# ACHARYA PRAFULLA CHANDRA COLLEGE

**NEW BARRACKPORE**

**B.Sc. (HONS)COMPUTER SCIENCE (HONS)**

**COURSE SPECIFIC OUTCOME (CBCS)**

**Semester – I**

| Course | Course prerequisite | Expected outcome |
|---|---|---|
| **CORE**<br><br>**CMSACOR01T: Programming Fundamental using C/C++ (THEORY)** | Elementary concepts on Algorithms and Programming. | 1. To learn how to implement object-oriented designs, stand-alone Java applications, exception handling, applications with threads, read and write files.<br>2. Students will be able to write independently C++ program using classes, Function and Operator Overloading, Inheritance, Polymorphism and Exception Handler in real world application. |
| **CMSACOR01P: Programming Fundamental using C/C++ (PRACTICAL)** | Elementary concepts on Programming. | Hands-on experience on C++ through practical sessions. |
| **CORE**<br><br>**CMSACOR02T: Computer System Architecture (THEORY)** | Basic Mathematics and Elementary concepts on Programming. | 1. Students will be able to understand and apply number systems, instruction sets, addressing modes, and data/instruction formats for designing and implementing computer-based system.<br>2. Students will be able to write program using assembly language for a variety of applications.<br>3. Students will be able to design independently control unit for a small instruction set.<br>4. Students will be able to learn different memory technologies and design memory organization and familiar with input and output organization techniques for a computing system. |
| **CMSACOR02P: Computer System Architecture (PRACTICAL)** | Elementary concepts on Programming. | Hands-on experience on Digital Design and Assembly Language Program through practical sessions. |

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**Semester – II**

| Course | Course prerequisite | Expected outcome |
|---|---|---|
| **CORE**<br><br>**CMSACOR03T: Programming in Java (THEORY)** | Basics of using a computer, knowledge of basic command line shell and introduction to Programming is strongly recommended. | 1. To learn how to implement object-oriented designs, stand-alone Java applications, exception handling, applications with threads, read and write files.<br>2. To learn how to implement graphical user interface (GUI) and web applications. |
| **CMSACOR03P: Programming in Java (PRACTICAL)** | Elementary concepts on Programming. | Hands-on experience on different object-oriented problems through practical sessions using Java. |
| **CORE**<br><br>**CMSACOR04T: Discrete Structure (THEORY)** | Foundations on basic mathematics (Algebra & Set Theory) | 1. To perform computations on members of sets, makes association between the members of the set.<br>2. To learn many special types of relation and function, counting to determine the complexity of algorithm, the relationship between sequences and recurrence relations, the recurrence relations by iteration, homogeneous recurrence relations and understand how to solve them.<br>3. To solve the problems using basic graph theory, determine whether graphs are Hamiltonian and/or Eulerian, solve problems related to vertex and edge connectivity and planarity, solve problems involving vertex and edge colouring, model real world problems using graph theory, propositional logic for determining validity of Arguments. |

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**Semester – III**

| Course | Course prerequisite | Expected outcome |
|---|---|---|
| **CORE**<br><br>**CMSACOR05T: Data Structure (THEORY)** | Basic concepts on Discrete Mathematics and Elementary concepts on Programming | 1. Students will be able to familiar with the concepts of Data Objects, Abstract Data Type (ADT), Data Structure, Data Types and how to use these in real world problems.<br>2. Students will be able to design programs independently using a variety of data structures like arrays, linked list, stacks, queues, recursion and binary trees etc.<br>3. Students will be able to design programs independently using a variety of data structures like binary search trees, hash tables etc.<br>4. Students will be able to analyse and implement various kinds of searching and sorting techniques. |
| **CMSACOR05P: Data Structure (PRACTICAL)** | Elementary concepts on Programming with C/C++. | Hands-on experience on Data Structure through practical sessions using C++. |
| **CORE**<br><br>**CMSACOR06T: Operating System (THEORY)** | Concepts on Digital Design, Computer Organizationand Architecture | 1. Students will be able to familiar with the important computer system resources and the role of operating system in their management policies and algorithms.<br>2. Students will be able to understand the process management policies and scheduling of processes by CPU and evaluate the requirement for Process synchronization and coordination handled by operating system.<br>3. Students will be able to analyse and apply different memory management techniques and its allocation policies.<br>4. Students will be able to learn the basic concepts of File and I/O management and various issues regarding protection and security aspects. |
| **CMSACOR06P: Operating System (PRACTICAL)** | Programming with C/C++. | Hands-on experience on operating systems through practical sessions. |

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| **CORE**<br><br>**CMSACOR07T: Computer Networks (THEORY)** | Basic concepts on Computer Organization and Operating Systems | 1. Students will be able to learn fundamentals of data communication and the basic concepts on network layered architecture.<br>2. Students will be able to learn the various Data Link layer design issues and Data Link protocols.<br>3. Students will be able to learn the important aspects and functions of network layer, transport layer and application layer in internetworking. |
| **CMSACOR07P: Computer Networks (PRATICAL)** | Knowledge of Programming with C. | 1. Hands-on experience on networking fundamentals through practical sessions (ns2 Simulator). |
| **SKILL ENHANCEMENT COURSE (SEC1)**<br><br>**CMSSSEC01M: Programming in Python** | Elementary Concepts on C++/JAVA and Shell Scripts. | 1. Students will be able to understand why Python is a useful scripting language for developers.<br>2. Students will be able to learn knowledge of syntax, variable declarations, control structures, loop constructs and understand modules in Python.<br>3. Students will be able to learn how to use lists, tuples, and dictionaries, how to identify Python object types, how to use indexing and slicing to access data, how to define the structure and components of a Python program, how to write functions and pass arguments in Python, how to build and package Python modules for reusability, how to read and write files in Python, how to design object-oriented programs with Python classes and how to use class inheritance in Python for reusability. |

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**Semester – IV**

| Course | Course prerequisite | Expected outcome |
|---|---|---|
| **CORE**<br><br>**CMSACOR08T: Design & Analysis of Algorithm (THEORY)** | Introduction to proofs, and discrete mathematics and probability. Basic Data structure knowledge. | 1. Understanding the concepts of time and space complexity, worst case, average caseand best-case complexities and the big-Onotation.<br>2. Apply design principles and concepts toalgorithm design.<br>3. Have the mathematical foundation inanalysis of algorithms.<br>4. Understand different algorithmic designstrategies.<br>5. Analyze the efficiency of algorithms usingtime and space complexity theory. |
| **CMSACOR08P: Design & Analysis of Algorithm (PRACTICAL)** | Programming knowledgewithC/C++. | 1. Hands-on experience on Implementation of different algorithms through practical sessions using C/C++ programming |
| **CORE**<br><br>**CMSACOR09T: Software Engineering (THEORY)** | Foundation on Programming (Problem Solving) and Concepts on Data Structure and Algorithms. | 1. Understand the software life cycle models and software development process. Elicit, analyze and specify software requirements through a productive working Relationship with project stakeholders. Understand the concept of Software Design and emphasizing upon various software metrics used for analyzing the software.<br>2. Demonstrate various testing methodologies and debugging tools for prototype software. Design various software reliability measures to assess the quality of software in case of various faults and failures. Adaptation of Software maintenance and emerging trends in software engineering. Develop correct and robust software products. |

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| **CMSACOR09P: Software Engineering (PRACTICAL)** | Basic Concepts on Programming. | 1. Ability to analysis and design of complex systems and meet ethical standards, legal responsibilities.<br>2. Ability to apply software engineering principles, techniques and develop, maintain, evaluate large-scale software systems.<br>3. Ability to work as an effective member or leader ofsoftware engineering teams and manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals. |
| **CORE**<br><br>**CMSACOR10T: DBMS (THEORY)** | Basic Concepts on Discrete Mathematics and Data Structures. | 1. Understand the fundamental elements of relational database management systems, concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.<br>2. Represent simple database application scenarios, Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.<br>3. Improve the database design by normalization.Familiar with basic database storage structures and access techniques. |
| **CMSACOR10P: DBMS (PRACTICAL)** | Elementary concepts in Programming. | Hands-on experience on SQL Commands through practical sessions using standard DBMS. |
| **SKILL ENHANCEMENT COURSE (SEC2)**<br><br>**CMSSSEC02M: R Programming** | Basic Concepts on Mathematics, Statistics and Programming. | 1. Understand the basics in R programming in terms of constructs, control statements, string functions. Learn to apply R programming for Text processing.<br>2. Understand the use of R for Big Data analytics. Able to appreciate and apply the R programming from a statistical perspective. Explore data-sets to create testable hypotheses and identify appropriate statistical tests. |

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**Semester – V**

| Course | Course prerequisite | Expected outcome |
|---|---|---|
| **CORE**<br><br>**CMSACOR11T: Internet Technology (THEORY)** | Basics knowledge of networking and using of internet, website. | 1. To learn how to create static and dynamic webpage.<br>2. To learn how to implement java script, JSP, JDBC and java bean to create webpage. |
| **CMSACOR11P: Internet Technology (PRACTICAL)** | Elementary concept on programming | 1. Students are able to develop a dynamic webpage by the use of java script andDHTML.<br>2. Students will be able to write a well-formed / valid XML document.<br>3. Students will be able to connect a java program to a DBMS and perform insert,update and delete operations on DBMS table.<br>4. Students will be able to write a server-side java application called Servlet to catchform data sent from client, process it and store it on database.<br>5. Students will be able to write a server-side java application called JSP to catch formdata sent from client and store it on database. |
| **CORE**<br><br>**CMSACOR12T: Theory of Computation (THEORY)** | Basic concepts on Discrete Mathematics, Graph Theory and Elementary Concepts on Data Structures. | 1. To use basic concepts of formal languages of finite automata techniques.<br>2. To Design Finite Automata for different Regular Expressions and Languages.<br>3. To Construct context free grammar for various languages.<br>4. To solve various problems of applying normal form techniques, push down automata and Turing Machines. |
| **Discipline Specific Elective (DSE)**<br><br>**CMSADSE01T: Microprocessor (THEORY)** | Computer Organization, Basic understanding of microprocessor 8085. | 1. Define the history of microprocessors.<br>2. Describe the architectures of 8085 and 8086 microprocessors.<br>3. Write programs using 8086 &Interface peripherals to 8086.<br>4. Evaluate the appropriateness of a memory expansion interface based on the address reference with particular application.<br>5. Apply the above concepts to real world problems and applications. |

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| **CMSADSE01P:Microprocessor (PRACTICAL)** | Basic concepts of writing ALP | Hands-on experience on Assembly Language Programs in 8086 through practical sessions using 8086 Simulator. |
| **Discipline Specific Elective (DSE)**<br><br>**CMSADSE02T: Data Mining (THEORY)** | Basic understanding of Statistics, Probability and Linear Algebra and elementary concepts in design and analysis of algorithm | 1. Implement classical models and algorithms in data mining.<br>2. Acquire the knowledge to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.<br>3. Able to compare and contrast different conceptions of data mining.<br>4. Able to characterize the kinds of patterns that can be discovered by association rule mining, classification, and clustering. |
| **CMSADSE02P: Data Mining (PRACTICAL)** | Elementary concepts on programming and Database Management System. | Hands-on experience on patterns characterization using different data mining approaches. |
| **Discipline Specific Elective (DSE)**<br><br>**CMSADSE03T: Cloud Computing (THEORY)** | Basic concepts on Computer Networks, Distributed Computing and Computer Organization and Architecture. | 1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.<br>2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.<br>3. Explain the core issues of cloud computing such as security, privacy, and interoperability.<br>4. Choose the appropriate technologies, algorithms, and approaches for the related issues.<br>5. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.<br>6. Provide the appropriate cloud computing solutions and recommendations according to the applications used. |
| **CMSADSE03P: Cloud Computing (PRACTICAL)** | Concepts on Web Application Development and Database Management System | Adapt different types of virtualizations and increase resource utilization, build a private cloud using open-source technologies, analyze security issues on cloud and develop real world web applications and deploy on commercial cloud. |

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**Semester – VI**

| Course | Course prerequisite | Expected outcome |
|---|---|---|
| **CORE**<br><br>**CMSACOR13T: Artificial Intelligence (THEORY)** | Basic concept on Linear algebra, Calculus, basic Probability theory and elementary concept on automata theory | 1. Understanding the history of artificial intelligence (AI) and its foundations.<br>2. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.<br>3. Apply these techniques in applications which involve perception, reasoning, and learning.<br>4. Understand the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.<br>5. Acquire the knowledge of real-world knowledge representation.<br>6. Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system. |
| **CMSACOR13P: Artificial Intelligence (PRACTICAL)** | Elementary concept on programming | 1. Hands on experience on how real-world problems are represented and solved with logical programming.<br>2. Use Prolog in solving various interesting problems in the Artificial Intelligence domain. |
| **CORE**<br><br>**CMSACOR14T: Computer Graphics (THEORY)** | Basic concept of Coordinate Geometry, Linear Algebra & Algorithm design. | 1. Understanding of the basics of computergraphics, graphics systems and applications.<br>2. Interpretation of the mathematicalfoundation of computer graphics.<br>3. Algorithms for scan conversion ofgraphical primitives.<br>4. Detailed understanding of the coreconcepts of transformation, viewing andclipping and projection.<br>5. Concepts of color models.<br>6. Understanding of curves, surfaces andhidden surface elimination. |
| **CMSACOR14P: Computer Graphics (PRACTICAL)** | Basic Programming skills in C. | 1. Implementation of scan conversion algorithmsusing C.<br>2. Practical implementation of clipping andfilling techniques to modify an object. |

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| | | 3. Practical implementation of geometric transformation of objects in 2D and 3D. |
| **Discipline Specific Elective (DSE)**<br><br>**CMSADSE04T: Big Data (THEORY)** | Basic concepts on Database Management System, Data Mining and Distributed System. | 1. Acquire the skill in handling Big Data using the state-of-art tools and techniques.<br>2. Use the various tools and techniques in big data analytics.<br>3. Apply Hadoop and related technologies to big data analytics.<br>4. Develop applications using Pig, Hive and Sqoop.<br>5. Apply Apache Spark and Flink to applications and understand the importance of NoSQL databases.<br>6. Understand the applications of Enterprise Data Science and data visualization tools. |
| **CMSADSE04P: Big Data (PRACTICAL)** | Basic Programming Skills in SQL | 1. Preparing for data summarization, query, and analysis.<br>2. Applying data modeling techniques to large data sets.<br>3. Creating applications for Big Data analytics.<br>4. Building a complete business data analytic solution. |
| **Discipline Specific Elective (DSE)**<br><br>**CMSADSE05T: Digital Image Processing (THEORY)** | Basic concepts on Linear Algebra, Probability and Statistics, Calculus and elementary concepts in data structure and programming. | 1. Acquire the fundamental concepts of a digital image processing system.<br>2. Familiarity with various mathematical tools used for 1D and 2D signal analysis and processing.<br>3. Acquire the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.<br>4. Familiarity with various 2D transformation techniques.<br>5. Acquire the knowledge of image Enhancement, Segmentation, Restoration and Compression techniques.<br>6. Get broad exposure to and understanding of various applications of image processing in industry, medicine, and defense. |
| **CMSADSE05P: Digital Image Processing (PRACTICAL)** | Basic concepts on Probability and Statistics, Basic Programming skills in MATLAB/SCILAB. | Hands-on experience on various Image Processing problems and techniques through practical sessions using MATLAB/SCILAB |
| **CMSADSE06P: Project** | | 1. To enable the students to gain knowledge in any of the technically relevant current topics on computer science and acquire the confidence in presenting the topic and preparing a report.<br><br>2. To apply the software engineering principles on a real software project. |