B.Sc.

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

SYLLABUS

(Common core syllabus under CBCS)

With effect from the academic year: 2025-2026 and onwards

Accredited with 'A^{+}' by NAAC

DEPARTMENT OF COMPUTER SCIENCE

KAKATIYA UNIVERSITY

WARANGAL-506009,

TELANGANA

KAKATIYA UNIVERSITY, WARANGAL
Department Of Computer Science
B.Sc. PROGRAMME Under CBCS System
with effect from Academic Year: 2025 – 2026
B.Sc. (AI & ML)

YEAR/ Semester	Type of Course	Paper Title	Hrs Per Week T: Theory P: Practical	No. of Credits	Max. Marks		
					Intr. Marks	External marks	Total marks
I/I	DSC-1	Programming with C	4 (T)	4	20	80	125
	DSC-1	Programming with C (Lab)	2 (P)	1	--	25	
I/II	DSC-2	Object Oriented Programming using C++	4 (T)	4	20	80	125
	DSC-2	Object Oriented Programming using C++ Lab	2 (P)	1	--	25	
II/I	DSC-3	Problem Solving and Python Programming	4 (T)	4	20	80	125
	DSC-3	Problem Solving and Python Programming Lab	2 (P)	1	--	25	
II/II	DSC-4	Data Structures and Algorithm using Python	4 (T)	4	20	80	125
	DSC-4	Data Structures and Algorithm using Python Lab	2 (P)	1	--	25	

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

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 (DSC – B)	Object Oriented Programming Using C++	Theory	04	Internal	External
				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.

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

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

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.

Annexure – I (Credits)
Proposed CBCS Structure from 2025-26 for Under Graduate Courses

Courses		Papers	Total Credits	Credits for each paper / Semester						Credits for each paper / Semester						Credits for each paper / Semester					
				BA						B.Com.						B.Sc.					
				I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Core Courses DSC	Major-1	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Major -2	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
MIL/AEC (First Language)	English	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Second Language (Telugu, Hindi, Urdu, etc.)		4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Multi-Disciplinary Course	MDC 1	1	4	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4	-
Sec 1, 2		2	4					2	2					2	2					2	2
Sec 3, 4		2	4					2	2					2	2					2	2
Value added course (VAC)	VAC 1, 2	2	6	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3	3
Internships	Internship / Project	1	4	-	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4
Total Credits in each semester			142	25	25	25	25	21	21	25	25	25	25	21	21	25	25	25	25	21	21
Total Credits in UG				142						142						142					
Credits under Non-CGPA (Community engagement and service)		NSS /NCC /sports / Extra curricular	6	Upto 6 (2 in each year)						Upto 6 (2 in each year)						Upto 6 (2 in each year)					
		IKS	4	Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)					