North Bengal St. Xavier's College
Department of Computer Science & Application
LESSON PLAN session 2024-2025

Session: 2024-25

Teacher:	**Partha S Dutta**	Designation:	**Assistant Professor**
Semester	**1st**	Course	**BCA [SEC]**
Lesson Type	**Theory + Practical**	Paper:	**Basic Programming in Python**
Lectures	**30 TH + 30 LAB**	Teaching Method:	**Chalk & Talk, PPT,LAB**

Learning Objectives

- The course is designed to introduce programming concepts using Python to students.
- The course aims to develop structured as well as object-oriented programming skills using Python.
- The course also aims to achieve competence amongst its students to develop correct and efficient Python programs to solve problems in their respective domains.

Month	Week	Topics
July	Week 1	Brief History of Python, Python Versions, Installing Python, Environment Variables Introduction to Python and installation: Beginning with Python programming: Why to use Python: Working with Python
	Week 2	Getting Help,Dynamic,Types,Python Reserved Words,Naming Conventions .Data types in Python and Practical for some basic programme.
	Week 3	Basic Syntax,Comments,StringValues,String Operator
	Week 4	String Methods, The format Method, Numeric Data Types, Conversion Functions
	Week 5	Simple Output,Simple Input, The % Method,The print Function
August	Week 1	Indenting Requirements,The if Statement. Practical to perform simple programme.
	Week 2	Different Types of operators in Python.
	Week 3	The while Loop, For loop. Practical to perform simple programme.
	Week 4	Stack and queue implementation in python
September	Week 5	break and continue statement
	Week 1	Lists and Methods
	Week 2	Tuples and different methods with example
	Week 3	Dictionary and Sorting Dictionaries
	Week 4	Lab Practice for different problem.
	Week 1	Introduction,Defining Your Own Functions,Parameters, Variable Number of Arguments Scope

November	Week 2	Function Documentation, Keyword and Optional Parameters Passing Collections to a Function, Lambda, Inner Functions
	Week 3	Errors, Runtime Errors, The Exception Model, Exception Hierarchy
	Week 4	Revision Sessions of Theory and LAB

OUTCOMES:

On completion of this course students will be able to develop the emerging applications of relevant field using Python.

Session: 2024-25

Teacher:	**Partha S Dutta**	Designation:	**Assistant Professor**
Semester	**3rd**	Course	**BCA**
Lesson Type	**Theory + Practical**	Paper:	**Data Structure through C**
Lectures	**30 TH + 30 LAB**	Teaching Method:	**Chalk & Talk, PPT,LAB**

Course Objectives:

1. Allow to assess how the choice of data structures and algorithm design methods impacts the performance of programs

2. To choose the appropriate data structure and algorithm design method for a specified application.

3. To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.

4. To efficiently implement the different data structures and solutions for specific problems

Month	Week	Topics
July	Week 1	Introduction: Elementary data organization, Data Structure definition, Data type vs. data structure, Categories of data structures
	Week 2	Data structure operations, Applications of data structures, Algorithms complexity and time-space tradeoff, Big-O notation
	Week 3	Strings: Introduction, strings, String operations, Pattern matching algorithms
	Week 4	Arrays: Introduction, Linear arrays, Representation of linear array in memory
	Week 5	Array Traversal, Insertions, Deletion in an array, Multidimensional arrays, Parallel arrays, Sparse matrix
August	Week 1	Linked List: Introduction, Array vs. linked list, Representation of linked lists in memory, Traversal, Insertion
	Week 2	Garbage collection, Applications of linked lists. Algorithm of insertion/ deletion in SLL
	Week 3	Stack: primitive operation on stack, algorithms for push and pop. Representation of Stack as Linked List and array

	Week 4	Stacks applications : polish notation, recursion
September	Week 5	Introduction to queues, Primitive Operations on the Queues, Circular queue, Priority queue
	Week 1	Representation of Queues as Linked List and array, Applications of queue
	Week 2	Algorithm on insertion and deletion in simple queue and circular queue
	Week 3	Trees - Basic Terminology, representation, Binary Trees, Tree Representations using Array & Linked List
	Week 4	Basic operation on Binary tree, Traversal of binary trees: Inorder, Preorder &postorder, Applications of Binary tree
November	Week 1	Algorithm of tree traversal with and without recursion
	Week 2	Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs
	Week 3	Revision Sessions of Theory
	Week 4	Revision Sessions of LAB

Course Outcomes: At the end of this course student will:

CO1) Analyze the concepts of algorithm evaluation and find time and space complexities for searching and sorting algorithms.
CO2) Implement linear data structure such as stacks, queues, linked lists and their applications.
CO3) Implement basic operations on binary trees
CO4) Demonstrate the representation and traversal techniques of graphs and their applications

Name of the Teacher: PARTHA SARATHI DUTTA
Designation: Assistant Professor
Course: Computer Science(H)&BCA (H)
Semester: VPaper: DSE54-E3 [Numerical Methods]
Lesson Type: Theory Duration: 1 Hour

Unit/Topics Covered	**Course Objective**	**Teaching Method**	**Expected learning outcome**
Unit 1: Introduction	This course enables the students to understand the basic concepts of numerical methods and will discuss the different technique to solve linear equations.	Lecture method along with Black board will be used. Teacher will also use power point presentation.	On successful completion of the course, students will be able to develop and apply the appropriate numerical techniques for the problem, interpret the results, and assess accuracy.
Unit 2: Iterative methods	This course enables the students to understand the basic concepts of iterative method to solve linear equation.	Lecture method along with Black board will be used. Teacher will also use power point presentation.	On successful completion of the course, students will be able to develop and apply the appropriate iterative technique to solve linear simultaneous equations.

Unit 3: Interpolation	This course enables the students to understand the basic concepts of interpolation.	Lecture method along with Black board will be used. Teacher will also use power point presentation.	On successful completion of the course, students will be able to develop and apply the appropriate Interpolation technique to solve the given Problem.
Unit 4: Numerical integration	This course enables the students to understand the basic concepts of Numerical integration.	Lecture method along with Black board will be used.	On successful completion of the course, students will be able to understand the basics of Numerical Integration like Trapezoid rule, Simpson's rule.
Unit 5: Extrapolation methods	This course enables the students to understand the basic concepts of Numerical differentiation.	Lecture method along with Black board will be used. Teacher will also use power point presentation.	On successful completion of the course, students will be able to understand the basics of Numerical Differentiation and numerical solutions of ordinary differential equations.
Unit 6: Eigen- values & Eigen- vectors	This course enables the students to understand the basic concepts of Eigen values and Eigen vectors.	Lecture method along with Black board will be used.	On successful completion of the course, students will be able to find the eigen values &Eigen vectors of the given problem.
Unit 7: Fitting	This course enables the students to understand the basic concepts of different curve fitting techniques.	Lecture method along with Black board will be used. Teacher will also use power point presentation.	On successful completion of the course, students will be able to apply different curve fitting techniques to solve the problem.

Name of the Teacher: PARTHA
SARATHI DUTTA Designation: Assistant
Professor
Course: Computer Science (H) &BCA (H)
Semester:
VPaper: DSE54L-E3 [Numerical Methods]
Lesson Type: LAB Duration: 2Hour

Course Objectives

This course enables the students

- To solve simultaneous linear algebraic using various methods.
- To evaluate definite integrals using numerical integration
- To know problem- solving through (computer language)programming.

Course Outcomes

On successful completion of the course, students will be able to

1. Familiarize with the programming environment for numerical methods.
2. Develop proficiency skills to solve the algebraic equations.
3. Evaluate the definite integrals using computer programming techniques.

List of Practical (Using MATLAB/SCILAB/MAPLE)

1. Solution of simultaneous linear algebraic equations- Gauss Elimination Method
2. Solution of simultaneous linear algebraic equations- Gauss Jordan Method
3. Solution of simultaneous linear algebraic equations- Gauss Jacobi Method
4. Solution of simultaneous linear algebraic equations- Gauss SeidalMethod
5. Computing Lagrange’s interpolating polynomial
6. Computing Newton’s interpolating polynomial
7. Numerical Integration – Simpson’s one third rule
8. Numerical Integration – Simpson’s three eight rule
9. Numerical Integration – Trapezoidal rule
10. Solution for ordinary differential equation-Euler method.
11. Solution for ordinary differential equation- Runge Kutta Second order.
12. Find the roots of the equation by bisection method.
13. Find the roots of the equation by Regula−Falsi method.
14. Find the roots of the equation by Newton’s method.
    a. Find the solution of a system of nonlinear equation using Newton’s method.

Session: 2024-25

Teacher:	**Partha S Dutta**	Designation:	**Assistant Professor**
Semester	**2nd**	Course	**B.Sc(Computer Sc.)**

Lesson Type	**Theory**	Paper:	**Discrete Structures (MAJ3)**
Lectures	**45 Lectures**	Teaching Method:	**Chalk & Talk, PPT**

Course objective:

This course will discuss fundamental concepts and tools in discrete mathematics with emphasis on their applications to computer science. Topics include logic and Boolean circuits, sets, functions, relations, deterministic algorithms and randomized algor ithms, analysis techniques based on counting methods and recurrence relations, trees and graphs.

Month	Week	Topics
January	Week 1	Set Theory: Basic Set Theory, Operations on Sets, Algebra of Sets, Venn Diagrams. Mathematical induction
	Week2	Relations: Binary Relations, Complement of Relations, Inverse of Relations.
	Week 3	Composite Relations, Properties, Equivalence, Partial Order and Total Order relations.
	Week 4	Functions: Functions on Set, Domain, Co-Domain, Representation of Functions.
February	Week 1	Types of Functions, Identity and Inverse of Functions, Composition of Functions, Inclusion-Exclusion Principle
	Week2	Propositional Calculus: Propositional Logic, Equivalences, Predicates.
	Week 3	Rules of Inference , Normal Forms, Proofs Methods, Strategy.
	Week 4	Counting: Pigeonhole Principle, Inclusion –Exclusion Principle, Permutations and Combinations, Binomial Coefficients, Counting Principles.
March	Week 1	Counting Techniques: Recurrences Relations, solving Recurrence Relations.
	Week2	Recurrence Relations, Solution of Recurrence Relations by method of Generating Function.
	Week 3	Asymptotic notations, Summation formulas and properties.
	Week 4	Graphs: Introduction, Terminology, Types of Graphs, Representation of Graphs
April	Week 1	Paths and Circuits, Cut-set and Cut-Vertices, Graph Isomorphism, Homomorphism.
	Week2	Connectivity, Bipartite Graphs, Subgraphs, Operations on Graphs.
	Week 3	Euler and Hamiltonian Graphs, Shortest Path Problem.
	Week 4	Planer and Dual Graphs, Graph Coloring.
May	Week 1	Tree: Tree Notations, Properties of Tree, Types of Tree Operations, Minimum Spanning Tree(MST).
	Week 2	Graph Traversal Technique (BFS and DFS)
	Week 3	Revision
	Week 4	Revision

Learning Outcomes:

After completion of the course students are expected to be able to:

1. Analyze logical propositions via truth tables.
2. Prove mathematical theorems using mathematical induction.

3. Understand sets and perform operations and algebra on sets.
4. Determine properties of relations, identify equivalence and partial order relations, sketch relations.
5. Identify functions and determine their properties.
6. Define graphs, digraphs and trees, and identify their main properties
7. Evaluate combinations and permutations on sets.

Name of the Teacher: PARTHA SARATHI DUTTA Designation: Assistant Professor
Course: Computer Science (H)
Semester: VI Paper: CC62 [Computer Graphics]
Lesson Type: Theory Duration: 1 Hour

Unit/Topics Covered	**Course Objective**	**Teaching Method**	**Expected learning outcome**
Unit 1: Introduction	This course presents an introduction to computer graphics designed to give the student an overview of fundamental principles.	Lecture method along with power point presentation	Upon completion of the course, students will be able to have a knowledge and understanding of the structure of an interactive computer graphics system, and their application.
Unit 2: Graphics Hardware	This course makes the student to understand about the video and raster scan displays and their storage. Also to make the student to understand the usage of input/output devices and its working	Lecture method along with power point presentation	Upon completion of the course, students will be able to have knowledge about the architecture of display unit and different input/ouput devices used in computer graphics.
Unit 3: Fundamental Techniques in Graphics	The course objective relies on the student to understand the line algorithm and 2D,3D Geometrical transformation. Also to make the student to understand the concept of clipping algorithm and projection.	Lecture method along with Black board will be used. Teacher will also use power point presentation	Upon completion of the course, students will be able to have a knowledge and understanding of geometrical transformations and 2D viewing, representing 3D geometrical objects and understanding of the various clipping algorithms
Unit 4: Geometric Modelling	The course objective relies on the student to understand the concept of method of Modelling.	Lecture method along with Black board will be used. Teacher will also use power point presentation	Upon completion of the course, students will be able to create interactive graphics applications using different modeling techniques.
Unit 5: Visible Surface determination	The course objective relies on the student to understand the concept of hidden-surface removal.	Lecture method along with power point presentation	Upon completion of the course, students will be able to have knowledge and understanding various visible surface detection algorithms.

Unit 6: Surface rendering	In this course the student will know about the concept of shading, illumination, and shadows .Also basic colour models and animation will be discussed.	Lecture method along with power point presentation	Upon completion of the course, students will be able to have a knowledge and understanding about shading technique, different colour model and computer animation.

Name of the Teacher: PARTHA SARATHI DUTTA Designation: Assistant Professor
Course: ComputerScience (H)
Semester: VIPaper: CC62L [Computer Graphics]
LessonType:LABDuration: 2Hour

Course Objectives

• To describe characteristics and functioning of common graphics input/output devices

• To learn the basic principles of 3- dimensional computer graphics

• ToProvideanunderstandingofhowtoscanconvertthebasicgeometricalprimitives,howtotransformthe shapes to fit them as per the picture definition

• To provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

Course Outcomes

- List the basic concepts used in computer graphics.
- Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
- Describe the importance of viewing and projections.

List of Programs

1. Write a program to implement Bresenham‘s line drawing algorithm.
2. Write a program to implement mid-point circle drawing algorithm.
3. Write a program to clip a line using Cohen and Sutherland line clipping algorithm.
4. Write a program to clip a polygon using Sutherland Hodgeman algorithm.
5. Write a program to apply various 2D transformations on a 2D object (use homogenous coordinates).
6. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.
7. Write a program to draw Hermite/Bezier curve.

Name of the Teacher: PARTHA SARATHI DUTTA Designation: Assistant Professor
Course: Computer Science (H)& BCA (H)Semester: VIPaper: DSE64P [Project]
LessonType: Project Duration: 2Hour

Course Objectives

The main objective of this project course is to provide learners a platform to demonstrate their practical and theoretical skills gained during the last semesters of study in their course. During project development studentsare expected to define a project problem, do requirements analysis, systems design, software development, apply testing strategies and do documentation with an overall emphasis on the development of a robust, efficient and reliable software systems. Students are encouraged to spend maximum time of the sixth semester working on a project. Topics selected should be complex and large enough to justify as final semester project. The courses studied by the students during the BCA/Computer science Programme provide them the comprehensive background knowledge on diverse subject areas in computer science such as computer programming, data structure, DBMS, Computer Organization, SAD, Software Engineering, Computer Networks etc., which will be helping students in doing project work.

Course Outcomes

Upon successful completion of the course, students will be able to:

- Know develop the software project.
- Learn developing methodology of software project.
- Understand tools and techniques of developing software.
- Learn critical thinking skills and inquiring skills through application-oriented project development inComputer science & Application in a team-work environment.
- Learn problem solving skills.
- Learn to develop skills to initiate an application-oriented project in the areas of Computer science& Application.

Name of the Teacher: Partha Sarathi Dutta
Designation: Assistant Professor
Course: BCA (H)Semester: VI
Paper: CC14 [Design and Analysis of Algorithm]
Lesson Type: Theory Duration: 1 Hour

Unit/Topics Covered	**Course Objective**	**Teaching Method**	**Expected learning outcome**
Unit 1: Introduction (5 Lectures)	This course will prepare the students to develop the idea about the concept of Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm	Lecture method along with power point presentation.	The successful completion of this lesson will enable the students to understand how to design and analyses an algorithm

Unit 2: Algorithm DesignTechniques (8 Lectures)	This course will prepare the students to develop the idea about the conceptof different techniques of algorithm like Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms	Lecture method along with power point presentation	The successful completion of this lesson will enable the students to know about different algorithm technique.
Unit 3: Sorting and Searching Techniques (20 Lectures)	This course will prepare the students to develop the idea about different sorting and searching method Elementary sorting techniques, Advanced Sorting techniques, Sorting in Linear Time Searching Techniques, Medians & Order Statistics, complexity analysis.	Lecture method along with power point presentation Laboratory work.	Upon the successful completion of this lesson Students will be able to implement different sorting and searching technique.
Unit 4: Lower BoundingTechniques (5 Lectures)	This course will prepare the students to develop the idea about Decision Trees and finding its complexity	Lecture method along with power point presentation Laboratory work.	Upon the successful completion of this lesson Studentswillbeabletowrite algorithm and implement the logic for decision tree.
Unit 5: Balanced Trees (7 Lectures)	This course will prepare the students to develop the idea about Red-Black Trees, how is it different from an AVL tree, its properties and the operation on Red black tree	Lecture method along with power point presentation Laboratory work.	Upon the successful completion of this lesson Students will be able to write C programs for creating a Redblack tree.

Unit 6: Advanced Analysi sTechnique (5 Lectures)	This course will prepare the students to develop the idea about Amortized analysis where the student will analyze a sequence of operations and guarantee a worst case average time which is lower than the worst case time of a particular expensive operation.	Lecture method along with power point presentation Laboratory work.	After learning this topic the student will You understand amortized analysis : aggregate, accounting, potential methods
Unit 7: Graphs (5 Lectures)	This course will prepare the students to develop the idea about Graph Algorithms such as Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees.	Lecture method along with power point presentation Laboratory work.	The students will be able to know how to : • represent graphs using data structures • matrices and graphs duality • design algorithms that operate on graphs • traverse graphs using DFS & BFS Construct the minimum spanning tree
Unit 8: String Processin g(5Lectures)	This course will prepare the students to develop the idea about string Matching algorithm like KMP Technique	Lecture method along with power point presentation Laboratory work.	The students will be able to know how to implement the string matching algorithm KMP. And also the Students will be able to select a proper pattern matching algorithm for given problem.

Name of the Teacher: Partha Sarathi Dutta
Designation: Assistant Professor
Course: BCA (H)Semester: VI
Paper: CC14 [Design and Analysis of Algorithm]
Lesson Type: Lab Duration: 2Hours

Course objectives:

1. Reinforce basic design concepts (e.g., pseudo code, specifications, top-down design)
2. Knowledge of algorithm design strategies
3. Familiarity with an assortment of important algorithms
4. Ability to analyze time and space complexity

Learning Outcomes:

Students who have completed this course should be able to

1. Apply design principles and concepts to algorithm design
2. Have the mathematical foundation in analysis of algorithms
3. Understand different algorithmic design strategies
4. Analyze the efficiency of algorithms using time and space complexity theory

List of practical performed:

1. Implement Insertion Sort (The program should report the number of comparisons)
2. Implement Merge Sort (The program should report the number of comparisons)
3. Implement Heap Sort (The program should report the number of comparisons)
4. Implement Randomized Quick sort (The program should report the number of comparisons)
5. Implement Radix Sort
6. Create a Red-Black Tree and perform following operations on it:

   Insert a node
   Delete a node
   Search for a number & also report the color of the node containing this number.

7. Write a program to determine the LCS of two given sequences
8. Implement Breadth-First Search in a graph
9. Implement Depth-First Search in a graph
10. Write a program to determine the minimum spanning tree of a graph
11. For the algorithms at S.No 1 to 3 tests run the algorithm on 100 different inputs of sizes varying from 30 to 1000. Countthe number of comparisons and draw the graph. Compare it with a graph of $n\log n$.