Maulana Abul Kalam Azad University of Technology, WB
(Formerly known as West Bengal University of Technology)
Syllabus of B.Sc. in IT (Artificial Intelligence)
Effective from academic session 2023-24

SEMESTER 1

Course: Programming in C / Programming in C lab
Credits: 3+2
Course Code – BITAI101 & 191

COURSE OBJECTIVE: The objective of the course "Programming in C" is to equip students with fundamental programming skills using the C programming language and foster a problem- solving mindset. Throughout the course, students will develop a solid foundation in computer programming concepts and techniques, enabling them to tackle real-world problems and develop efficient, structured, and modular solutions.

COURSE OUTCOME

CO1	Apply programming constructs of C language to solve the real world problem
CO2	To implement conditional branching, iteration and recursion
CO3	Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting
CO4	Explore user-defined data structures like structures, unions and pointers in implementing solutions
CO5	Create problem-solving solutions utilizing modular programming elements and functions.
CO6	Use files to store information after solving the problem related to the real world

Module 1: Introduction to Principles of programming Introduction to Programming, Programming Languages: Machine Level Languages, Assembly Level Languages and High Level Languages. Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, Hexadecimal Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

Module 2: Conditional Control Statements
Bitwise Operators, Relational and Logical Operators, If, If- Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break

and Goto statements Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions.. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

Module 3: Preprocessors, Arrays, Pointers

Preprocessor Commands Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, Lvalue and Rvalue, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command Line Arguments.

Module 4: Strings

Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions.

Module 5: Functions

Function Basics, Function Prototypes, and Passing Parameters: Passing Parameter by value and Passing Parameter by reference, passing string to function, Passing array to function, Structures and Functions Recursion

Module 6: Structures and File

Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types. Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/Output Functions, Character Input/Output Functions.

Module 7: Recursion

Developing Recursive Definition of Simple Problems and their implementation, Advantages and Limitations of Recursion, Understanding what goes behind Recursion (Internal Stack Implementation)

Module 8: Storage Classes: Storage Classes and Visibility, Automatic or local variables, Global variables, Staticvariables, External variables

Module 9: Dynamic Memory Allocation: Dynamic Memory Allocation, Allocating Memory with malloc, Allocating Memory with calloc, Freeing Memory, Reallocating Memory Blocks

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Course: Introduction to Artificial Intelligence
Credits: 3+2
Course Code -BITAI102 & 192

COURSE OBJECTIVE: The objective of the course "Introduction to Artificial Intelligence" is to enable computers to perform such intellectual tasks as decision making, problem solving, perception, understanding human communication

COURSE OUTCOME

CO1	Understand the theory of Artificial intelligence
CO2	Understand the Knowledge representation issues and concept learning.
CO3	Interpret the modern view of AI as the study of agents that receive percepts from the environment and perform actions
CO4	Build awareness of AI facing major challenges and the complexity of typical problems within the field
CO5	Assess critically the techniques presented and apply them to real world problems. Develop self-learning and research skills to tackle a topic of interest on his/her own or as part of a team.

Module 1: Introduction
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Module 2: Search and Techniques
Search techniques : Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Module 3: Heuristic search strategies :
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Module 4: Adversarial search:
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta

pruning, additional refinements, iterative deepening. Knowledge & reasoning Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Module 5:
Using predicate logic Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Module 6: Probabilistic reasoning
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics. Planning [2] Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. Natural Language processing :Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning : Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. Expert Systems Representing and using domain knowledge, expert system shells, knowledge acquisition.

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SEMESTER 2

Course: Data Structure and Algorithm and Data Structure and Algorithm Lab
Credits: 3T + 2 P
Course Code -BITAI201 & 291

COURSE OBJECTIVE: The objective of the course "Data Structure and Algorithm" is to give you a vibe for algorithms and data structures as a focal area of what it is to be a computer science student. You ought to know about the way that there are regularly a few calculations for some issue, and one calculation might be superior to another, or one calculation better in certain conditions and another better in others. You should have some idea of how to work out the efficiency of an algorithm. You will be able to use and design linked data structures. You will learn why it is good programming style to hide the details of a data structure within an abstract data type. You should have some idea of how to implement various algorithm using python programming.

COURSE OUTCOME

CO1	Understand fundamentals of data structures and their applications essential for programming/problem solving.
CO2	Apply linear Data Structures: Stack, Queues and Recursion.
CO3	Apply linear data structures: Linked lists.
CO4	Apply Non-linear data structures: Trees and Graphs
CO5	Understand the concepts of Hashing, Files and their organization and sorting algorithms.

Module 1: Introduction
Introduction to data structure, Abstract data type.

Module 2: Arrays
1D, 2D and Multi-dimensional Arrays, Sparse Matrices. Polynomial representation.

Module 3: Linked List
Singly, Doubly and Circular Lists, Normal and Circular representation of Self Organizing Lists, Skip Lists, Polynomial representation.

Module 4: Stack

Implementing single / multiple stack/s in an Array, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another, Applications of stack, Limitations of Array representation of stack.

Module 5: Queues

Array and Linked representation of Queue, Circular Queue, De-queue, Priority Queues.

Module 6: Recursion

Developing Recursive Definition of Simple Problems and their implementation, Advantages and Limitations of Recursion, Understanding what goes behind Recursion (Internal Stack Implementation)

Module 7: Trees

Introduction to Tree as a data structure, Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals of Binary Search Trees), Threaded Binary Trees (Insertion, Deletion, Traversals), Height-Balanced Trees (Various operations on AVL Trees).**Module 4:**

Module 8: Searching and Sorting

Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Merge Sort, Quick sort, Shell Sort, Comparison of Sorting Techniques

Module 9: Hashing

Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collision by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function.

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Course: Machine Learning
Credits: 4T + 1TL
Course Code -BITAI202

COURSE OBJECTIVE: The objective of the course "Machine Learning" is to compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach. Analyse various machine learning approaches and paradigms.

COURSE OUTCOME

CO1	Understand the basic concepts of regression analysis, supervised and unsupervised machine learning algorithms
CO2	Apply the learned concepts of machine learning to interpret the various problems
CO3	Analyze the different mathematical machine learning models for various systems
CO4	Evaluate the performance of the machine learning model using measuring parameters
CO5	Create the efficient machine learning system to solve the various real time problems

Module 1:
Supervised Learning (Regression/Classification) Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods ,Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

Module 2:
Unsupervised Learning, Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion,Generative Models (mixture models and latent factor models).

Module 3:
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

Module 4:
Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

Module 5:
Scalable Machine Learning (Online and Distributed Learning),A selection from some other advanced topics, e.g., Semi-supervised Learning,Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.