

Kumaun University

Master of Science (Computer Science)

Bachelor of Science (Computer Science)

Bachelor of Computer Application (Professional Course)



Curriculum Structure

*First Semester Examination December-2019, Second Semester Examination May/June-2020,
Third Semester Examination, December-2020 Fourth Semester Examination, May/June-2021*

Kumaun University
Sleepy Hollow,
Nainital PO 263001

Kumaun University is a place where a student not only comes to learn but also to grow. We have always been proud of our student-focused curriculum that helps students to gain knowledge in their respective fields and to become active and responsible citizens of our great Nation. We have formed our education ideology not only on the pursuit of knowledge but also on strong morals and ethics along with a keen focus on the environment which helps us in developing strong character within our students.

Computer Science is the study of computers and technology. Computers have been shaping the future of mankind with the great surge in technology like IoT in the last decade. The curriculum of our subject aims to provide any pupil in the course to understand the architecture, theory, and math behind the technologies that drive our modern world forward.

UG and PG in Computer Science facilitate the knowledge about the science behind computers and provide a platform to develop skills like programming, networking, cybersecurity, and database administration. It also focuses on the ethics of developing and working with new technologies by providing strong arguments for green computing, security, and user privacy protection.

Vision and Mission of the Department

VISION

To generate competent professionals to become part of the industry and research organizations at the global level with moral values committed to build a vibrant nation.

MISSION

- To strengthen the core competence in Computer Science through analytical learning.
- To provide a strong theoretical and practical background across the Computer Science discipline with an emphasis on application development.
- To inculcate professional behaviour, strong ethical values, innovative research capabilities and leadership qualities.
- To Empower the youth in rural and remote communities with computer education at the minimum cost.

Master of Science (Computer Science)

1. Programme Educational Objectives (PEOs)

The graduate will:

- PEO1: Continuously acquire and apply theoretical and applied knowledge related to the core areas of *Computer Science*.
- PEO2: Acquire a thorough knowledge of the conceptual, theoretical, and practical aspects of advanced-level core subject realms of *Computer Science*.
- PEO3: Work productively as a computer professional in traditional careers, graduate school, or academia.

2. Programme Outcomes (POs)

At the end of the M.Sc. Programme, graduates will be able to:

- PO1: Gain a full-fledged knowledge of the theories and practices of the core and advanced subject areas of *Computer science*.
- PO2: Get transformed into a skilled problem solver and researcher.
- PO3: Prepare for NET/SET/GATE examinations.
- PO4: Explore how the advanced concepts and applications of *Computer Science* lead to innovative and philosophical thought processing with a problem-rectifying attitude.

3. Programme Specific Outcomes (PSOs)

- PSO1: To demonstrate an understanding of the principles and mechanisms of the conceptual and software aspects of computer systems.
- PSO2: To become able to understand the design, architecture, and development methodologies of computational techniques and software systems.
- PSO3: To possess professional knowledge and skills of the software design process. Familiarity and practical competence with current programming languages, technologies, and open-source platforms.

- PSO4: To polish project development skills with insight into real-world problems, enhancement of researcher aptitude to solve them, and to work in a team cooperatively.

Master of Science (Computer Science)

First Semester

CS 101 Operating System

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basics of Operating Systems including Definitions, Generations of OS, Types of OS, and OS Architecture.
- Understand the core concepts and knowledge of advanced features of OS.
- Understand the various components of Process Management and Process Scheduling including Scheduling Algorithms
- Understand the process and applications of Inter-process Communication.
- Understand the reasons, detection, and recovery of Deadlocks in Operating Systems.
- Understand the basics of how Operating Systems manage Primary and Secondary Memories.
- Understand the reasons and solutions of Memory Fragmentation.
- Be proficient in Translating Virtual Address to Physical Address.
- Learn the complex, traditional and modern theories and practices of OS.

CS 102 Discrete Mathematics

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understanding the discrete structures and their role and implementation in Computer Science.
- Gain knowledge of the principles and practices of mathematical logic and its application.
- To be familiar with the advanced concepts of mathematical logic.
- Make a hands-on applications of mathematical tools and concepts related with digital systems and theoretical Computer Science.

CS 103 Theory of Computation

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand the automata theory and its applications to Computer Science.
- Understand the foundation of methods and tools for compiler designing.
- Gain knowledge of the core machines and their mathematical modeling.
- Become Familiar with the advanced concepts of the Automata theory.

CS 104 Advanced Database Systems

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Revisit the basic principles, theories, and practices of the Database management System (DBMS).
- Gain knowledge of the core and advanced design principles of DBMS.
- Understand of the transaction system, its methodologies, challenges, and practices.
- Learn the application of DBMS theory in designing modern age distributed systems.

Second Semester

CS 201 Compiler Design

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basic and sophisticated concepts of Compiler Design (CD).
- Gain knowledge of the core components of the CD process, their mechanisms, and roles.
- Understand the implementation issues and dynamic management of related problems.

CS 202 Design and Analysis of Algorithms

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand the classical algorithms of theoretical and applied Computer science.
- Learn the basic and advanced design and analysis procedures.
- Gain knowledge of advanced and sophisticated data structures, their mechanism, operations, and interconnection with algorithms.
- Understand the applications of the classical algorithms of Computer Science to real-world problems.
- Become Familiar with the classes of computing problems and their approximation.

CS 203 Advanced Computer Networks

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basic principles, theories, and concepts of the Computer Networks with a practical study of a live network.
- Gain knowledge of the advanced and contemporary protocols.
- Understand mobile computing technology.
- Become familiar with advanced security issues and technologies.

CS 204 Software Engineering

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand the software development processes, tools, and mythologies.
- Gain knowledge of different software development models, design processes, concepts, and methodologies.
- Understand the software project management.
- Knowledge of implementation, testing, and maintenance issues, theories, and practices.

Third Semester

CS 301 (A) .Net Framework and C#

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the .NET framework, its theories, methodologies, and practices.
- Become familiar with C# language, its basic and advanced features.
- Learn OOP concepts with C#-specific implementation.
- Make a hands-on practice of windows, web, and distributed applications with C #.
- Study the Case study of the messenger application.

CS 301 (B) Network Security and Cryptography

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand the system and network security concepts, potential threats, and their solutions.
- Gain Knowledge of traditional and modern age encryption and related tools and techniques.
- Learn the advanced concepts of cryptography theory and practices.

CS 302 (A) Artificial Intelligence

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basics of Artificial Intelligence (AI) theory.
- Formulate of real-world problems in AI terminology and their possible solutions.
- Become familiar with the Natural Language Processing (NLP) theories and practices.
- Gain knowledge of the learning process and its models.
- Understand the AI applications in the design of expert systems.

CS 302 (B) Fuzzy Logic and Design

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understanding of the classical theory of Fuzzy logic, its basic operations, and tools.
- Knowledge of core and advanced concepts of Fuzzy logic.
- Understanding the applications of Fuzzy logic.

CS 303 Data mining and Warehousing

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand data warehousing and data mining with their concepts, models, architectures, theories, and practices.
- Learning of the applications of data mining tools in the business.
- Understanding of the advanced features of data mining and knowledge discovery.
- Learning applications of data mining tools in the domain of multimedia.

CS 304 Image Processing

Max. Marks: 100

(IA: 25 + ESA: 75)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand of the concepts, methodologies, principles of digital image processing.
- Gain knowledge of the basic and advanced image processing operations and techniques.
- Become familiarity with the theory of feature detection and recognition.
- Make a hands-on applications of modern image compression tools.

Fourth Semester

CS 401 Project Work

Max. Marks: 500

(IA: 200 + ESA: 300)

Learning Outcomes: On completion of the course, the student will be able to:

- Become Familiar with real-world computing problems, latest technologies, and tools.
- Understand of the project development technicalities.
- Learn of design of modules, integration, testing, and debugging.
- Study applications of soft, research-oriented, and communication skills.

Bachelor of Science (Computer Science)

1. Programme Educational Objectives (PEOs)

The graduate will

- PEO1: Comprehend the world of *Computer Science* and its diverse fields.
- PEO2: Acquire a thorough knowledge of the conceptual, theoretical, and practical aspects of beginner and intermediate-level core subject realms of *Computer Science*.
- PEO3: Develop flair for the *Computer Science* and to acquire and polish programming and technical skills in traditional and modern programming languages and technologies.
- PEO4: Develop a lifelong learning temptation for adapting educational needs in a changing world to maintain competency and to contribute to the advancement of knowledge in a multidisciplinary environment.

2. Programme Outcomes (POs)

At the end of the B.Sc. Programme, graduates will be able to:

- PO1: Gain a complete exposure to the theories and practices of *Computer science*.
- PO2: Get transformed into a skilled learner and active programmer, enabling the students to focus on their higher studies.
- PO3: Value computer professionals and programmers.
- PO4: Explore how the concepts and applications of *Computer science* lead to innovative thinking with a problem-solving attitude.

3. Programme Specific Outcomes (PSOs)

- PSO1: To Gain knowledge of the fundamentals and intermediate-level concepts of *Computer Science* would have enhanced.
- PSO2: To understand the basics and intermediate-level soft skills.
- PSO3: To understand of the traditional and current technologies and practices in the world of Computers and digital platforms.
- PSO4: To view the real-world problems from the spectacles of conceptual knowledge of *Computer Science* and to develop their solutions in a technical oriented way.

Bachelor of Science (Computer Science)

First Semester

BCS 101 Computer Fundamentals

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand and appreciate the history and evolution of computers.
- Understand the classification of computers and various input/output devices.
- Understand various forms of data representation
- Understand different types of computer memories, memory hierarchy, and various types of storage devices.
- Understand software and need for different types of software.
- Understand the Basics of Unix and be proficient in Basic Unix commands.

BCS 102 Introduction to C and C++ Programming

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the history of C and C++ Programming languages.
- Understand various data types, operators, statements, keywords, and functions in the context of C/C++ programming.
- Understand Procedural as well as Object-Oriented Model of Programming.
- Proficient in setting up a programming environment for both C and C++.
- Proficient in solving simple as well as complex problems through programming in C and C++.
- Understand and Adapt the various programming conventions related to C and C++.

BCS L01 Lab: Practical (C, C++ Programming & Unix basics)

Max Marks: 60

(IA: 15 + ESA: 45)

Learning Outcomes: On completion of the course, the student will be able to:

- Be proficient in writing programs in C and C ++.
- Be proficient in setting up the Unix environment.
- Be perform various tasks through Unix shell commands
- Be proficient in setting up a programming environment on Windows as well as Unix.

Second Semester

BCS 201 Data Structures

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand concepts such as Data Organizations, Need of Data Structures, Types of Data Structure, Algorithm Complexity, and Time-Space trade-off.
- Understand and apply data structures such as Stacks, Queues, Arrays, and Linked List.
- Understand the uses of Binary Tree and Binary Search Tree.

- Understand various Tree traversal algorithms as well as various Spanning Tree algorithms.
- Understand and be proficient in various searching and sorting algorithms.
- Understanding cases for using various algorithms and data structures over one another.

BCS 202 Digital Electronics

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand Digital Computer and Digital Systems
- Understand the logic and applications of Boolean algebra and logic gates.
- Understand the basics of Combinational and Sequential Logic Design.
- Understand the architecture of various Combinational and Sequential Circuits like Adders, Encoder-Decoder, Multiplexers-De-Multiplexers, and various types of Flip-Flops.
- Understand the architecture of Registers, Counters RAM, ROM.
- Be proficient in solving K-Maps, POS Simplification, NAND, and NOR Condition.

BCS L02 Lab: Practical (Data Structures)

Max Marks: 60

(IA: 15 + ESA: 45)

Learning Outcomes: On completion of the course, the student will be able to:

- Be proficient in the Implementation of Various Data Structures in C/C++.
- Be proficient in Solving Various Computer Science Problems using Data Structures.
- Be proficient in the Implementation of Various Searching and Sorting algorithm in C/C++.
- Be proficient in applying the various algorithms to solve a given problem.
- Be proficient in Implementation of Trees, Binary Trees, Binary Search Trees, and various Tree Traversal Algorithm in C/C++.

Third Semester

BCS 301 Programming in Python

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the history of Python Language, the difference between Python 2.0/3.0, and a brief overview of the philosophy of Python language.
- Understand how to install, start, and use python Interpreter.
- Understand Python's basic data types, functions, and error handling.
- Understand how to divide a Python program into functions, how to design reliable and scalable functions, use of documentation strings, and anonymous functions.
- Understand the implementation of the Object-Oriented Program in Python Language.
- Understand the use of iterators and generators, how to create iterators and generators in python and when to use iterators over generators and vice versa.
- Learn how to test and debug Python Code.

BCS 302 Computers System Architecture

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basics of computer organization and Design including Arithmetic and Logical micro-operations, shift micro-operations, computer registers, bus system, instruction set, design of basic computer, etc.
- Understand the function and architecture of the Central Processing Unit.
- Understand the basics of Input-Output Organization including Peripheral devices, I/O interfaces, Input-Output Processor, Modes of Transfer, Priority Interrupt, Direct Memory Access, Strobe Control, etc.
- Understand the basics of Memory Organization including Memory Hierarchy, Different types of Memory, and Memory Management Hardware.
- Understand the use and architecture of Pipelining and Parallel Processing.
- Understand Amdahl's law, Flynn's Classification, and Space-time diagram.

BCS L03 Lab: Practical (Python)

Max Marks: 60

(IA: 15 + ESA: 45)

Learning Outcomes: On completion of the course, the student will be able to:

- Be proficient in installing and Setting up a Python programming environment.
- Be proficient in using the Python interpreter.
- Be proficient in writing and running scripts in Python Idle.
- Be proficient in writing Python programs to solve various problems.
- Be proficient in implementing OOP Model in Python.
- Be proficient in the implementation and use of Iterators and Generators in their Python program.

Fourth Semester

BCS 401 Introduction to Database Systems

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand various elements of DBMS and its architecture.
- Understand the history of the development of various DBMS Models, CODD's rule for referential Model.
- Understand and apply the Entity-relationship Model.
- Understand Normalization concepts, use of Normalization, and various Normal Forms including 1NF, 2NF, 3NF, and BCNF.
- Understand Various DBMS and RDBMS systems like Centralized systems, Client-Server Systems, and Parallel Systems.
- Be proficient in SQL fundamentals including creating and managing a Database.
- Understand the various measures of Backup, Recovery, Security, and Privacy of their Database Systems.

BCS 402 Operating Systems

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basics of Operating Systems including Definitions, Generations of OS, Types of OS, and OS Architecture.
- Understand the various components of Process Management and Process Scheduling including Scheduling Algorithms
- Understand the process and applications of Inter-process Communication.
- Understand the reasons, detection, and recovery of Deadlocks in Operating Systems.
- Understand the basics of how Operating Systems manage Primary and Secondary Memories.
- Understand the reasons for and solutions of Memory Fragmentation.
- Be proficient in Translating Virtual Address to Physical Address.

BCS L04 Lab: Practical (DBMS)

Max Marks: 60

(IA: 15 + ESA: 45)

Learning Outcomes: On completion of the course, the student will be able to:

- Be proficient in Installing and Setting up the Microsoft MySQL server.
- Be proficient in creating, managing, and deleting records, tables, and databases using SQL.
- Be proficient in designing databases aimed at solving organizational needs.
- Be proficient in securing databases for basic security threats.

Fifth Semester

BCS 501 Computer Networks

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand various components of a Computer Network.

- Understand Data Communication Fundamentals and Techniques including modulation, conversion, encoding, and multiplexing schemes.
- Understand the OSI/ISO Network Model and its components.
- Understand the role of each layer of the OSI/ISO Model.
- Understand the working and application of various Error Detection Techniques.
- Understand the Networks Switching Techniques and Access mechanisms.
- Understand various Routing algorithms.

BCS 502 Programming in JAVA

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the various components of the Java Runtime Environment.
- Understand and be proficient in Core Java features.
- Understand and Apply Network Programming in Java.
- Learn how to connect to a Database in Java and the benefits of database programming.
- Understand the basics of GUI programming and create various GUI applications in Java using AWT.
- Understand what threads are and how to use threads for a proficient Java Application.
- Understand how to apply multithreading in Java.

BCS L05 Lab: Practical (JAVA)

Max Marks: 60

(IA: 15 + ESA: 45)

Learning Outcomes: On completion of the course, the student will be able to:

- Be proficient in installing and setting up the Java Development Kit.
- Be proficient in setting up multiple Java IDEs like Eclipse, IntelliJ Idea, and NetBeans.
- Be proficient in solving various problems in Java.
- Be proficient in programming network applications in Java-like Greet and Chat Servers and Clients.
- Be proficient in programming for databases in Java.

- Be proficient in creating a multithreaded application in Java.

Sixth Semester

BCS 601 Computer Graphics

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basic elements of Computer Graphics.
- Learn Fundamental Techniques in Graphics like Line Drawing, Circle Drawing, and Filling.
- Learn and Apply Two-Dimensional Geometric Transformation.
- Understand the Two-Dimensional Viewing pipeline.
- Learn and Apply Various Clipping Operations.
- Understand some Three-Dimensional Concepts of Computer Graphics.
- Be proficient in implementing the studied graphics techniques in C/C++ or Java.

BCS 602 Information Security

Max Marks: 80

(IA: 20 + ESA: 60)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basics of Computer Security, Threats, and Attacks.
- Learn Cryptography and various Cryptography algorithms.
- Understand and Apply Various Program Security concepts and measures.
- Understand the Two-Dimensional Viewing pipeline.
- Learn about various Threats in an OS and how to protect against those Threats.
- Understand various Network Security Components.

BCS L06 Project Work

Max Marks: 60

(IA: 15 + ESA: 45)

Learning Outcomes: On completion of the course, the student will be able to:

- Become familiar with real-world computing problems, latest technologies, and tools.
- Understand the project development technicalities.
- Learn the design of modules, integration, testing, and debugging.
- Apply soft, research-oriented, and communication skills.

Bachelor of Computer Application (Professional Course)

1. Programme Educational Objectives (PEOs)

The professional course graduates will be

- PEO1: Equipped to get employment in IT industries by being provided with required domain knowledge.
- PEO2: Provided with the practical training, hands-on and project experience to meet the industrial needs.
- PEO3: Motivated to develop entrepreneurial skills to provide solutions and to develop software products as per the enterprise needs.
- PEO4: Trained to deploy creativity, to develop innovative ideas and to work in teams for accomplishing a common goal.
- PEO5: Addressed with contemporary social issues and will be guided to deal with problems with a result-oriented attitude.

2. Programme Outcomes (POs)

At the end of the BCA Programme, graduates will be able to:

- PO1: Excel in the IT industry and to design and develop reliable software solutions for commercial and social needs.
- PO2: Understand and identify the actual customer requirements, create high-level designs, and to implement robust software applications using the latest technologies and tools.
- PO3: Work professionally with social, cultural, and ethical responsibilities as an individual as well as in multifaceted teams with a positive attitude.

- PO4: Be capable of adapting to new technologies and constantly upgrade their skills with an attitude towards independent and lifelong learning process.

3. Programme Specific Outcomes (PSOs)

- PSO1: Attainment of the professional skills to provide innovative solutions, to design and develop computer applications, and to present oneself emphatically in the industry.
- PSO2: Explore technical knowledge in diverse areas of *Computer Applications* and experience of a professional environment to nurture the required skills needed for a successful career and higher studies.
- PSO3: Developing skills, strength, determination, and confidence for entrepreneurship.

Bachelor of Computer Application (Professional Course)

First Semester

BCA 111 Communicative English

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the effective methods of oral and written communication.
- Be capable to represent own ideas and views both in speech and writing
- Gain in confidence to present oneself in the interview, group discussion, and extempore.
- Gain knowledge of various components of English grammar.
- Learn the design of different business letters and other professional communication tools.

BCA 112 Basic Mathematics

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the mathematical theories and practices required in the analysis of algorithms.
- Visualize computer graphics and other related realms of Computer Science and Applications.
- Be proficient construction of logical arguments and rigorous proofs.
- Formulate and solve abstract mathematical problems.

BCA 113 Computer Fundamentals

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand and appreciate the history and evolution of computers.
- Understand the classification of computers and various input/output devices.
- Understand various forms of data representation
- Understand different types of computer memories, memory hierarchy, and various types of storage devices.
- Understand software and need for different types of software.
- Understand the Basics of Unix and be proficient in Basic Unix commands.

BCA 114 Introduction to C Language

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the programming languages and allied technologies.
- Make a hands-on implementation of basic programming tools.

- Understand the advanced and modern-age programming languages.
- Understand the history of C Programming languages.
- Understand various data types, operators, statements, keywords, and functions in the context of C programming.
- Be proficient in setting up a programming environment for C.
- Be proficient in solving simple as well as complex problems through programming in C.

Second Semester

BCA 211 Discrete Mathematics

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the discrete structures and their role and implementation in Computer Science and Applications.
- Gain knowledge of the principles and practices of mathematical logic and its application.
- Be familiar with the mathematical tools and concepts related to digital systems and theoretical Computer Science.

BCA 212 Introduction to C++

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the Object-Oriented Programming (OOP) paradigm and the C++ language.
- Revisit the primitive and advanced programming tools with the C++ language.
- Gain knowledge of OOP concepts, methodologies, and implementations with the C++ language.
- Be familiar with advanced features of the C++ language.

BCA 213 Data Structure

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand concepts such as Data Organizations, Need of Data Structures, Types of Data Structure, Algorithm Complexity, and Time-Space trade-off.
- Understand and apply data structures such as Stacks, Queues, Arrays, and Linked List.
- Understand the uses of Binary Tree and Binary Search Tree.
- Understand various Tree traversal algorithms as well as various Spanning Tree algorithms.
- Understand and be proficient in various searching and sorting algorithms.
- Understanding cases for using various algorithms and data structures over one another.

BCA 214 Digital Electronics

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand Digital Computer and Digital Systems
- Understand the logic and applications of Boolean algebra and logic gates.
- Understand the basics of Combinational and Sequential Logic Design.
- Understand the architecture of various Combinational and Sequential Circuits like Adders, Encoder-Decoder, Multiplexers-De-Multiplexers, and various types of Flip-Flops.
- Understand the architecture of Registers, Counters RAM, ROM.
- Proficient in solving K-Maps, POS Simplification, NAND, and NOR Condition.

Third Semester

BCA 301 Organization Behavior

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the concepts and theories of Organizational Behaviour.
- Gain knowledge of motivation theories and practices.
- Understand the concepts of personality and stress management.
- Learn of the attitude of teamwork and leadership qualities.

BCA 302 Optimization Techniques

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the theories, concepts, and applications of Operations Research (OR).
- Learn of mathematical formulation of computational problems and their solutions.
- Gain knowledge of various mathematical models and their applications in classical problems of Computer Science.

BCA 303 Computer Graphics

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basic elements of Computer Graphics.
- Learn Fundamental Techniques in Graphics like Line Drawing, Circle Drawing, and Filling.
- Learn and Apply Two-Dimensional Geometric Transformation.
- Understand the Two-Dimensional Viewing pipeline.
- Learn and Apply Various Clipping Operations.

- Understand some Three-Dimensional Concepts of Computer Graphics.
- Be proficient in implementing the learned Graphics techniques in C/C++ or Java.

BCA 304 Computer System Architecture

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basics of computer organization and Design including Arithmetic and Logical micro-operations, shift micro-operations, computer registers, bus system, instruction set, design of basic computer, etc.
- Understand the function and architecture of the Central Processing Unit.
- Understand the basics of Input-Output Organization including Peripheral devices, I/O interfaces, Input-Output Processor, Modes of Transfer, Priority Interrupt, Direct Memory Access, Strobe Control, etc.
- Understand the basics of Memory Organization including Memory Hierarchy, Different types of Memory, and Memory Management Hardware.
- Understand the use and architecture of Pipelining and Parallel Processing.
- Understand Amdahl's law, Flynn's Classification, and Space-time diagram.

BCA 305 Object-Oriented Programming Using C++

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand Object-Oriented Programming (OOP) paradigm and the C++ language.
- Revisit of primitive and advanced programming tools with the C++ language.
- Gain knowledge of OOP concepts, methodologies, and implementations with the C++ language.
- Be familiar with file handling concepts and tools.

Fourth Semester

BCA 401 Computer Networks

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand various components of a Computer Network.
- Understand Data Communication Fundamentals and Techniques including modulation, conversion, encoding, and multiplexing schemes.
- Understand the OSI/ISO Network Model and its components.
- Understand the role of each layer of the OSI/ISO Model.
- Understand the working and application of various Error Detection Techniques.
- Understand the Networks Switching Techniques and Access mechanisms.
- Understand various Routing algorithms.

BCA 402 Numerical and Statistical Techniques

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand various statistical tools for data collection, processing, and analysis.
- Learn foundations for machine learning technology.
- Learn various mathematical tools for computing and business problems.

BCA 403 Unix and Shell Programming

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand network operating systems with UNIX and LINUX.
- Gain knowledge of primitive and advanced concepts of the UNIX operating system.
- Make a Hands-on practice of tools of Shell programming.
- Be familiar with an advanced editor and scripting language.

BCA 404 Environmental Science

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the ecosystem, resources, environment, etc., and human dependence on them.
- Be awareness about the moral duties of mankind towards nature.
- Gain knowledge of the environmental, social, and ethical issues.
- Make a hands-on experience of natural assets and their study.

BCA 405 Java Programming

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the various components of the Java Runtime Environment.
- Understand and be proficient in Core Java features.
- Understand and Apply Network Programming in Java.
- Learn how to connect to a Database in Java and the benefits of database programming.
- Understand the basics of GUI programming and create various GUI applications in Java using AWT.
- Understand what threads are and how to use threads for a proficient Java Application.
- Understand how to apply multithreading in Java.

Fifth Semester

BCA 501 Software Engineering

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand the software development processes, tools, and methodologies.
- Gain Knowledge of different software development models and their implementations and cost estimation.
- Understand of the software design process, concepts, and methodologies.
- Be Familiar with modern and programming language features and their impact on the software development process.

BCA 502 Artificial Intelligence

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the basics of Artificial Intelligence (AI) theory.
- Formulate of real-world problems in AI terminology and their possible solutions.
- Gain knowledge of the learning process and its models.
- Be familiarity with applications of AI with Natural Language Processing (NLP).

BCA 503 (A) Programming in Python

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand the history of Python Language, the difference between Python 2.0/3.0, and a brief overview of the philosophy of Python language.
- Understand how to install, start, and use python Interpreter.
- Understand Python's basic data types, functions, and error handling.
- Understand how to divide a Python program into functions, how to design reliable and scalable functions, use of documentation strings, and anonymous functions.
- Understand the implementation of the Object-Oriented Program in Python Language.
- Understand the use of iterators and generators, how to create iterators and generators in python and when to use iterators over generators and vice versa.
- Learn how to test and debug Python Code.

BCA 503(B) .Net Framework and C#

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Understand of the .NET framework, its theories, methodologies, and practices.
- Be familiar with C# language, its basic and advanced features.
- Revisit of OOP concepts with C#-specific implementation.
- Make a hands-on practice of windows and web applications with C #.

BCA 504 Theory of Computation

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand the Automata theory and its applications to Computer Science.
- Understand foundation of methods and tools for compiler designing.
- Gain knowledge of the core machines and their mathematical modeling.
- Be Familiar with classical complexity theory of Computer Science.

BCA 505 Web Technology

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Completely understand the contemporary theories and practices of web development and maintenance.
- Gain knowledge of web development tools, their basic and advanced features.
- Make a hands-on applications of HTML and Java Scripts.

Sixth Semester

BCA 601 Project Work

Max. Marks: 100

(IA: 30 + ESA: 70)

Learning Outcomes: On completion of the course, the student will be able to:

- Be Familiar with real-world computing problems, latest technologies, and tools.
- Understand the process of real-world project development technicalities.
- Gain experience of working in a team with solo responsibilities.
- Apply soft, research-oriented, and communication skills.
- Learn of design of modules, integration, testing, and debugging.