	BCA
UG	**BSC – Computer Science**

Program Outcomes and Course Outcomes

NEP – 2021

Bachelor of Computer Applications (BCA): (3 Years) Degree Curriculum

Sem	Core Courses	Hour / Week		DS Elective Courses	Hours / Week
		Theory	Lab		
1	i. Fundamentals of Computers ii. Programming in C iii. Mathematical Foundation/ Accountancy iv. LAB: Information Technology v. LAB: C Programming	3 3 3	 4 4		
2	i. Discrete Mathematical Structures ii. Data Structures using C iii. Object Oriented Concepts using JAVA iv. LAB: Data Structure v. LAB: JAVA Lab	3 3 3	 4 4		
3	i. Data Base Management Systems ii. C# and DOT NET Framework iii. Computer Communication andNetworks iv. LAB: DBMS v. LAB: C# and DOT NET Framework	3 3 3	 4 4		
4	i. Python Programming ii. Computer Multimedia and Animation iii. Operating Systems Concepts iv. LAB: Multimedia and Animation v. LAB: Python programming	3 3 3	 4 4		
5	i. Internet Technologies ii. Statistical Computing and RProgramming iii. Software Engineering iv. LAB: R Programming v. LAB: JAVA Script, HTML and CSS vi. Vocational 1	3 3 3 3	 4 4	(a) Cyber Law and CyberSecurity (b) Cloud Computing (c) Business Intelligence	3 3 3
6	i. Artificial Intelligence and Applications ii. PHP and MySQL iii. LAB: PHP and MySQL iv. PROJECT: v. Vocational 2	3 3 3	 4 12	(a) Fundamentals of DataScience (b) Mobile Application Development (c) Embedded Systems	3 3 3

Program Outcomes:

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.

2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.

3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems and acquiring a minimum knowledge on statistics and optimization problems. Establishing excellent skills in applying various design strategies for solving complex problems.

4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.

5. **Application Systems Knowledge**: Possessing a sound knowledge on computer application software and ability to design and develop app for applicative problems.

6. **Modern Tool Usage:** Identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.

7. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.

8. **Project Management:** Practicing of existing projects and becoming independent to launch own project by identifying a gap in solutions.

9. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

10. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.

11. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Course Outcomes:

Semester: I

Course Title: Fundamentals of Computers

Course Code: CAC01	Hours/Week: 03
Course Credits: 03	Formative Assessment Marks: 40
Total Contact Hours: 42	Exam Duration: 02
Exam Marks: 60	

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Introduction to computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers
- Operating systems, functions of operating systems, classification of operating systems, kernel, shell, basics of Unix, shell programming, booting
- Databases, why databases are used, users, SQL, data types in SQL, introduction of queries - select, alter, update, delete, truncate, using where, and or in not in
- Internet basics, features, applications, services, internet service providers, domain name system, browsing, email, searching
- Web Programming basics, introduction of HTML and CSS programming
- Introduction of computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers.

Course Title: Programming in C

Course Code: CAC02	Hours/Week: 03
Course Credits: 03	Formative Assessment Marks: 40
Total Contact Hours: 42	Exam Duration: 02
Exam Marks: 60	

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts

- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays

Course Title: Mathematical Foundation

Course Code: CAC03(a)	**Course Title:** Mathematical Foundation
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 02

Course Outcomes (COs):

- · Study and solve problems related to connectives, predicates and quantifiers under different situations.
- Develop basic knowledge of matrices and to solve equations using Cramer's rule.
- Know the concept of Eigen values.
- To develop the knowledge about derivatives and know various applications of differentiation.
- Understand the basic concepts of Mathematical reasoning, set and functions

Course Title: Accountancy

Course Code: CAC03(b)	**Course Title:** Accountancy
Course Credits: 03	Hours/Week: 03
Total Contact Hours: 42	Formative Assessment Marks: 40
Exam Marks: 60	Exam Duration: 02

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Study and understand Accounting, systems of Book, Branches of accounting advantage and limitations
- Know the concept of accounting, financial accounting process and Journalization.
- Maintenance different account book and reconciliations
- Preparations of different bills, and trial balance.
- Understand the basic concepts of Mathematical reasoning, set and functions

Course Title: Data Structures using C

Course Code: CAC04	Hours/Week: 03
Course Credits: 03	Formative Assessment Marks: 40
Total Contact Hours: 42	Exam Duration: 02 Hours
Exam Marks: 60	

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

Course Title: Object Oriented Programming with JAVA

Course Code: CAC05	Hours/Week: 03
Course Credits: 03	Formative Assessment Marks: 40
Total Contact Hours: 42	Exam Duration: 02 Hours
Exam Marks: 60	

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Understand the features of Java and the architecture of JVM
- Write, compile, and execute Java programs that may include basic data types and control flow constructs and how type casting is done
- Identify classes, objects, members of a class and relationships among them needed

for a specific problem and demonstrate the concepts of polymorphism and inheritance
- The students will be able to demonstrate programs based on interfaces and threads and explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language
- Write, compile, execute Java programs that include GUIs and event driven programming and also programs based on files.

Course Title: Discrete Mathematical Structures

Course Code: CAC06	Hours/Week: 03
Course Credits: 03	Formative Assessment Marks: 40
Total Contact Hours: 42	Exam Duration: 02 Hours
Exam Marks: 60	

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- To understand the basic concepts of Mathematical reasoning, set andfunctions.
- To understand various counting techniques and principle of inclusion andexclusions.
- Understand the concepts of various types of relations, partial ordering and
- equivalence relations.
- Apply the concepts of generating functions to solve the recurrence relations.
- Familiarize the fundamental concepts of graph theory and shortest pathalgorithm

Semester III:

Course Title: Database Management Systems

Course code: CAC07	Course Credits: 03
Total Contact Hours: 42	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the various database concepts and the need for database systems.
- Identify and define database objects, enforce integrity constraints on a database usingDBMS.

- Demonstrate a Data model and Schemas in RDBMS.

- Identify entities and relationships and draw ER diagram for a given real-worldproblem.

- Convert an ER diagram to a database schema and deduce it to the desired normalform.

- Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.

- Explain the transaction processing and concurrency control techniques.

Course Title: Course Title: C# and .Net Technologies

Course code: CAC08	Course Credits: 03
Total Contact Hours: 42	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Describe Object Oriented Programming concepts like Inheritance and PolymorphisminC# programming language.

- Interpret and Develop Interfaces for real-time applications.

- Build custom collections and generics in C#.

Course Title: Computer Networks

Course code: CAC09	Course Credits: 03
Total Contact Hours: 42	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the transmission technique of digital data between two or more computersand a computer network that allows computers to exchange data.

- Apply the basics of data communication and various types of computer networks inreal world applications.

- Compare the different layers of protocols.
- Compare the key networking protocols and their hierarchical relationship in the conceptual model like TCP/IP and OSI.

Semester: IV

Course Title: Python Programming

Course code: CAC10	Course Credits: 03
Total Contact Hours: 42	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the basic concepts of Python Programming.
- Demonstrate proficiency in the handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving file handling.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Develop the emerging applications of relevant fields using Python.

Course Title: Computer Multimedia and Animation

Course code: CAC11	Course Credits: 03
Total Contact Hours: 42	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Write a well-designed, interactive Web site with respect to current standards andpractices.
- Demonstrate in-depth knowledge of an industry-standard multimedia developmenttool and its associated scripting language.
- Determine the appropriate use of interactive versus standalone Web applications.

Course Title: Operating System Concepts

Course code: CAC12	Course Credits: 03
Total Contact Hours: 42	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the fundamentals of the operating system.
- Comprehend multithreaded programming, process management, process synchronization, memory management and storage management.
- Compare the performance of Scheduling Algorithms
- Identify the features of I/O and File handling methods.

B.Sc (Computer Science) –(3years degree)

Curriculum for B.Sc (computer science)

Sem	Discipline Specific Core Courses (DSC)	Hour of Teaching/ Week		Discipline Specific Elective Courses (DSE)	Hour of Teaching/ Week
		Theory	Lab		
1	DSC-1: Computer Fundamentals and Programming in C	4			
	DSC-1Lab: C Programming Lab		4		
2	DSC-2: Data Structures using C	4			
	DSC-2Lab: Data structures Lab		4		
3	DSC-3: Object Oriented Programming Concepts and Programming in JAVA	4			
	DSC-3Lab: JAVA Lab		4		
4	DSC-4: Database Management Systems	4			
	DSC-4Lab: DBMS Lab		4		
5	DSC-5: Programming in PYTHON DSC-6: Computer Networks	3 3			
	DSC-5Lab: PYTHON Programming lab DSC-6Lab: Computer Networks Lab		4 4		
6	DSC-7: Internet Technologies DSC-8: Operating System Concepts	3 3			

| DSC-7Lab: JAVA Script, HTML, CSS Lab | | 4 | | |
| DSC-8Lab: C# Programming Lab | | 4 | | |

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3. **Design and Development of Solutions:** Ability to design and developmentof algorithmic solutions to real world problems.

4. **Programming a computer**: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.

5. **Application Systems Knowledge**: Possessing a minimum knowledge topractice existing computer application software.

6. **Communication**: Must have a reasonably good communication knowledge both in oral and writing.

7. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

8. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.

9. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Course Outcomes:

Semester I:

Course Title: Computer Fundamentals and Programming in C

Course Code: DSC-1	Hour of Teaching/Week: 04
Course Credits: 04	Formative Assessment Marks: 40
Total Contact Hours: 52	Exam Duration: 02

Exam Marks: 60	

Course Outcomes (COs):

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- Confidently operate computers to carry out computational tasks
- Understand working of Hardware and Software and the importance of operating systems
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
- Read, understand and trace the execution of programs written in C language
- Write the C code for a given problem
- Perform input and output operations using programs in C
- Write programs that perform operations on arrays, strings , structures, unions and functions

Semester: II

Course Title: Data Structures using C

Course Code: DSC-2	Hour of Teaching/Week: 04
Course Credits: 04	Formative Assessment Marks: 40
Total Contact Hours: 52	Exam Duration: 02 Hours
Exam Marks: 60	

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
- Demonstrate different methods for traversing trees
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use
- Discuss the computational efficiency of the principal algorithms for sorting and

searching

Semester: III

Course Title: Object Oriented Programming in JAVA

Course code: DSC3	Course Credits: 04
Total Contact Hours: 52	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the object-oriented concepts and JAVA.
- Write JAVA programs using OOP concepts like Abstraction, encapsulation,Inheritance and Polymorphism.
- Implement Classes and multithreading using JAVA.
- Demonstrate the basic principles of creating Java applications with GUI.

Semester: IV

Course Title: Database Management System

Course code: DSC4	Course Credits: 04
Total Contact Hours: 52	Duration of SEE/Exam: 02 Hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

Course Outcomes (COs):

At the end of the course, students will be able to:

- Explain the various database concepts and the need for database systems.
- Identify and define database objects, enforce integrity constraints on a database using DBMS.
- Demonstrate a Data model and Schemas in RDBMS.
- Identify entities and relationships and draw ER diagram for a given real-world problem.
- Convert an ER diagram to a database schema and deduce it to the desired normal form.
- Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.
- Explain the transaction processing and concurrency control techniques.