KAKATIYA UNIVERSITY, WARANGAL – 506 009
B.Sc. PROGRAMME Under CBCS System
Scheme with effect from Academic Year: 2024 – 2025
B.Sc. (AI & ML)

Year	Semester	Theory / Practical	Title of the Paper	# Credits	Hrs. PW	Max.Marks			Total Marks
						Intr. Marks	End Marks	Lab Marks	
I	FIRST	Paper – I (DSC – A)	Programming with C	4	4T	20	80	25	125
		Practical-1	Programming with C Lab	1	3P				
	SECOND	Paper – II (DSC – B)	Object Oriented Programming using C++	4	4T	20	80	25	125
		Practical-2	Object Oriented Programming using C++ Lab	1	3P				
II	THIRD	SEC - 1	Web Programming	2	2	10	40	--	50
		SEC - 2	University Specified Course Bio Statistics (Taught by: Statistics)	2	2	10	40	--	50
		Paper – III (DSC – C)	Problem Solving and Python Programming	4	4T	20	80	25	125
		Practical-3	Problem Solving and Python Programming Lab	1	3P				
	FOURTH	SEC – 3	Statistical Structure in Data Using R	2	2	10	40	--	50
		SEC – 4	University Specified Course Remedial Methods of Pollution – Drinking Water & Soil Fertility (Taught by: Chemistry)	2	2	10	40	--	50
		Paper – IV (DSC – D)	Data Structures and Algorithm using Python	4	4T	20	80	25	125
		Practical-4	Data Structures and Algorithm using Python Lab	1	3P				
III	FIFTH	Paper – V (A) (DSE – A)	Artificial Intelligence	4	4T	20	80	25	125
		Practical-5 (A)	Artificial Intelligence Lab	1	3P				
		Paper – V (B) (DSE – A)	Machine Learning	4	4T	20	80	25	125
		Practical-5 (B)	Machine Learning Lab	1	3P				
		Paper VI - GE	Big Data	4	4T	20	80	--	100
	SIXTH	Paper – VII (A) (DSE – A)	Natural Language Processing	4	4T	20	80	25	125
		Practical –7 (A)	Natural Language Processing Lab	1	3P				
		Paper – VII (B) (DSE – B)	Deep Learning	4	4T	20	80	25	125
		Practical – 7 (B)	Deep Learning Lab	1	3P				
		Paper VIII (Project)	Major Project	4	4P	100			100

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper – I (DSC – A)	Programming with C	Theory	04	Internal	external
				20	80

Unit – I

Program Fundamentals: Generation and Classification of Programming Languages, Compiling, Interpreting, Loading, Linking of a program, Developing a program, Software Development. **Algorithms:** Definitions, Different ways of Stating Algorithms (Step-form, Pseudo-code, Flowchart), Strategy for Designing Algorithms, Structured Programming Concept. **Basics of C:** Overview of C, Developing Programs in C, Parts of Simple C Program, Structure of a C Program, Comments, Program Statements, C Tokens, Keywords, Identifiers, Data Types, Variables, Constants, Operators and Expressions, Expression Evaluation- Precedence and Associativity, Type Conversions.

Unit — II

Input-Output: Non-Formatted and Formatted Input and Output Functions, Escape Sequences. Control Statements: Selection Statements-if, if-else, nested if-else, comma operator, Conditional Operator, switch; Iterative Statements-while, for, do-while; Special Control Statement-goto, break, continue, return, exit. Array and Strings: One-dimensional Arrays, Character Arrays, Functions from ctype.h, string.h, Multidimensional Arrays.

Unit — III

Functions: Concepts of function, Using Functions, Call-by-value Vs Call-by-reference, passing Arrays to Functions, Scope of Variables, Storage Classes, Inline Functions, and Recursion. **Pointer**: Introduction, Address of Operator(&),Pointer, Uses of Pointers, Arrays and Pointers and Strings, Pointers to Pointers, Arrays of pointers, pointers to Arrays, Dynamic Memory allocation.

Unit — IV

User-defined Data Types: Declaring a Structure (Unions) and its members, Initialization Structure (Union), Accessing member of a Structure (Union), Array of Structure (Union), Structure verses Unions, Enumeration types. **Files:** Introduction, Using Files in C, Working with Test Files. Working with Binary Files of Records, Random Access to Files of Records, other File Management Function.

Text Books:
 1. Pradip Dey, Manas Ghosh, Computer Fundamentals and programming in c(2e)

Reference Books

   1. Programming with C, Dr. B. Rama, Dr. P. Praveen, Professional Books Publisher, ISBN Number 9789385506284, 2017
 2. Ivor Horton, Beginning C
 3. Ashok Kamthane, Programming in C
 4. Herbert Schildt, the Complete Reference C
 5. Paul Deitel, Harvey Deitel, C How to Program
 6. Byron S.Gottfried, Theory and Problems of Programming with C
 7. Brain W.Kernighan, Dennis M, Ritchie, the C Programming Language.
 8. B, A Forouzan, R.F.Gilberg, a Structured Programming Approach Using C

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical-1	Programming with C Lab	Practical	03	External	25

1. Write a program to find the largest two (three) numbers using if and conditional operator.
2. Write a program to print the reverse of a given number.
3. Write a program to print the prime number from 2 to n where n is given by user.
4. Write a program to find the roots of a quadratic equation using switch statement.
5. Write a program to print a triangle of stars as follows (take number of lines from user):

$$*$$
$$* \ *$$
$$* \ * \ * \ *$$
$$* \ * \ * \ * \ * \ *$$
$$* \ * \ * \ * \ * \ * \ * \ *$$

6. Write a program to find largest and smallest elements in a given 1ist of numbers.
7. Write a program to find the product of two matrices.
8. Write a program to find the GCD of two numbers using iteration and recursion.
9. Write a program to illustrate use of storage classes.
10. Write a program to demonstrate the call by value and the call by reference concepts.
11. Write a program that prints a table indicating the number of occurrences of each alphabet in the text Entered as command 1ine arguments.
12. Write a program to illustrate use of data type enum.
13. Write a program to demonstrate use of string functions string.h header file.
14. Write a program that opens a file and counts the number of characters in a file.
15. Write a program to create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
16. Write a program that opens an existing text file and copies it to a new file with lower case letters Changed to capital letters and all other characters unchanged.

Note: Recommended to use Open Source Software: GCC on Linux, DevC++ or Code Blocks on Windows.

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper – II	Object Oriented Programming Using C++	Theory	04	Internal	External
(DSC – B)				20	80

Unit – I
Introduction to C++: Applications, Example Programs, Tokens, Data Types, Operators, Expressions, Control Structures, Arrays, Strings, Pointers, Searching and Sorting Arrays. Functions: Introduction, Prototype, Passing Data by Value, Reference Variables, Using Reference Variables as Parameters, Inline Functions, Default Arguments, Overloading Functions, Passing Arrays to Functions. **Object Oriented Programming:** Procedural and Object-Oriented Programming, Terminology, Benefits of OOP Languages and OOP Applications.

Unit – II
Classes: Introduction, Defining an Instance of a Class, Why Have Private Members? Separating Class Specification from Implementation, Inline Member Functions, Constructors, Passing Arguments to Constructors, Destructors, Overloading Constructors, Private Member Functions, Arrays of Objects, Instance and Static Members, Friends of Classes, Member-wise Assignment, Copy Constructors, Operator Overloading, Object Conversion, Aggregation.

Unit – III
Inheritance: Introduction, Protected Members and Class Access, Base Class Access Specification, Constructors and Destructors in Base and Derived Classes, Redefining Base Class Functions, Class Hierarchies, Polymorphism and Virtual Member Functions, Abstract Base Classes and Pure Virtual Functions, Multiple Inheritance. **C++ Streams**: Stream Classes, Unformatted I/O Operations, Formatted I/O Operations.

Unit—IV
Exceptions: Introduction, Throwing an Exception, Handling Exception, Object-Oriented Exception Handling with Classes, Multiple Exceptions, Extracting Data from the Exception Class, Re-throwing an Exception, Handling the bad_alloc Exception. **Templates**: Function Templates-Introduction, Function Templates with Multiple Types, Overloading with Function Templates, Class Templates-Introduction, Defining Objects of the Class template, Class Templates and Inheritance, Introduction to the STL.

Text Book:
1. Tony Gaddis, Starting out with C++: from Control structures through objects (7e)

References:
1. C++ Programming for Beginners Foundations, Analysis and Examples by Dr. B. Manjula, P. Venkateshwarlu, BlueRose Publishers, ISBN 978-93-5347-999-2, 2019
2. Bruce Eckel, Thinking in C++
3. K.R. Venugoppal, Mastering in C++
4. Herbert Schildt, C++:The Complete Reference
5. Bjarne Stroustrup, The C++ Programming Language
6. Sourav Sahay, Object Oriented Programming with C++

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical-2	**Object Oriented Programming Using C++ Lab**	Practical	**03**	External	**25**

1. Write a program to:
    a. Print the sum of digits of a given number.
    b. Check whether the given number is Armstrong or not
    c. Print the prime number from 2 to n where n is natural number given.
2. Write a program to find largest and smallest elements in a given list of numbers and sort the given list.
3. Write a program to read the student name, roll no, marks and display the same using class and object.
4. Write a program to implement the dynamic memory allocation and de-allocation using new and delete operators using class and object.
5. Write a program to find area of a rectangle, circle and square using constructors.
6. Write a program to implement copy constructor.
7. Write a program using friend functions and friend class
8. Write a program to implement constructors.
    a. Default Constructor, Parameterized Constructor, Copy Constructor
    b. Define the Constructor inside/outside of the class
    c. Implement all three constructors within a single class as well as use multiple classes (individual Classes)
9. Write a program to implement the following concepts using class and object
    a. Function Overloading
    b. Operator Overloading(unary/binary(+ and -))
10. Write a program to demonstrate single inheritance, multilevel inheritance and multiple inheritances.
11. Write a program to implement overloaded constructors in inheritance.
12. Write a program to implement the polymorphism and the following concept using class and object.
    a. Virtual functions
    b. Pure virtual functions
13. Write a program to implement the virtual concepts for following concepts,
    a. Constructor (not applied)
    b. Destructor (applied)
14. Write a program to demonstrate static polymorphism using method overloading.
15. Write a program to demonstrate dynamic polymorphism using method overriding and dynamic method dispatch.
16. Write a program to implement the template (generic) concepts
    a. Without template class and object
    b. With template class and object

Note: Recommended to use Open Source Software: GCC on Linux, Dev C++ or Code Blocks on Windows.

Course Category	Title of the Paper	Hours Per Week		Marks
SEC – I	**Web Programming**	Theory	**02**	**50**

Unit - I
HTML- Basic HML, The document body, Text, Hyperlinks, Adding More Formatting, Lists, Using Color and Images, Images, Tables, Frames, Forms-Toward Interactivity. **Cascading Style Sheets** - Introduction, Inline Styles, and Embedded Style Sheets, Linking external sheets.

Unit - II
JavaScript- Introduction, simple programming, Obtaining User Input with prompt Dialogs, Operators (arithmetic, Decision making, assignment, logical, increment and decrement). Control Structures - if…else selection statement, while, do… while repetitions statement, for statement, switch statement, break and continue statements. Functions - program modules in JavaScript, programmer defined functions, function definition, Random-number generator, scope rules, global functions, recursion.

Text Book:
1. Internet& World Wide Web- H. M. Deitel, P.J. Deitel, A. B. Goldberg-Third Edition

Course Category	Title of the Paper	Hours Per Week		Marks
SEC – II	**University Specified Course Bio Statistics** **(Taught by: Statistics)**	Theory	**02**	**50**

Course Category	Title of the Paper	Hours Per Week		Marks
SEC – II	**University Specified Course Bio Statistics** **(Taught by: Statistics)**	Theory	**02**	**50**

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper – III	**Problem Solving and Python Programming**	Theory	04	Internal	external
(DSC – C)				20	80

Unit-I
Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language, Control Flow Statements, The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Catching Exceptions Using try and except Statement, Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Unit -II
Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement. Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement , Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozen set.

Unit-III
Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Pythons and os. path Modules, Regular Expression Operations, Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module.

Unit-IV
Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism. Introduction to Data Science: Functional Programming, JSON and XML in python, NumPy with python, Pands, Altair.

Text Books:
1. Gowrishankar S, Veena A, "Introduction to Python Programming",1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

References:
1. Getting Started with Python For Data Scientists by Dr. B. Manjula, R. Lakshman Naik, BlueRose Publishers, ISBN: 978-93-5472-615-6, 2021
2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media, 2016. ISBN-13:978-1491912058.
3. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media, 2017. ISBN – 13: 978-1491962299.

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical-3	**Problem Solving and Python Programming Lab**	Practical	**03**	External	**25**

1. Write a python program that displays the following information: Your name, Full address Mobile number, College name, Course subjects.
2. Write a python program to find the largest three integers using if-else and conditional operator.
3. Write a python program that asks the user to enter a series of positive numbers (The user should enter a negative number to signal the end of the series) and the program should display the numbers in order and their sum.
4. Write a python program to find the product of two matrices [A]mxp and [B]pxr .
5. Write recursive functions for GCD of two integers.
6. Write recursive functions for the factorial of positive integer.
7. Write recursive functions for Fibonacci Sequence up to given number n.
8. Write recursive functions to display prime number from 2 to n
9. Write a python program that writes a series of random numbers to a file from 1 to n and display
10. Write a python program to sort a given sequence: String, List and Tuple.
11. Write a python program to make a simple calculator.
12. Write a python program for Linear Search and Binary Search

Course Category	Title of the Paper	Hours Per Week		Marks
SEC – III	**Statistical Structure in data using R**	Theory	02	50

Unit -I

Introduction- What Is R?, Installing R, Choosing an IDE, Your First Program, Installing Extra Related Software, Scientific Calculator- Mathematical Operations and Vectors, Assigning Variables, Special Numbers, Logical Vectors; Inspecting Variables- Classes, Different Types of Numbers, Other Common Classes, Checking and Changing Classes, Examining Variables, Workspace.

Unit -II

Vectors, Matrices, and Arrays; Lists and Data Frames-Lists, NULL, Pairlists, Data Frames; Environments and Functions.
Strings and Factors, Flow Control and Loops, Advanced Looping; Packages- Loading Packages, Installing Packages, Maintaining Packages; Dates and Times-Date and Time Classes, Conversion to and from Strings, Time Zones, Arithmetic with Dates and Times, Lubridate.

Text book:

1. Richard cotton "A step-by-step function guide to data analysis: Learning R" First edition, O"REILLY, 2013

B.Sc. (AI & ML)
Semester-IV

Course Category	Title of the Paper	Hours Per Week		Marks
SEC – IV	**University Specified Course Remedial Methods of Pollution – Drinking Water & Soil Fertility (Taught by: Chemistry)**	Theory	**02**	**50**

Course Category	Title of the Paper	Hours Per Week		Marks
SEC – IV	**University Specified Course Remedial Methods of Pollution – Drinking Water & Soil Fertility (Taught by: Chemistry)**			

B.Sc. (AI & ML)
Semester-IV

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper – IV (DSC – D)	Data Structures and Algorithm using Python	Theory	04	Internal	external
				20	80

Unit-I
Data Structures -What is a data structure, why do we need, how to prepare data structure, types of data structures, **Abstract Data type and Analysis**- introduction, complexity, asymptotic notations, recursion.
Linear Data Structures- introduction, declaration of arrays, implementation.

Unit – II
Continuous Memory-Based Linear Data Structures- stack, implementation of stack using pointers, complex operations, application of stacks, queues, single-end-queues, double-end-queues, priority queues.
Pointer-Based linear data structures- linked list, doubly linked lists, circular linked list, **pointer-based hierarchical data structures**- non-linear data structures, trees, implementation of binary tree, traversal, basic operations, threaded binary trees.

Unit – III
Search trees- binary search trees, AVL trees, Red-Black trees, splay trees, B-Trees, **priority Queues and Heaps** – introduction, binary heaps, Leftist heaps, priority queues using heaps.
Other non-linear data structures - non-linear, non- hierarchical data structures data structures, trie, hash tables, data structures in memory management, B+ trees.

Unit-IV
Graphs- components of a graph, graph representation, types of graphs, working, traversal, implementation of graphs, topological sorting, spanning trees, shortest distance, graph connectivity. **Sorting-** importance of sorting algorithms, exchange sort, selection sort, insertion sort, divide and conquer, distributed sort, **Searching**- linear search, binary search, tree-based search, hashing.

TextBook:

1. Data Structures using Python by Shriram K Vasudeva, Abhish S. Nagarajan, Karthick Nanmaran, Oxford University Press, ISBN: 978-019-012408-3, 2021

References:
1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, Data Structures and Algorithms Python John Wiley & Sons, 2013.
2. Problem Solving with algorithams and Data Structures Using Python by Miller and David L. Ranum.
3. Algorithmic Problem Solving with Python by John B. Schneider

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical-4	Data Structures and Algorithm using Python Lab	Practical	03	External	25

Implement all the concepts covered in syllabus. Programs need to implement in Python:

1. Program for implementing selection sort.

2. Program for implementing insertion sort.

3. Program for implementing quick sort.

4. Program for implementing merge sort.

5. Write a program to implement Singly Linked List.

6. Write a program to implement Doubly Linked list.

7.   Write a program to implement Binary Search Tree.

8. Program for implementing Stack using array.

9. Program for implementing Stack.

10. Program for implementing multiple stack.

11. Program for implementing Queue using array.

12. Program for dynamic implementation of queue.

13. Program for implementing circular queue.

14. Program for implementing priority queue.

15. Program for implementing Singly Linked list.

16. Program for implementing Doubly Linked list.

17. Program for implementing Binary Search Tree.

18. Program for Breadth First Search (BFS) for graph traversal.

19. Program for Depth First Search (DFS) for graph traversal.

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper – V(A) (DSC – V)	Artificial Intelligence	Theory	04	Internal	External
				20	80

UNIT - I

Artificial Intelligence: AI Problems – Underlying Assumption – AI Technique – Level of the Model – Criteria of Success – Some General References. Problems, Problem Spaces, and Search: Defining the Problem as a State Space Search – Production Systems – Problem Characteristics – Production System Characteristics – Issues in the Design of Search Programs.

UNIT – II

Heuristic Search Techniques: Generate and Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction – Means-ends Analysis. Knowledge Representation Issues: Representations and Mappings – Approaches to Knowledge Representation – Issues in Knowledge Representation – The Frame Problem.

UNIT - III

Using Predicate Logic: Representing Simple Facts in Logic – Representing Instance and ISA Relationships – Computable Functions and Predicates – Resolution – Natural Deduction - Representating Knowledge Using Rules: Procedural Versus Declarative Knowledge – Logic Programming – Forward Versus Backward Reasoning – Matching – Control Knowledge.

UNIT - IV

Symbolic Reasoning Under Uncertainty: Introduction to Non-monotonic Reasoning – Logics for Non-monotonic Reasoning – Implementation Issues – Augmenting a Problem-solver – Implementation Depth First Search – Implementation Breadth First Search. Statistical Reasoning: Probability and Baye's Theorem – Certainty Factors and Rule- based Systems – Bayesian Networks – Dempster-Shafer Theory – Fuzzy Logic

Text Book:

1.Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2017

References:

1. M. Tim Jones, - Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers Inc.; First Edition, 2008.

2. Nils J. Nilsson, - The Quest for Artificial Intelligence, Cambridge University Press, 2009.

3. Gerhard Welss, - Multi Agents Systems, Second Edition, 2013

4. David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

5. Dan W. Patterson, "Introduction to AI and ES", PearsonEducation,2007

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical-5A	**Artificial Intelligence Lab**	Practical	**03**	External	**25**

Implement all the concepts covered in the syllabus.

Use any language such as C/C++/LISP/PROLOG/Python

1. Write a program to implement the Hill Climbing problem

2. Write a program to implement the Towers of Hanoi problem

3. Write a program to implement the Missionaries and Cannibals problem

4. Write a program to implement the 8 queens problem

5. Write a program to implement the A* Algorithm

6. Write a program to implement the Breadth first algorithm

7. Write a program to implement the Depth first algorithm

8. Write a program to implement the predicate logic

Course Category	Title of the Paper	Hours Per Week		Marks	
				Internal	External
Paper – V(B)	**Machine Learning**	Theory	04		
(DSC – V)				20	80

Unit – I

Introduction to Machine Learning - Need for Machine Learning, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process. (Ch-1)

Similarity-based Learning - Introduction, Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR). (Ch-4)

Regression Analysis – Introduction, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression. (Ch-5)

Unit – II

Decision Tree Learning – Introduction, Decision Tree Induction Algorithms, Validating and Pruning of Decision Trees. (ch-6)

Bayesian Learning - Introduction, Fundamentals of Bayes Theorem, Classification Using Bayes Model, Naïve Bayes Algorithm for Continuous Attributes, Bayesian Belief Network, Markov Chain, Problems Solved with HMM. (ch-8 & 9)

Unit – III

Ensemble Learning - Ensembling Techniques, Parallel Ensemble Model, Incremental Ensemble Models, Sequential Ensemble Models. (ch-12)

Clustering Algorithms - Introduction, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Grid-based Approach, Probability Model-based Methods, Cluster Evaluation Methods. (ch-13)

Unit – IV

Reinforcement Learning - Overview of Reinforcement Learning, Scope of Reinforcement Learning, Reinforcement Learning As Machine Learning, Components, Markov Decision Process, Multi-Arm Bandit Problem and Reinforcement Problem Types. (ch-14)

Genetic Algorithms – Overview of Genetic Algorithms, Optimization Problems and Search Spaces, General Structure of a Genetic Algorithm, Genetic Algorithm Components. (ch-15)

Text Books:

1. Machine Learning- Dr. S. Sridhar, Dr. M. Vijayalakshmi, oxford university press, 2021.

2. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013.

Reference Books:

1. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018.

2. Ethem Alpaydin, Introduction to Machine Learning, 3rd Edition, MIT Press, 2014.

3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical-5B	Machine Learning Lab	Practical	03	External	25

Note:
1. Identify various tools for machine learning.
2. Installation of any open source machine learning tool.
3. Searching of data sets on the web.
4. Implementation of various machine learning algorithms based on syllabus of core subject

List of Programs:

1. Python program to demonstrate the different operators in python.

2. Python program to demonstrate the matrices addition, subtraction, and multiplication.

3. Find the mean, median, mode, variance and standard deviation of a list.

4. Implement the linear regression algorithm.

5. Implement the logistic regression algorithm.

6. Implement the lasso regression algorithm.

7. Implement the ridge regression algorithm.

8. Implement the K-nearest neighbour algorithm.

9. Implement the decision tree algorithm.

10. Implement the random forest algorithm.

11. Implement the naïve bayesian classification algorithm.

12. Implement the support vector machine algorithm.

13. Implement the principal component analysis algorithm.

14. Implement the singular value decomposition algorithm.

15. Implement the k – means clustering algorithm.

B.Sc. (AI & ML)
Semester-V

Course Category	Title of the Paper	Hours Per Week	Marks	
Paper – VI	Big Data	Theory	Internal	External
GE		04	20	80

UNIT – I

Getting an overview of Big Data: Introduction to Big Data, Structuring Big Data, Types of Data, Elements of Big Data, Big Data Analytics, and Advantages of Big Data Analytics. Introducing Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Cloud Computing and Big Data, Features of Cloud Computing, Cloud Deployment Models, Cloud Services for Big Data, Cloud Providers in Big Data Market.

UNIT – II

Understanding Hadoop Ecosystem: Introducing Hadoop, HDFS and MapReduce, Hadoop functions, Hadoop Ecosystem. Hadoop Distributed File System- HDFS Architecture, Concept of Blocks in HDFS Architecture, Namenodes and Datanodes, Features of HDFS. MapReduce. Introducing HBase- HBase Architecture, Regions, Storing Big Data with HBase, Combining HBase and HDFS, Features of HBase, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

UNIT- III

Understanding MapReduce Fundamentals and HBase: The MapReduceFramework ,Exploring the features of MapReduce, Working of MapReduce, Techniques to optimize MapReduce Jobs, Hardware/Network Topology, Synchronization, File system, Uses of MapReduce, Role of HBase in Big Data Processing- Characteristics of HBase. Understanding Big Data Technology Foundations: Exploring the Big Data Stack, Data Sources Layer, Ingestion Layer, Storage Layer, Physical Infrastructure Layer, Platform Management Layer, Security Layer, Monitoring Layer, Visualization Layer.

UNIT – IV

Storing Data in Databases and Data Warehouses: RDBMS and Big Data, Issues with Relational Model, Non – Relational Database, Issues with Non Relational Database, Polyglot Persistence, Integrating Big Data with Traditional Data Warehouse, Big Data Analysis and Data Warehouse. NoSQL Data Management: Introduction to NoSQL, Characteristics of NoSQL, History of NoSQL, Types of NoSQL, Data Models- Key Value Data Model, Column Oriented Data Model, Document Data Model, Graph Databases, Schema-Less Databases, Materialized Views, CAP Theorem.

Text Book:
1. BIG DATA, Black Book TM, DreamTech Press, 2016 Edition.

Reference Books:
1. Seema Acharya, SubhasniChellappan , "BIG DATA and ANALYTICS", Wiley Publications, 2016.
2. Nathan Marz and James Warren, "BIG DATA- Principles and Best Practices of Scalable Real-Time Systems", 2010

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper – VII (A) DSC – A	**Natural Language Processing**	**Theory**	**04**	**Internal**	**External**
				20	**80**

UNIT - I
Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models, Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches, Features.

UNIT - II
Syntax I: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms.

UNIT – III
Syntax II: Models for Ambiguity Resolution in Parsing, Multilingual Issues Semantic Parsing I: Introduction, Semantic Interpretation, System Paradigms, Word Sense.
Semantic Parsing II: Predicate-Argument Structure, Meaning Representation Systems

UNIT - IV
Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Bayesian parameter estimation, Language Model Adaptation, Language Models- class based, variable length, Bayesian topic based, Multilingual and Cross Lingual Language Modeling.

Text Book:
1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.

Reference Book:
1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical – 7 (A)	Natural Language Processing Lab	Practical	03	External	25

Note: Implement all the concepts covered in the syllabus.

List of Experiments

1. Write a Python Program to perform following tasks on text
     a) Tokenization   b) Stop word Removal

2. Write a Python program to implement Porter stemmer algorithm for stemming

3. Write Python Program for:
     a) Word Analysis b) Word Generation

4. Create a Sample list for at least 5 words with ambiguous sense and Write a Python
     Program to implement WSD

5. Install NLTK tool kit and perform stemming

6. Create Sample list of at least 10 words POS tagging and find the POS for any given word

7. Write a Python program to
     a) Perform Morphological Analysis using NLTK library
     b) Generate n-grams using NLTK N-Grams library
     c) Implement N-Grams Smoothing

8. Using NLTK package to convert audio file to text and text file to audio files.

Text Books:
1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Oreilly Practical natural Language Processing, A Comprehensive Guide to Building Real World NLP Systems.
3. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

Reference Books:
1. Steven Bird, Ewan Klein and Edward Loper, ― Natural Language Processing with Python, First Edition, O'Reilly Media, 2009

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper – VII (B) DSC – B	**Deep Learning**	Theory	04	Internal	External
				20	80

UNIT - I

The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron–FF Neural, Networks–Types of Neurons –Soft max output layers. Tensor flow–Variables–Operations–Placeholders– Sessions–Sharing Variables – Graphs–Visualization.

UNIT – II

Convolution Neural Network – Feature Selection–Max Pooling- Full Architectural Description of Convolution Networks–Filters and Feature Maps–Convolution Layer–Applications.

UNIT- III

Embedding and Representation Learning- Learning Lower-Dimensional Representations, Principal Component Analysis, Implementing an Autoencoder in TensorFlow. Recurrent Neural Network – Memory cells–sequence analysis–lSTM— TensorFlow Primitives for RNN Model

UNIT – VI

Memory augmented Neural Networks–NTM- DNC—Application Reinforcement Learning –MDP–Q Learning– Applications.

TextBook:

1. Nikhil Buduma, Nicholas Locascio, ―Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms‖ O'Reilly Media, 2017.

Reference Books:

1. Lan Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive computation and Machine Learnings eries ‖,MITPress,2017.
2. Goodfellow, Ian, Deep Learning, MIT Press, 2016.
3. Gibson, Adam, and Patterson, Josh,Deep dearning: A Practitioner's Approach, O'Reilly, 2017.
4. Charniak, Eugene, Introduction to Deep Learning, MIT Press, 2019.
5. Locascio, Nicholas, and Buduma, Nikhil, Fundamentals of Deep Learning:
6. Designing Next-Generation Machine Intelligence Algorithms, O'Reilly Media, 2017.

Course Category	Title of the Paper	Hours Per Week		Marks	
Practical – 7 (B)	**Deep Learning Lab**	Practical	**03**	External	**25**

1. Identify various tools for Deep learning.
2. Installation of any open source Deep learning tool.
3. Searching of data sets on the web.
4. Implementation of various Deep learning algorithms based on syllabus of core subject.

B.Sc. (AI & ML)
Semester-VI

Course Category	Title of the Paper	Hours Per Week		Marks	
Paper VIII (Project)	**Project**	Practical	**04**	External	**100**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report need to be submitted to the University through the Head of the Department on or before the date fixed by the University. The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

Assessment / Evaluation / Viva voce:

1. PROJECT REPORT EVALUATION (Both Internal & External):

1.	Plan of the Project	20 Marks
2.	Execution of the Plan/collection of Data / Organization of Materials / Hypothesis, Testing etc. and presentation of the report.	45 Marks
3.	Individual initiative	15 Marks

2. Viva-Voce / Internal & External   20 Marks

Total: 100 Marks