	K2
2	Demonstration the various methodologies of descriptive statistics	K2
3	Understanding of modeling uncertainty and statistical inference	K2
4	Understanding of analytical frameworks	K2

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

UNIT I	OVERVIEW OF BUSINESS ANALYTICS	9

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support–

Skills Required for a Business Analyst–Framework for Business Analytics Life Cycle for Business Analytics Process.

UNIT II	ESSENTIALS OF BUSINESS ANALYTICS	9

Descriptive Statistics–Using Data–Types of Data–Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation– Data Visualization: Tables,Charts,Line Charts,Bar and Column Chart,Bubble Chart, Heat Map–Data Dashboards.

UNIT III	MODELING UNCERTAINTY AND STATISTICAL INFERENCE	9

Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution–Statistical Inference: Data

Sampling–Selecting a Sample–Point Estimation–Sampling Distributions–Interval Estimation–Hypothesis Testing.

UNIT IV	ANALYTICS USING HADOOP AND MAP REDUCE FRAMEWORK	9

Introducing Hadoop– RDBMS versus Hadoop –Hadoop Overview–HDFS(Hadoop Distributed File System)–Processing Data with Hadoop–Introduction to Map Reduce–Features of Map Reduce–Algorithms Using Map-Reduce:Matrix- Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation–Extensions to Map Reduce.

UNIT V	OTHER DATA ANALYTICAL FRAMEWORKS	9
Overview of Application development Languages for Hadoop – Pig Latin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL–Introduction to Apache: Sqoop, Drill and Spark, Cloud era Impala–Introduction to No SQL Databases– H base and Mongo DB.		
	Total Lecture Hours	**45**

	Text Book(s)
1	VigneshPrajapati,-BigDataAnalyticswithR andHadoop‖,PacktPublishing,2013.
2	UmeshR Hodeghatta, UmeshaNayak,-BusinessAnalyticsUsingR–APracticalApproach‖, Apress,2017.
	Reference Book(s)
1	AnandRajaraman,JeffreyDavidUllman,-MiningofMassiveDatasets‖,Cambridge UniversityPress,2012.
2	JeffreyD.Camm,JamesJ.Cochran,MichaelJ.Fry,JeffreyW.Ohlmann,DavidR.Anderson, -EssentialsofBusinessAnalytics‖,CengageLearning,secondEdition,2016
3	U.DineshKumar,-BusinessAnalytics:TheScienceofData-DrivenDecisionMaking‖, Wiley,2017.
4	A.Ohri,–RforBusinessAnalytics‖,Springer,20127.RuiMiguelForte,-Mastering PredictiveAnalyticswithR‖,PacktPublication,2015.
	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**	**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		Social Network Analysis	L	T	P	C
Core/elective/Supportive		Elective : I	6	0	0	4
Pre-requisite		None	Syllabus		2023-26 Batch	

Course Objectives

- To explain the methodologies used in social network analysis

Expected Course Outcomes

1	Understand abroad 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	10

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	10

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	10

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	10

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 Counter measures.

UNIT V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	10

Graph Theory–Centrality–Clustering–Node-Edge Diagrams–Matrix representation–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–Recommendation in Social Media: Challenges– Classical Recommendation Algorithms–Recommendation Using Social Context– Evaluating Recommendations.		
	Total Lecture Hours	**50**
Text Book(s)		
1	PeterMika,-SocialnetworksandtheSemanticWeb‖,Springer,2007.	
2	BorkoFurht,—HandbookofSocialNetworkTechnologiesandApplications‖,Springer,2010.	
Reference Book(s)		
1	BingLiu,-WebDataMining: ExploringHyperlinks,Contents,andUsageData(DataCentric SystemsandApplications)‖,Springer;SecondEdition,2011.	
2	RezaZafarani,MohammadAliAbbasi,HuanLiu,‖SocialMediaMining‖,Cambridge UniversityPress,2014.	
3	GuandongXu,YanchunZhangandLinLi,—WebMiningandSocialNetworkingTechniques andapplications‖,Springer,2011	
4	DionGohandSchubertFoo,-Socialinformationretrievalsystems:emergingtechnologiesand ApplicationsforsearchingtheWebeffectively‖,IdeaGroup,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		Software Agents	L	T	P	C
Core/elective/Supportive		Elective : I	6	0	0	4
Pre-requisite		None	Syllabus		2023-26 Batch	

Course Objectives

- To explain the fundamentals of agents and agent programming paradigms.
- To explain about agents and security

Expected Course Outcomes

1	Understanding the fundamentals of agents and agent programming paradigms.	K2
2	Discussing the basics of java agents.	K2
3	Learning the concepts of multivalent systems.	K2
4	Understanding the concepts of intelligent software agents.	K2
5	Understanding the agents and security.	K2

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

UNIT I	AGENTS–OVERVIEW	10

UNITI Agent Definition–Agent Programming Paradigms–Agent Vs Object–Aglet–Mobile Agents–Agent Frameworks–Agent Reasoning

UNIT II	JAVA AGENTS	10

UNIT II Processes–Threads–Daemons–Components–Java Beans–Active X–Sockets–RPCs–Distributed Computing–Aglets Programming–Jini Architecture–Actors and Agents–Typed and Proactive Messages

UNIT III	MULTI AGENT SYSTEMS	10

Interaction between Agents–Reactive Agents–Cognitive Agents–Interaction Protocols–Agent Coordination–Agent negotiation–Agent Cooperation–Agent Organization–Self - Interested Agents in Electronic Commerce Applications

UNIT IV	INTELLIGENT SOFTWARE AGENTS	19

Interface Agents–Agent Communication Languages–Agent Knowledge Representation–Agent Adaptability–Belief Desire Intension–Mobile Agent Applications

UNIT V	AGENTS AND SECURITY	10

Agent Security Issues–Mobile Agents Security–Protecting Agents against Malicious Hosts–Untrusted Agent–Black Box Security–Authentication for Agents–Security Issues for Aglets

	Total LectureHours	**50**
	Text Book(s)	
1	1.Bigus&Bigus,—ConstructingIntelligentagentswithJava‖,Wiley,2010.	
2	2.Bradshaw,–SoftwareAgents‖,MITPress,2012.	
	Reference Book(s)	
1	Russel&Norvig,–ArtificialIntelligenceamodernapproach‖,PrenticeHall,1994.	
2	RichardMurchandTonyJohnson,–IntelligentSoftwareAgents‖,PrenticeHall,2000.	
3	MichaelWooldridge,–AnIntroductiontoMultiAgentSystems‖,JohnWiley,2002.	
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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		Capstone Project Work Phase II	L	T	P	C
Core/elective/Supportive		Skill Based Subject : 3	0	0	3	2
Pre-requisite		• Students should have completed Capstone Project Work Phase–I • Strong coding skills in any one programming paper	Syllabus version		2023-26 Batch	

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 in corporating 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 and 30 for CEE (20 for evaluation and 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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Output Design
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4. Software Testing and Implementation Conclusion
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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		Natural Language Processing	L	T	P	C
Core/elective/Supportive		Core: 10	5	0	0	4
Pre-requisite		None	Syllabus		2023-26 Batch	

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	10

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	10

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	10

Syntactic level: grammars(eg. Formal / Chomsky hierarchy, DCSGs, systematic case, unification, stochastic) -parsing(top-down,bottomup,char(early algorithm), CYKalgorithm)-automated estimation of probabilistic model parameters (inside-outside algorithm)-data oriented parsing- grammar formalisms and tree banks-efficient patsing for context-free grammars(CFGs)-statistcial

Parsing and probabilistic CFGs(PCFGs)-lexicilized PCFGse.

UNIT IV	Semantic Level	10

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	10

Pragmatic level: knowledge representation-reasoning- plan/goal recognition–speech acts/intentions –belief models-discourse-reference. Natural language generation: content determination–sentence planning-surface realization, subjectivity and sentiment analysis: information extraction–automatic summarization-information retriveval and question answering–name identity recognition and relation extraction– IE using sequence labeling-machine transilation: basic issues in MT-Statisticaltranslation-word alignment-phrase-based translation and synchronous grammars.

	Total Lecture Hours	**50**

Text Book(s)

1	DanielJandJamesH.Martin,‖speechandlanguageprocessing‖anintroductiontonatural languageprocessing,computationallinguistcs&speechrecognition‖prenticehall,2009.

Reference Book(s)

1	LanHWrittenandElbef,MarkA.Hall,‖datamining:practicalmachinelearningtoolsand techiniques‖,MorganKaufmann,2013

	Related Online Contents(MOOC,SWAYAM,NPTEL,Websitesetc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
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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		Natural Language Processing Lab	L	T	P	C
Core/elective/Supportive		Core Lab : 7	0	0	5	3
Pre-requisite		None	Syllabus		2023-26 Batch	

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

LIST OF PROGRAMS

1. Implementing word similarity
2. Implementing simple problems related to word disambiguation
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic Analyzer.
6. Sentiment Analysis.

Total Lecture Hours	**50**

Text Book(s)

1	DanielJandJamesH.Martin,‖speechandlanguageprocessing‖anintroductiontonatural languageprocessing,computationallinguistcs&speechrecognition‖prenticehall,2009

Reference Book(s)

1	LanHWrittenandElbef,MarkA.Hall,‖datamining:practicalmachinelearningtoolsand techiniques‖,MorganKaufmann,2013
	Related Online Contents(MOOC,SWAYAM,NPTEL,Websites etc)
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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		2023-26 Batch	

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

Expected 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.

2. Out of 100 marks, 25 marks for CIA and 75 for CEE (50 evaluation of project report + 25 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

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5. Conclusion

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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		Artificial Neural Network and Fuzzy Systems	L	T	P	C
Core/elective/Supportive		Elective: II	5	0	0	4
Pre-requisite		None	Syllabus Batch		2023-26	

Course Objectives

- To introduce the concepts of artificial neural networks and fuzzy systems
- To explain the basic mathematical elements of the theory of fuzzy sets.

Expected Course Outcomes

1	Explain the concepts of neural networks and, fuzzy logic	K2
2	Understanding of the basic mathematical elements of the theory of fuzzy sets.	K2
3	Understanding the differences and similarities between fuzzy sets and classical sets theories	K2
4	Solve problems that are appropriately solved by neural networks and fuzzy logic	K3

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

UNIT I	Introduction	10

Basic concepts-single layer perceptron-Multilayer perceptron-Adaline-Madaline-Learning rules-

Supervised learning-Back propagation networks-Training algorithm, Advanced algorithms-Adaptive network-Radial basis network modular network-Applications

UNIT II	Learning	10

Introduction-unsupervised learning-Competitive learning networks-Kohonen self organizing networks-Learning vector quantisation- Hebbian learning–Hopfield network-Content address able nature, Binary Hopfield network, Continuous Hopfield network Travelling Salesperson problem-Adaptive resonance theory–Bidirectional Associative Memory-Principle component Analysis

UNIT III	Fuzzy Sets	10

Introduction–crisp sets an overview–the notion of fuzzy sets–Basic concepts of fuzzy sets–classical logic an overview–Fuzzy logic. Operations on fuzzy sets-fuzzy complement–fuzzy union – fuzzy intersection–combinations of operations–general aggregation operations

UNIT IV	Relations	10

Crisp and fuzzy relations–binary relations–binary relations on a single set–equivalence and similarity relations–Compatibility or tolerance relations–orderings–Membership functions–methods of generation – defuzzification methods

UNIT V	Tree Learning	10

Adaptive Neuro Fuzzy based inference systems–classification and regression trees: decision tress, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real–Time Recurrent Learning.	
Total Lecture Hours	**50**

Text Book(s)	
1	–NeuroFuzzyandSoftcomputing‖,JangJ.S.R.,SunC.TandMizutaniE–Pearsoneducation, 2004
2	‖FundamentalsofNeuralNetworks‖,LaureneFauseett,PrenticeHallIndia,NewDelhi,1994.
Reference Book(s)	
1	‖FuzzyLogicEngineeringApplications‖,TimothyJ.Ross,McGrawHill,NewYork,1997.
2	–Neuralnetworks,Fuzzylogics,andGeneticalgorithms‖,S.Rajasekaranand G.A.VijayalakshmiPaiPrenticeHallofIndia,2003
3	‖FuzzySetsandFuzzyLogic‖,GeorgeJ.KlirandBoYuan,PrenticeHallInc.,NewJersey,1995
4	–PrinciplesofSoftComputing‖S.N.Sivanandam,S.N.DeepaWileyIndiaPvtLtd.
	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**

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

Course Code		Web Application Security	L	T	P	C
Core/elective/Supportive		Elective: II	5	0	0	4
Pre-requisite		None	Syllabu		2023-26 Batch	

Course Objectives

- To introduce the concepts of security in web applications
- To explain about crime prevention and routine duties in a police station

Expected Course Outcomes

1	Illustrate about the concept of HTML, DHTML, CSS and Java Script	K2
2	Explain the history, characteristics, technologies, concepts, usage in web 2.0 and web 3.0	K2
3	Apply the core concepts of web applications to create web pages	K3
4	Apply the concepts of servers side programming	K3

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

UNIT I	Introduction to Web	10

Data with URL-HTML-DHTML: Cascading Style Sheets, Common Gateway Interface: Programming CG! Scripts-HTML Forms-:- Custom Database Query Scripts-Server Side Includes-Server_security issues.

UNIT II	X HTML	10

X HTML: Introduction, CSS-Scripting languages-Java Script: Control statements, Functions,Arrays, Objects-DOM- Aiax enable rich internet applications.

UNIT III	Server Side Programming	10

Server side Programming-Active server pages-Java server pages-Java Servlets: Servlet container-

Exceptions- Sessions and Session Tracking_-Using Servlet context-Dynamic Content Generation-Servlet Chaining and Communications.

UNIT IV	HTML 5	10

HTML review, Feature detection, The HTML 5 new Elements, Canvas, Video and audio, Web storage, Geo location, Offline Web pages, Micro data, HTML 5 APLS, Migrating from HTML 4 to HTML5, CSS 3.

UNIT V	WEB 2.0	17

WEB 2.0- HISTORY, characteristics, technologies, concepts, usage, web 2.0 in education, philanthropy, social work. Web 3.0-Theory-and history understanding. Basic web artifacts and applications, implementation. MS share point -Share point 2013 overview, share (Put social to work, Share your stuff, Take share point on the go), Discover (find experts, discover answers, find what you are looking for), Manage(cost, risk, time)	
Total Lecture Hours	**50**

Text Book(s)

1	1.Deitel,DeitelandNeita,-InternetandWorldWide_Web-Howtoprogramll,PearsonEducation Asia, 4th Edition,2009.
2	ElliotteRustyHerold,-JavaNetworkProgrammingII,O'ReillyPublications,3rdEdition,2004.

Reference Book(s)

1	JeffyDwight,MichaelErwinandRobertNikes-USINGCGIII,PH.IPublications,1997
2	JasonHunter,WilliamCrawford-JavaServletProgrammingO'ReillyPublications,2nd Edition,2001.
3	EricLaddandJimO'Donnell,etal,-USINGHTML4,XML,andJAVA1.2,PrenticeHall,2003
4	JeremyKeith,-Html5forwebdesigners
	Related Online Contents(MOOC,SWAYAM,NPTEL,Websites etc)
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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**

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

Course Code		Fundamentals of Robotics	L	T	P	C
Core/elective/Supportive		Elective: II	5	0	0	4
Pre-requisite		None	Syllabus		2023-26 Batch	

Course Objectives

- To introduce the basic concepts of robotics and its characteristics

Expected Course Outcomes

1	Describe the different physical forms of robot architectures.	K2
2	Explain about the actuators and characteristics of actuating system	K2
3	Demonstrate to mathematically describe a kinematic robot system.	K2
4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	K3

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

UNIT I	**Introduction to Robotics**	**10**

Introduction to Robotics: Classification, Components, Characteristics, Applications.

UNIT II	**Robotics Kinematics**	**10**

Robotics Kinematics: Position Analysis, Robots as Mechanisms, Matrix Representation, Transformation Matrices, Forward and Inverse Kinematics.

UNIT III	**Actuators**	**10**

Actuators: Characteristics of Actuating Systems, Actuating Devices and Control.

UNIT IV	**Sensors**	**10**

Sensors: Sensor Characteristics, Description of Different Sensors. Dynamic characteristics- Speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors, & Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

UNIT V	**Kinematics**	**10**

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots

Total Lecture Hours	**50**

Text Book(s)

1	SaeedB.Niku,IntroductiontoRoboticsAnalysis,Application,PearsonEducationAsia,2001

	Reference Book(s)	
1	R.K.MittalandIJNagrath,RoboticsandControl,TMH,2003.	
2	Computational Intelligence,DavisPoole,AlanMackwath,RandyCoehel,OxfordUniversityPress1998.	
3	IndustrialRobotics/GrooverMP/McGrawHill	
4	IntroductiontoRobotics/JohnJ.Craig/Pearson	
	Related Online Contents(MOOC,SWAYAM,NPTEL,Websites etc)	
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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

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

Course Code		Embedded Systems	L	T	P	C
Core/elective/Supportive		Elective: III	5	0	0	4
Pre-requisite		None	Syllabus		2023-26 Batch	

Course Objectives

- To introduce the concepts of embedded systems and its architecture

Expected Course Outcomes

1	Understand hardware and software design requirements of embedded systems.	K2
2	Explain about the architecture of microprocessor and operating systems in embedded systems	K2
3	Analyze the embedded systems 'specification and develop software programs.	K4
4	Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.	K5

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

UNIT I	**Introduction to Embedded System**	**10**

Examples of Embedded Systems–Typical Hardware–Memory–Microprocessors–Busses–Direct Memory Access–Introduction to 8051 Microcontroller–Architecture-Instruction set–Programming.

UNIT II	**Microprocessor**	**10**

Microprocessor Architecture–Interrupt Basics–The Shared-Data problem–Interrupt Latency-Round– Robin Architecture-Round–Robin with Interrupts Architecture-Function-Queue

Scheduling Architecture –Real-Time Operating Systems Architecture–Selection of Architecture.

UNIT III	**Semaphores**	**10**

Tasks and Task States–Tasks and Data–Semaphores and Shared Data–Semaphore Problems–Semaphore variants.

UNIT IV	**Message Queues & RTOS**	**10**

Message Queues–Mail boxes–Pipes–Timer Functions–Events–Memory Management–Interrupt Routines in RTOS Environment. RTOS design–Principles–Encapsulation Semaphores and Queues–Hard Real-Time Scheduling Considerations–Saving Memory Space–Saving Power.

UNIT V	**Host machine & Testing**	**10**

Host and Target Machines–Linker/Locator for Embedded Software-Getting Embedded Software into the Target System. Testing on your Host Machine–Instruction Set Simulators–Laboratory Tools used for Debugging.

Total Lecture Hours	**50**

	Text Book(s)
1	The8051MicrocontrollerArchitecture,Programming&Applications,KennethJ.Ayala,PenramInternational.
2	AnEmbeddedSoftwarePrimer,DavidE.Simon,PearsonEducation,2005.
	Reference Book(s)
1	Embedded Systems: Architecture , Programming and Design, Raj Kamal, Tata McGraw-HillEducation,2008

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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**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

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

Course Code		Principles of Secure Coding	L	T	P	C
Core/elective/Supportive		Elective: III	5	0	0	4
Pre-requisite		None	Syllabu		2023-26 Batch	

Course Objectives

- To understand the secure software development life cycle
- To explain about the secure coding techniques

Expected Course Outcomes

1	Explain about the secure software development lifecycle	K2
2	Understand the secure coding techniques	K2
3	Demonstrate the threat modeling process and benefits	K2
4	Explain about the database and web specific issues	K2

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

UNIT I	Introduction to Security	10

Need for secure systems: Proactive Security development process, Secure Software Development Cycle(S-SDLC), Security issues while writing SRS, Design phase security, Development Phase, Test Phase, Maintenance Phase, Writing Secure Code- Best Practices SD3 (Secure by design, default and deployment), Security principles and Secure Product Development Timeline

UNIT II	Threat modeling process and its benefits	10

Threat modeling process and its benefits: Identifying the Threats by Using Attack Trees and rating threats using DREAD, Risk Mitigation Techniques and Security Best Practices. Security techniques, authentication, authorization. Defense in Depth and Principle of Least Privilege.

UNIT III	Secure Coding Techniques	10

Secure Coding Techniques: Protection against DoS attacks, Application Failure Attacks, CPU Starvation Attacks, In secure Coding Practices In Java Technology. ARP Spoofing and its counter measures. Buffer Over run-Stack over run, Heap Over run, Array Indexing Errors, Format String Bugs. Security Issues in C Language: String Handling, Avoiding Integer Over flows and Under flows and Type Conversion Issues- Memory Management Issues, Code Injection Attacks, Canary based

counter measures using Stack Guard and Pro police. Socket Security, Avoiding Server Hijacking, Securing RPC.

UNIT IV	Database and Web-specific issues	10

Database and Web-specific issues: SOL Injection Techniques and Remedies, Race conditions, Time of Check Versus Time of Use and its protection mechanisms. Validating Input and Inter process

Communication, Securing Signal Handlers and File Operations. XSS scripting attack and its types-

Persistent and Non persistent attack XSS Counter measures and By passing the XSS Filters.		
UNIT V	**Testing Secure Applications**	**10**
Testing Secure Applications: Security code overview, secure software installation. The Role of the Security Tester, Building the Security Test Plan. Testing HTTP- Based Applications, Testing File-Based Applications, Testing Clients with Rogue **Servers**		
	Total Lecture Hours	**50**

Text Book(s)	
1	WritingSecureCode,MichaelHowardandDavidLeBlanc,MicrosoftPress,2ndEdition,2004

Reference Book(s)		
1	ProgrammingPHP,RasmusLerdorfandLevinTatroe,O_Reilly,2002	
2	CorePythonProgramming,WesleyJ.Chun,PrenticeHall,2001	
3	Perl:TheCompleteReference,2nd Edn,MartinC.Brown,TMH,2009	
4	MySQL:TheCompleteReference,2nd Edn,VikramVaswani,TMH,2009	
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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**

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

Course Code		Open Source Software	L	T	P	C
Core/elective/Supportive		Elective: III	5	0	0	4
Pre-requisite		None	Syllabus		2023-26 Batch	

Course Objectives

- To explain the need and importance of open source software
- To introducethevariousopensourcesoftware'slikeLinux,MySQL,PHPandPython

Expected Course Outcomes

1	Explain about the need and importance of open source software	K2
2	Demonstrate the concepts of open source software's	K2
3	Apply the programming constructs of My SQL, PHP, Python and PERL to create programs	K3
4	Develop small programs using open source software's	K3

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

UNIT I	Introduction to open sources	10

Introduction to open sources–Need of open sources–advantages of open sources–application of open sources. Open source operating systems: LINUX: Introduction–general overview–Kernel mode

And user mode–process–advanced concepts–scheduling–personalities–cloning–signals–development with Linux.

UNIT II	My SQL	10

My SQL: Introduction–setting up account–starting, terminating and writing your own SQL programs-Record selection Technology– working with strings–Date and Time– sorting Query results– generating summary–working with meta data–using sequences–My SQL and Web.

UNIT III	PHP	10

PHP: Introduction–programming in web environment–variables-constants–data types–operators–statements–functions–arrays–OOP–string manipulations and regular expression–file

Handling and data storage–PHP and SQL database–PHP and LDAP–PHP connectivity–

sending and receiving E-mails–debugging and error handling–security–templates

UNIT IV	Python	10

Syntax and style–python objects–numbers–sequences–strings–lists and tuples–dictionaries–conditional loops–files–input and output–errors and exceptions–functions–modules–classes and OOP–

Execution environment		
UNIT V	**Pearl**	**10**
Pearl back grounder–pearl overview–pearl parsing rules–variables and data–statements and control structures–sub routines-, packages and modules–working with files–data manipulation.		
	Total Lecture Hours	**50**
Text Book(s)		
1	TheLinuxKernelBook,RemyCard,EricandFrankMevel,WileyPublications2003	
2	MySQLBible,SteveSuchring,JohnWiley2002.	
Reference Book(s)		
1	ProgrammingPHP,RasmusLerdorfandLevinTatroe,O_Reilly,2002	
2	CorePythonProgramming,WesleyJ.Chun,PrenticeHall,2001	
3	Perl:TheCompleteReference,2nd Edn,MartinC.Brown,TMH,2009	
4	MySQL:TheCompleteReference,2nd Edn,VikramVaswani,TMH,2009	
	Related Online Contents(MOOC,SWAYAM,NPTEL,Websites etc)	
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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		Ethical Hacking	L	T	P	C
Core/elective/Supportive		Skill Based Subject: 4	6	0	0	3
Pre-requisite		None	Syllabus		2023-26 Batch	

Course Objectives

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

Expected CourseOutcomes

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	10

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Foot printing – Information Gathering Methodology–Foot printing Tools–WHO IS Tools–DNS Information Tools–Locating the Network Range–Meta Search Engines.

UNIT II	Scanning And Enumeration	10

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

UNIT III	System Hacking	10

Introduction–Cracking Passwords–Password Cracking Websites–Password Guessing–Password Cracking Tools–Password Cracking Counter measures–Escalating Privileges–Executing Applications–Key loggers and Spyware.

UNIT IV	Programming For Security Professionals	10

Programming Fundamentals–C language–HTML–Perl–Windows OS Vulnerabilities–Tools for Identifying Vulnerabilities – Counter measures – Linux OS Vulnerabilities – Tools For Identifying Vulnerabilities–Counter measures

UNIT V	Penetration Testing	10

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

	Total Lecture Hours	**50**
Text Book(s)		
1	EC-Council,–EthicalHackingandCountermeasures:AttackPhases‖,CengageLearning,2010.	
2	JonErickson,–Hacking,2ndEdition:TheArtofExploitation‖,NoStarchPressInc.,2008.	
3	MichaelT.Simpson,KentBackman,JamesE.Corley,–Hands-OnEthicalHacking andNetworkDefense‖,CengageLearning,2013.	
Reference Book(s)		
1	PatrickEngebretson,–TheBasicsofHackingandPenetrationTesting–EthicalHackingand PenetrationTestingMadeEasy‖,SecondEdition,Elsevier,2013.	
2	RafayBoloch,–EthicalHackingandPenetrationTestingGuide‖,CRC Press,2014	
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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