Siddharth University, Kapilvastu, Siddharthnagar, U.P.

SYLLABUS

of

BCA

(According to CBCS & NEP 2020)

[With effect from the Academic Year 2025-26 onwards Approved in Board of Studies (BOS) meeting on dated 21/11/2025]

Siddharth University, Kapilvastu, Siddharthnagar, U.P.

Bachelor of Computer Applications (BCA)

(Three-Year Undergraduate Programme under FYUP (NEP 2020))

The Bachelor of Computer Applications (BCA) shall be offered as a single-subject three-year undergraduate programme in accordance with the provisions of the National Education Policy (NEP) 2020 and guidelines issued by the State Higher Education Council.

The programme shall be implemented under the Choice Based Credit System (CBCS) and the FYUP framework, incorporating the multiple-entry and multiple-exit mechanism. Candidates who have passed 10+2 or equivalent examination through regular mode from a recognized board shall be eligible for admission to the BCA programme. Students may exit the programme at the end of each academic year with the corresponding qualification, as detailed below:

Year 1 (1st & 2nd Semester): Undergraduate Certificate

Year 2 (3rd & 4th Semester): Undergraduate Diploma

Year 3 (5th & 6th Semester): Bachelor's Degree

Year	Sem.	Paper Name & Code		Credit
I	I	BCA-101T	Computer Fundamental & Office Automation	4
		BCA-102T	Programming in C	4
		BCA-101P	Computer Laboratory and Practical Work of Office Automation	2
		BCA-102P	Computer Laboratory and Practical Work of Programming in C	2
		BCA-103M	Minor Paper : Foundation Course In Mathematics For Computing	4
			Vocational (Select from List)	3
			Co-curricular (Select from List)	2
I	II	BCA-201T	Python Programming	4
		BCA-202T	Digital Electronics & Computer Organization	4
		BCA-203T	Data Structure Using C	4
		BCA-201P	Computer Lab based on BCA-201T	2
		BCA-202P	Computer Lab based on BCA-202T & BCA-203T	2
			Vocational (Select from List)	3
			Co-curricular (Select from List)	2

Year	Sem.	Paper Name & Code		Credit
II	III	BCA-301T	Object Oriented Programming Using C++	4
		BCA-302T	Introduction to Database Management System	4
		BCA-301P	Computer Lab based on BCA-301T	2
		BCA-302P	Computer Lab based on BCA-302T	2
		BCA-303M	Minor Paper : Numerical Methods & Statistical Techniques	4
			Vocational (Select from List)	3
			Co-curricular (Select from List)	2
II	IV	BCA-401T	Internet & JAVA Programming	4
		BCA-402T	Operating Systems & Shell Programming	4
		BCA-403T	Data Communication & Computer Network	4
		BCA-401P	Computer Lab based on BCA-401T	2
		BCA-402P	Computer Lab based on BCA-402T	2
			Vocational (Select from List)	3
			Co-curricular (Select from List)	2
III	V	BCA-501T	Web Technology	4
		BCA-502T	Data Science and Machine Learning	4
		BCA-503T	Software Engineering	4
		BCA-501R	Research Project with Dissertation – I (Minor Project & Viva-Voice on Summer Training)	6
		BCA-501P	Computer Lab based on Web Technology	2
III	VI	BCA-601T	Cyber Security and Cyber Laws	4
		BCA-602T	E-Commerce	4
		BCA-603T	Cloud Computing	4
		BCA-601R	Research Project with Dissertation – II (Major Project)	6
		BCA-601P	Presentation/Seminar based on Major Project	2

Syllabus Developed by:

S.No.	Name	Designation	Department	College/ University
1	Dr. Ashwini Kumar Srivastava	Asst. Professor & Head	Dept. of Computer Application	Shivharsh Kisan P.G. College, Basti

BCA: First Year Course Structure

Year-1/Semester-I

(Major & Minor)

Year	Sem	Paper Name & Code		External	Internal	Total	L	T	P	Credit
I	I	BCA-101T	Computer Fundamental & Office Automation	75	25	100	3	1	0	4
		BCA-102T	Programming in C	75	25	100	3	1	0	4
		BCA-101P	Computer Laboratory and Practical Work of Office Automation	75	25	100	0	0	2	2
		BCA-102P	Computer Laboratory and Practical Work of Programming in C	75	25	100	0	0	2	2
		BCA-103M	**Minor Paper :** Foundation Course In Mathematics For Computing	75	25	100	4	0	0	4

Course Code	Course Name	L	T	P	C
BCA-101T	Computer Fundamental and Office Automation	3	1	0	4

Course-outcome:
Learner will come to know about the basics of computer and its different parts. The learner will also get aware of office package including MS-word, excel, power point.

UNIT-I

Introduction to Computers

Definition, Characteristics of Computers, Block diagram of computer. Types of computers and features: Mini Computers, Micro Computers, Mainframe Computers, Super Computers.

Types of Programming Languages (Machine Languages, Assembly Languages, High Level Languages). Data Organization, Drives, Files, Directories.

Types of Memory (Primary And Secondary) RAM, ROM, PROM, EPROM. Secondary Storage Devices (FD, CD, HD, Pen drive)

I/O Devices (Scanners, Plotters, LCD, Plasma Display) Number Systems

Introduction to Binary, Octal, Hexadecimal system Conversion, Simple Addition, Subtraction, Multiplication

UNIT-II

Algorithm and Flowcharts

Algorithm: Definition, Characteristics, Advantages and disadvantages, Examples.

Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples.

UNIT-III

Operating System and Services in O.S.

Introduction, Types of O.S., DOS – History, Files and Directories, Internal and External Commands, Batch Files, Windows Operating Environment-Features of MS–Windows, Control Panel, Taskbar, Desktop, Windows Application, Icons, Windows Accessories, Notepad, Paintbrush.

UNIT-IV

Editors and Word Processors- Basic Concepts, Examples: MS-Word, Introduction to desktop publishing. Spreadsheets and Database packages- Purpose, usage, command, MS-Excel, Creation of files in MS-Access, MS- PowerPoint.

Suggested Readings :

1. Fundamental of Computers – By V.Rajaraman B.P.B.Publications
2. Fundamental of Computers – By P.K.Sinha
3. Computer Today- By Suresh Basandra
4. Unix Concepts and Application – By Sumitabha Das
5. MS-Office 2000(For Windows) – By Steve Sagman
6. Computer Networks – By Tennenbum Tata MacGraw Hill Publication

Course Code	Course Name	L	T	P	C
BCA-102T	Programming in C	3	1	0	4

Course outcome:
The learner will come to know about the need of programming in problem solving through C.
The learner will also come to know about different structures which include looping, structure, pointers.

UNIT-I
Introduction to 'C' Language: History, Structures of 'C' Programming, Function as building blocks. C Language Fundamentals: Character set, C Tokens, Keywords, Identifiers, Variables, Constant, Data Types, and Comments. Operators: Types of operators, Precedence and Associatively, Expression, Statement and types of statements, Build in Operators and function : Console based I/O and related built in I/O function: printf(), scanf(), getch(), getchar(), putchar(); Concept of header files, Preprocessor directives: #include, #define.

UNIT-II
Control structures: Decision Making Statements: if, if-else, Nested if-else, Selection Statements, Iteration Statements: while, do-while, for, Jumping Statements: goto, return, break, continue.
Arrays in C: Definition, Declaration, Initialization of Array, Types of Arrays- Single & Multi-dimensional arrays.

UNIT-III
Functions: Basic types of function, Declaration and definition, Function call, Types of function, Parameter passing, Call by value, Call by reference, Scope of variable, Storage classes, Recursion, Passing Arrays to a Function, String Handling in C- String Declaration, various functions using Manipulation of String, Passing Strings to Functions.

UNIT-IV
Pointers: Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays.
Structures and Unions: Structure variables, initialization, structure assignment, nested structure structures and functions, structures and arrays: arrays of structures, structures containing arrays. Unions.
File Handling: Concept of files, File opening in various modes and closing of a file, Reading from a file, writing onto a file.

Suggested Readings :

1. Yashwant Kanetkar "Let us C", 16th Edition, BPB Publication, 2018.
2. E. Balaguruswami, "Programming with ANSI-C" Forth Edition,2008, Tata McGraw Hill
3. Ashwini Kr Srivastava & Vijay Kumar "A Textbook of C Programming with Computer's Basics", Neelkamal Parakshan,
4. The C programming Lang., Pearson Ecl- Dennis Ritchie
5. Structured programming approach using C- Forouzah & Ceilber Thomson learning publication.
6. Ashwini Kr Srivastava & Vijay Kumar "A Text Book of C Programming Essentials: From Basics to Advanced", Discount Group of Publication, 2024
7. Byron Gottfried, "Programming with C", Forth Edition, Tata McGraw Hill, 2018.

Course Code	Course Name	L	T	P	C
BCA-101P	Computer Laboratory and Practical Work of Office Automation	0	0	2	2

In this course the students shall be exposed to various practical problems based on BCA-101T: Covers UNIT-III and UNIT-IV of Syllabus. Teacher-in-Charge shall design 20-30 problems. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

Course Code	Course Name	L	T	P	C
BCA-102P	Computer Laboratory and Practical Work of Programming in C	0	0	2	2

In this course the students shall be exposed to various practical problems based on BCA-102T. Teacher-in-Charge shall design 20-30 problems. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

Minor Paper

Course Code	Course Name	L	T	P	C
BCA-103M	Foundation Course In Mathematics For Computing	4	0	0	4

Course outcome: The learner will come to know about different mathematical techniques used algebra and calculus.

UNIT-I

Introduction Set, relations and functions: elements of a set, methods of describing a set, types of set, Venn diagram, Operations on sets, union, intersection and difference of set, Duality, partitioning of a set, Types of Functions, Operations on Functions. trigonometric functions. Definition of sequence and series; A.P, G.P, and H.P ., Idea of limit of a sequence. Binomial expansion and other simple algebraic expansions.

UNIT-II

Introduction to matrix, properties of matrix; addition and multiplication of matrices. Adjoint and inverse of a matrix. Solution of a system of linear equations – homogeneous and nonhomogeneous. Elementary row operations; rank of a matrix, Inverse of a matrix using elementary row operations. Determinants, minor and cofactors and Properties of determinant.

UNIT-III

Differential Calculus: Concept of limit and continuity, Differentiation, Derivative of a. Function of One Variable, differentiation of the sum, difference, product and quotient of two functions, chain rule. Maxima and Minima.
Integral Calculus: Indefinite Integral, Integration by substitution, integration by parts. Integration by Partial fractions, definite integral.

UNIT-IV

Boolean Algebra, Algebra of Logic: Propositions and logic operations, truth tables and propositions generated by set, Equivalence and implication laws of logic, mathematical system, and propositions over a universe, Mathematical induction, quantifiers.

Suggested Readings :

1. Doerr A & Kenneth L. Applied Discrete Structure of computer Science (Galgotia Publication).
2. Tremblay J.P. and Manohar R. Discrete Mathematical structure with application to computer science. (McGrah Hill).
3. B.S. Grewal, “Elementary Engineering Mathematics”, 34th Ed.,1998.
4. Shanti Narayan, “Integral Calculus”, S. Chand & Company,1999
5. Shanti Narayan, “Differential Calculus”, S.Chand & Company,1998.
6. H.K.Dass,“Advanced Engineering Mathematics”, S. Chand & Company, 9th Revised Edition, 2001.

BCA: First Year Course Structure

Year-1/Semester-II

(Major)

Year	Sem	Paper Name & Code		External	Internal	Total	L	T	P	Credit
I	II	BCA-201T	Python Programming	75	25	100	3	1	0	4
		BCA-202T	Digital Electronics & Computer Organization	75	25	100	3	1	0	4
		BCA-203T	Data Structure Using C	75	25	100	3	1	0	4
		BCA-201P	Computer Lab based on BCA-201T	75	25	100	0	0	2	2
		BCA-202P	Computer Lab based on BCA-202T & BCA-203T	75	25	100	0	0	2	2

Course Code	Course Name	L	T	P	C
BCA-201T	Python Programming	3	1	0	4

Course outcome: The learner will come to know about the python programming structure and solving the problem using python programming.

UNIT-I

Overview of Programming: Structure of a Python Program, Elements of Python, Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Data Types, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

UNIT-II

Creating Python Programs: Input and Output Statements, Control statements (Looping-while Loop, for Loop, Loop Control, Conditional Statement- if...else, Difference between break, continue and pass). Functions: function definition, function call, Flow of execution, functions with arguments different argument types, void functions, functions with return statements, built-in functions, Math functions.

UNIT-III

Managing Files and Handling Exceptions in Python: Introduction, File Handling in Python, Advantages & Disadvantages of File Handling in Python, Basic File Handling Operations- Opening and Closing, File Modes in Python, Reading Files, Working with Binary files. Exception Handling in Python, Combining File Handling and Exception Handling, Benefits of Using Exception Handling with File Operations.

UNIT-IV

Introduction to Advanced Python : Objects and Classes, Inheritance, Regular Expressions, Event Driven Programming, GUI Programming.

Suggested Readings:

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011
2. Python Tutorial/Documentation www.python.or 2010
3. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely available online.2012.
4. Ashwini Kr Srivastava & Vijay Kumar “A Text Book of Python Programming Essentials: From Basics to Advanced", Discount Group of Publication, 2024.

Course Code	Course Name	L	T	P	C
BCA-202T	Digital Electronics & Computer Organization	3	1	0	4

Course outcome: The learner will come to know about the different types of gate including AND, NOR, NAND , XOR etc. The Boolean algebra concepts that will be used to create complex circuit for different problems.

UNIT-I

Logic gates and circuit

Gates(OR, AND, NOR, NAND, XOR & XNOR); De-Morgan's theorem; Boolean laws, Circuit designing techniques (SOP, POS, K-Map).

UNIT-II

Combinational Building Blocks

Multiplexes; Decoder; Encoder; Adder and Subtracter.

UNIT-III

Sequential Building Blocks

Flip-Flop (RS, D, JK, Master-slave & T flip-flops); Registers & Shift registers; Counters; Synchronous and Asynchronous Designing method.

UNIT-IV

Memory Organization:

Memories and its types: ROMs, PROMs, EPROMs, RAMs, Hard Disk, Floppy Disk and CD-ROM, flash memories, etc. Basic cell of static and dynamic RAM, Building large memories using chips, Associative memory; Cache memory organization and Virtual memory organization.

Suggested Readings:

1. Digital Logic and Computer design (PHI) 1998 : M. M. Mano
2. Computer Architecture (PHI) 1998 : M. M. Mano
3. Digital Electronics (TMH) 1998 : Malvino and Leach
4. Computer Organization and Architecture : William Stallings
5. Digital fundamentals (Universal Book Stall) 1998 : Floyd,L.Thomas
6. Computer Organization (MC Graw-Hill, Signapore) : Hamcher, Vranesicand Zaky

Course Code	Course Name	L	T	P	C
BCA-203T	Data Structure using C	3	1	0	4

Course Outcome: The learner will learn different types of data structures including linear and non -linear data structures and their implementation using C language.

UNIT-I

Array: Representation of single and multidimensional arrays; Sparse arrays – lower and upper triangular matrices and Tri-diagonal matrices with Vector Representation also.

Stacks and Queues: Introduction and primitive operations on stack; Stack application; Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion between prefix, infix and postfix, introduction and primitive operation on queues, D- queues and priority queues.

Lists: Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion searching, two way lists and Use of headers

UNIT-II

Analysis of algorithm, complexity with big 'O'notation, Searching - sequential search, binary search and their comparison, Sorting - external & internal, sorting algorithm - Insertion, Selection, Quick, Bubble, and Heap, comparison of sorting methods.

UNIT-III

Trees: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; Binary Search Tree, b-tree.

UNIT-IV

Graphs- Introduction to graphs, basic terminology, directed, undirected & weighted graph, representation of graphs, graph traversals, Spanning trees, minimum spanning tree, applications of graphs: shortest path problem using Dijkstra method.

Suggested Readings:

1. E.Horowizand S.Sahani, "Fundamentals of Data structures",GalgotiaBooksourcePvt.Ltd.,2003
2. R.S.Salaria, "Data Structures & Algorithms ",Khanna Book Publishing Co.(P)Ltd..,2002
3. Y.Langsam et. Al., " Data Structures using C and C++" , PHI,1999.
4. Ashwini Kr Srivastava & Vijay Kumar "A Text Book of C Programming Essentials: From Basics to Advanced", Discount Group of Publication, 2024

Course Code	Course Name	L	T	P	C
BCA-201P	Computer Lab based on BCA-201T	0	0	2	2

Practical will be based on BCA-201T using Python Programming. Teacher-in-Charge shall design 20-30 problems. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

Course Code	Course Name	L	T	P	C
BCA-202P	Computer Lab based on BCA-202T & BCA-203T	0	0	2	2

Practical will be based on BCA-202T using a training kit for constructing and testing various electronic circuits. Students shall design, assemble, and verify the functionality and truth tables of basic electronic and digital circuits such as logic gates, combinational circuits, and simple sequential circuits.

The practical component shall be based on BCA-203T and will be implemented using the C programming language with emphasis on data structure–based problems.

Teacher-in-Charge shall design 15 problems for each. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

BCA: Second Year Course Structure

Year-2/Semester-III

(Major & Minor)

Year	Sem	Paper Name & Code		External	Internal	Total	L	T	P	Credit
II	III	BCA-301T	Object Oriented Programming Using C++	75	25	100	3	1	0	4
		BCA-302T	Introduction to Database Management System	75	25	100	3	1	0	4
		BCA-301P	Computer Lab based on BCA-301T	75	25	100	0	0	2	2
		BCA-302P	Computer Lab based on BCA-302T	75	25	100	0	0	2	2
		BCA-303M	Minor Paper : Numerical Methods & Statistical Techniques	75	25	100	4	0	0	4

Course Code	Course Name	L	T	P	C
BCA-301T	Object Oriented Programming Using C++	3	1	0	4

Course outcome: The Lerner will come to know about the basics of object oriented programming and its different paradigms. The Lerner will implement these concepts using C++ language.

UNIT-I

Introduction

Introducing Object – Oriented Approach, Relating to other paradigms {Functional, Data decomposition}.

Basic terms and ideas

Abstraction, Encapsulation, Inheritance, Polymorphism, Review of C, Difference between C and C++, *cin*, *cout*, *new*, *delete*, operators.

UNIT-II

Classes and Objects

Encapsulation, information hiding, abstract data types, Object & classes, attributes, methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, instantiation of objects, Default parameter value, object types, C++ garbage collection, dynamic memory allocation, Metaclass / abstract classes.

UNIT-III

Inheritance and Polymorphism

Inheritance, Class hierarchy, derivation–public, private & protected, Aggregation, compositions classification hierarchies, Polymorphism, Categorization of polymorphism techniques, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric Polymorphism

UNIT-IV

Generic function

Template function, function name overloading, Overriding inheritance methods, Run time polymorphism, Multiple Inheritance.

Files and Exception Handling- Streams and files, Namespaces, Exception handling, Generic Classes

Suggested Readings:

1. A.R.Venugopal, Rajkumar, T. Ravishanker “Mastering C++”, TMH,1997.
2. S.B.Lippman & J.Lajoie,“C++Primer”,3rd Edition,AddisonWesley,2000.
3. Dennis Ritchie “The C programming Language”., Person
4. R.Lafore, “Object Oriented Programming using C++”, Galgotia Publications, 2004
5. D.Parasons, “Object Oriented Programming using C++”, BPB Publication.
6. E. Balagurusamy,”Object Oriented Programming with C++”, TMH Publication

Course Code	Course Name	L	T	P	C
BCA-302T	Introduction to Database Management System	3	1	0	4

Course outcome: The learner will learn about basics of database and need of database management system. The learner will learn about structured query language and concept of normalization.

UNIT I

Introduction: Why Database, characteristics of Data in Database, DBMS, Significance of Database, Database System Applications ,Data Independence, advantages and disadvantages of DBMS, DBMS/RDBMS. Database Architecture and Modeling: Three level architecture of database, Conceptual, Physical and logical database models. Role of DBA, Database Design Entity Relationship Model, Components of ER Model, ER Modeling symbols. Super class and sub class types, Attribute inheritance, Specialization, Generalization, and Categorization.

UNIT II

Relational DBMS and Relational Algebra and Calculus: Introduction to Relational DBMS. RDMBS Terminology. Database normalization, Keys, Relationships, First Normal Form, Functional dependencies, Second Normal form, third Normal form, Boyce-Codd Normal form, fourth Normal form, Fifth Normal form, case study, Relational Algebraic operations, tuple Relational calculus(TRC), Domain Relational Calculus(DRC).

UNIT III

Introduction to SQL : History of SQL. Characteristics cf SQL. Advantages of SQL. SQL in Action. SQL data types and Literals. Types of SQL commands. SQL Operators and their precedence. Tables. Views and indexes. Queries and Sub queries. Aggregate functions. Insert. Update and Delete operations. Joins. Unions. Inter section. Minus. Cursors in SQL. Embedded SQL.

UNIT IV

Backup, Recovery and Database Security: Database backups. Why plan backups? Hardware protection and redundancy, Transaction logs, Importance of backups, Database recovery, Types of Integrity constraints, Restrictions on integrity constraints, Data security risks, Authenticating users to the database.

Suggested Readings:

1. Abraham Silberschatz, Henry Korth, S. Sudarshan,“DatabaseSystemsConcepts”,4th Edition, McGraw Hill,1997.
2. Jim Melton, Alan Simon, “Understanding the new SQL:A complete Guide”, Morgan Kaufmann Publishers, 1993.
3. K. Majumdar, P. Bhattacharya,“ Database Management Systems”,TMH,1996.
4. Bipin Desai, “AnIntroductiontodatabasesystems”,GalgotiaPublications,1991.

Course Code	Course Name	L	T	P	C
BCA-301P	Computer Lab based on BCA-301T	0	0	2	2

Practical will be based on **BCA-301T** (Object Oriented Programming using C++). Teacher-in-Charge shall design 20-30 problems. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

Course Code	Course Name	L	T	P	C
BCA-302P	Computer Lab based on BCA-302T	0	0	2	2

Practical will be based on **BCA-302T** (DBMS/SQL Programming). Teacher-in-Charge shall design 20-30 problems. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

Minor Paper

Course Code	Course Name	L	T	P	C
BCA-303M	Numerical Methods & Statistical Techniques	4	0	0	4

Course outcome: The learner will be able to understand basic numerical methods, apply elementary statistical and probability concepts, and perform simple data analysis using correlation and regression techniques topics of Data Science.

UNIT-I

Basics of Numerical Computation: Addition and multiplication principles, basic permutations and combinations, fixed and floating-point number representation, rounding and truncation errors, bisection method for solution of equations.

UNIT-II

Matrices and Curve Fitting: Elementary concepts of matrices, linear equations, Gauss elimination method, concept of interpolation, Lagrange interpolation, fitting of straight line by method of least squares.

UNIT-III

Statistics and Data Handling: Introduction to statistics and data science, data and information, qualitative and quantitative data, tabulation of data, histogram and box plot, measures of central tendency—mean, median and mode.

UNIT-IV

Probability and Statistical Analysis: Basic concepts of probability, simple and conditional events, random variables (discrete and continuous), binomial and normal distributions (introductory), correlation and regression, scatter diagram and simple linear regression.

Reference Books:

1. K.E. Atkinson, W. Han, Elementary Numerical Analysis, 3rd Ed., Wiley, 2003.
2. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, 2007.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 7th Ed., New Age International Publishers, 2007.
4. Computer oriented numerical methods by V Rajaraman
5. Fundamentals of mathematical Statistics by V.K. Kapoor and S.C. Gupta
6. Statistics Theory and Practice by R S N Pillai, Bagavathi
7. Practical statistics by S P Gupta

BCA: Second Year Course Structure

Year-2/Semester-IV

(Major)

Year	Sem	Paper Name & Code		External	Internal	Total	L	T	P	Credit
II	IV	BCA-401T	Internet & JAVA Programming	75	25	100	3	1	0	4
		BCA-402T	Operating Systems & Shell Programming	75	25	100	3	1	0	4
		BCA-403T	Data Communication & Computer Network	75	25	100	3	1	0	4
		BCA-401P	Computer Lab based on BCA-401T	75	25	100	0	0	2	2
		BCA-402P	Computer Lab based on BCA-402T	75	25	100	0	0	2	2

Course Code	Course Name	L	T	P	C
BCA-401T	Internet & JAVA Programming	3	1	0	4

Course outcome: The learner will learn about Java programming and it's use for developing different types of applications. The learner will also learn about database connectivity with Java.

UNIT-I

Internet: Internet, Connecting to Internet: Telephone, Cable, Satellite connection, Choosing an ISP, Introduction to Internet services, E-Mail concepts, Sending and Receiving secure E-Mail, Voice and Video Conferencing.

UNIT-II

Core Java: Introduction, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Networking, Event handling, Introduction to AWT, AWT controls, Layout managers, Menus, Images, Graphics.

UNIT-III

Java Swing: Creating a Swing Applet and Application, Programming using Panes, Pluggable Look and feel, Labels, Text fields, Buttons, Toggle buttons, Checkboxes, Radio Buttons, View ports, Scroll Panes, Scroll Bars, Lists, Combo box, Progress Bar, Menus and Toolbars, Layered Panes, Tabbed Panes, Split Panes, Layouts, Windows, Dialog Boxes, Inner frame.

JDBC: The connectivity Model, JDBC/ODBC Bridge, java.sql package, connectivity to remote database, navigating through multiple rows retrieved from a database.

UNIT-IV

Java Beans: Application Builder tools, The bean developer kit(BDK), JAR files, Introspection, Developing a simple bean, using Bound properties, The Java Beans API, Session Beans, Entity Beans, Introduction to Enterprise Java beans (EJB), Introduction to RMI (Remote Method Invocation): A simple client-server application using RMI.

Java Servlets: Servlet basics, Servlet API basic, Life cycle of a Servlet, Running Servlet, Debugging Servlets, Thread-safe Servlets, HTTP Redirects, Cookies, Introduction to Java Server pages (JSP).

Suggested Readings:

1. Margaret Levine Young, "The Complete Reference Internet", Tata Mcgraw-hill Education Pvt. Ltd.
2. Thampi, "Object Oriented Programming in JAVA" Wiley Dreamtech Publication.
3. Balagurusamy E, "Programming in JAVA", Tata Mcgraw-hill Education Pvt. Ltd.
4. Dustin R. Callway, "Inside Servlets", Addison Wesley.
5. Mark Wutica, "Java Enterprise Edition", QUE.
6. Steven Holzner, "Java2 Black book", Wiley Dreamtech Publication.
7. Liang, "Introduction to Java Programming, Comprehensive Version", Pearson Education.

Course Code	Course Name	L	T	P	C
BCA-402T	Operating Systems & Shell Programming	3	1	0	4

Course outcome: The learner will understand different operating system concepts related to user management, process management, and memory management. Learners will apply theoretical knowledge of operating systems and shell programming to solve practical problems, demonstrating their ability to implement solutions in real-world scenarios.

UNIT-I

Operating system overview: objectives and functions, Evolution of Operating System, Types of Operating Systems. Operating system structure. Process Management and Coordination: Process concept, Process States, Process Description and Process Control, Interrupts, Process Scheduling, Types of Scheduling – Scheduling algorithms.

UNIT-II

Inter-process Communication, Processes and Threads, Concurrency: Principles of Concurrency, Mutual Exclusion, Semaphores, Monitors, Readers/Writers Problem Deadlocks: Basic concepts, necessary conditions for deadlock, resource allocation graph, Banker's algorithm, Recovery from Deadlock.

UNIT-III

Memory management requirements, Memory Hierarchy, Cache Memory, Direct Memory Access Partitioning, Paging and Segmentation, Demand Paging, Virtual memory - Hardware and control structures.

I/O management and disk scheduling—I/O devices, organization of I/O functions; File management—organization, directories, File sharing, and Record blocking, secondary storage management.

UNIT-IV

Unix/Linux Operating System: Development Of Unix/Linux, Role & Function Of Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure, System Administration Case study: Linux, Windows Operating System.

Suggested Readings:

1. Silbersachatz and Galvin,"Operating System Concepts",Person,5th Edition
2. Madnick E., Donovan J., " Operating Systems:,Tata McGrawHill,2001
3. Tannenbaum, "Operating Systems", PHI, 4 Edition,2000
4. Operating system, Internals and Design principles, W Stallings, Pearson Education
5. "Unix Shell Programming" by Stephen G. Kochan and Patrick Wood.
6. "Shell Scripting: Expert Recipes for Linux, Bash and more" by Steve Parker.
7. The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
8. Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson.

Course Code	Course Name	L	T	P	C
BCA-403T	Data Communication & Computer Networks	3	1	0	4

Course outcome: The learner will describe and analyze the hardware, software, components of Data Communication & Computer Networks.

UNIT-I

Basic Concepts: Components of data communication, distributed processing, standards and organizations. Line configuration, computer network, topology, Transmission mode, and categories of networks. OSI and TCP/IP Models: Layers and their functions, comparison of models.

UNIT-II

Digital Transmission: Interfaces and Modems: DTE-DCE Interface, Modems, Cable modems.

Transmission Media: Guided and unguided, Attenuation, distortion, noise, throughput, propagation speed and time, wavelength, Shannon capacity, comparison of media.

UNIT-III

Telephony: Multiplexing, error detection and correction: Many to one, One to many, WDM, TDM, FDM, Circuit switching, packet switching and message switching.

Data link control protocols: Line discipline, flow control, error control, synchronous and asynchronous protocols, character and bit oriented protocols, Link access procedures.

Point to point controls: Transmission states, PPP layers, LCP, Authentication, NCP. ISDN: Services, Historical outline, subscriber's access, ISDN Layers and broadcast ISDN.

UNIT-IV

Devices: Repeaters, bridges, gateways, routers, The Network Layer; Design issues, Internetworking, Network-Layer in the internet.

Transport and upper layers in OSI Model: Transport layer functions, connection management, functions of session layers, presentation layer and application layer.

Suggested Readings:

1. A.S.Tanenbaum, "Computer Networks"; Pearson Education Asia, 4th Ed.2003.
2. Behrouz A.Forouzan, "Data Communication and Networking", 3rd Ed. Tata MCGraw Hill, 2004.
3. William stallings, "Data and computer communications", Pearson education Asia, 7th Ed., 2002.

Course Code	Course Name	L	T	P	C
BCA-401P	Computer Lab based on BCA-401T	0	0	2	2

Practical will be based on BCA-401T (Internet and Java Programming). Teacher-in-Charge shall design 20-30 problems. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

Course Code	Course Name	L	T	P	C
BCA-402P	Computer Lab based on BCA-402T	0	0	2	2

Practical will be based on BCA-402T (Operating Systems & Shell Programming). Teacher-in-charge will allot at least 10 questions from these or similar.

1. Study of UNIX basic commands: cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, stty, pwd, cd, mkdir, rmdir, ls, cat, cp, rm, mv, more, file, wc, od, cmp,comm, diff, chmod, vi.
2. Study of vi editor
3. Write a Script to print "hello world"
4. Write a script to create a simple function.
5. Write a script to study local variables.
6. Write a script to study if...else
7. Write a script to study for, while and until
8. Write a script that finds the prime factors of a given number.
9. Write a script to check if the two strings are the same or not.
10. Write a script that will print a message "Good Morning" or "Good Afternoon" according to the user login time.
11. Linux Commands: ls, cd, pwd, cp, mv, rm, mkdir, rmdir, chmod, grep, find, touch, cat, man, ps, cmp, find, grep, od, tar, ps, df, du, kill, nice, sleep, test, who,cal, tee, expr, uname,
12. Introduction of Bash shell, Bash Features, Command Line, Command Line Expansion, and Editing, gnome-terminal.

The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

BCA: Third Year Course Structure

Year-3/Semester-V

(Major)

Year	Sem	Paper Name & Code		External	Internal	Total	L	T	P	Credit
III	V	BCA-501T	Web Technology	75	25	100	3	1	0	4
		BCA-502T	Data Science and Machine Learning	75	25	100	3	1	0	4
		BCA-503T	Software Engineering	75	25	100	3	1	0	4
		BCA-501R	Research Project with Dissertation – I (Minor Project & Viva-Voice on Summer Training)	75	25	100	0	2	4	6
		BCA-501P	Computer Lab based on Web Technology	75	25	100	0	0	2	2

Course Code	Course Name	L	T	P	C
BCA-501T	Web Technology	3	1	0	4

Course outcome: The learner will learn about development of static as well as dynamic web pages

UNIT-I

Introduction: Introduction to web, protocols governing the web, web development strategies, Web applications, web project, web team.

Web Page Designing:

HTML: list, table, images, frames, forms, CSS; XML: DTD, XML schemes, presenting and using XML

UNIT-II

Scripting:

Java script: Introduction, documents, forms, statements, functions, objects; event and event handling; introduction to AJAX, VB Script.

UNIT-III

Server Site Programming:

Introduction to active server pages (ASP),ASP.NET, java server pages (JSP), JSP application design, tomcat server, JSP objects, declaring variables, and methods, debugging, sharing data between JSP pages, Session, Application: data base action , development of java beans in JSP, introduction to COM/DCOM.

UNIT-IV

PHP (Hypertext Preprocessor):

Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form ,mail, file upload, session, error, exception, filter, PHP-ODBC.

Suggested Readings:

1. Xavier, C, " Web Technology and Design" , New Age International.
2. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication.
3. Ramesh Bangia, "Internet and Web Design" , New Age International
4. Bhave, "Programming with Java", Pearson Education
5. Ullman, "PHP for the Web: Visual QuickStart Guide", Pearson Education
6. Deitel, "Java for programmers", Pearson Education

Course Code	Course Name	L	T	P	C
BCA-502T	Data Science and Machine Learning	3	1	0	4

Course outcome: The learner will come to know about the basics and applications of Data Science, data collection and preprocessing methods, fundamental statistical and machine learning techniques, optimization for accurate modeling, and the basic concepts and working of neural networks.

UNIT-I

Introduction to Data Science and Data Preparation: Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues, Data Collection Strategies, Overview of Data Pre-Processing, Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT-II

Exploratory Data Analytics: Descriptive Statistics: Mean and Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Tables, Correlation Statistics, Analysis of Variance (ANOVA).

UNIT-III

Machine Learning: Introduction**,** Idea of Machines learning from data, Classification of problem – Regression and Classification, Supervised and Unsupervised learning.

UNIT-IV

Neural Networks: History, Artificial and biological neural networks, Artificial intelligence and neural networks, Biological neurons, Models of single neurons, Different neural network models.

Suggested Readings:

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
3. Machine Learning, Tom M. Mitchell
4. Introduction to Machine learning, Nils J.Nilsson Anderson, James, "Introduction to Neural Networks", PHI Publication, Delhi, India
5. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press, USA, 2005.
6. Simon Haykin,"Neural Netowrks and Learning Machines "Prentice Hall of India, 2005,Third Edition.

Course Code	Course Name	L	T	P	C
BCA-503T	Software Engineering	3	1	0	4

Course outcome: The learner will learn about different system development techniques and concepts.

UNIT-I

Introduction to Software Engineering, software components, software characteristics, software crisis, software engineering processes, software vs conventional engineering, software quality attributes, SDLC, Waterfall model, Prototype model, Spiral model, Evolutionary model, Iterative enhancement model.

UNIT-II

Software Requirement Specification (SRS), requirement engineering, elicitation, analysis, documentation, review, requirement management, feasibility study, information modelling, Data Flow Diagram (DFD), Entity Relationship Diagram, decision tables, IEEE SRS standards, Software Quality Assurance (SQA), verification and validation, SQA plans, software quality frameworks, ISO 9000, SEI–CMM..

UNIT-III

Software design concepts, architectural design, low-level design, modularization, design structure charts, pseudocode, flowcharts, coupling and cohesion, function-oriented design, object-oriented design, top-down design, bottom-up design, software metrics, Halstead metrics, function point measures, cyclomatic complexity, control flow graph, software testing, unit testing, integration testing, acceptance testing, regression testing, functional testing, performance testing, white box testing, black box testing, test drivers, test stubs, alpha testing, beta testing, static testing, reviews, walkthroughs, code inspection.

UNIT-IV

Software maintenance, evolutionary nature of software, preventive maintenance, corrective maintenance, perfective maintenance, maintenance cost, software re-engineering, reverse engineering, software configuration management, change control, version control, CASE tools, software project management, cost estimation, effort estimation, schedule estimation, COCOMO model, resource allocation, software risk analysis, risk management.

Suggested Readings:

1. R S Pressman, “Software Engineering: A Practitioners Approach”, McGraw Hill.
2. Pankaj Jalote, “Software Engineering”, Wiley
3. Rajib Mall, “Fundamentals of Software Engineering”, PHI Publication.
4. K K Aggarwal and Yogesh Singh, “Software Engineering”, New Age International Publishers.
5. Ghezzi, M. Jarayeri, D. Manodrioli, “Fundamentals of Software Engineering”, PHI Publication.
6. Ian Sommerville, “Software Engineering”, Addison Wesley.

Course Code	Course Name	L	T	P	C
BCA-501P	Computer Lab based on BCA-501T	0	0	2	2

Practical will be based on BCA-501T (Web technology). Teacher-in-Charge shall design 20-30 problems. The students shall be required to systematically work out the solution of those problems and implement in the computer laboratory.

Course Code	Course Name	L	T	P	C
BCA-501R	**Research Project with Dissertation – I** (Minor Project & Viva-Voice on Summer Training)	0	2	4	6

Evaluation and viva-voce of this minor project work will be based on Summer Training held after end of fourth semester and will be conducted by the Internal & External examiners.

BCA: Third Year Course Structure

Year-3/Semester-VI

(Major)

Year	Sem	Paper Name & Code		External	Internal	Total	L	T	P	Credit
III	VI	BCA-601T	Cyber Security and Cyber Laws	75	25	100	3	1	0	4
		BCA-602T	E-Commerce	75	25	100	3	1	0	4
		BCA-603T	Cloud Computing	75	25	100	3	1	0	4
		BCA-601R	Research Project with Dissertation – II (Major Project)	75	25	100	0	2	4	6
		BCA-601P	Presentation/Seminar based on Major Project	75	25	100	0	0	2	2

Course Code	Course Name	L	T	P	C
BCA-601T	Cyber Security and Cyber Laws	3	1	0	4

Course outcome: The learner will learn about the requirement of cyber security and cyber law in current changing cyber eco system.

UNIT-I

Introduction: Introduction to Information System, Type of information system, Development of information system, CIA model of Information Characteristics, Introduction to Information Security, Need of Information Security, Cyber Security, Business need, Ethical and Professional issues of security. Information Security Model, Component of an Information security, Aspect of information security, Security attacks(Active and Passive Attacks), Security mechanism and Security Services (X.800).

UNIT-II

Information Security Techniques: Introduction to Cryptography: Terminology, cryptanalysis, Security of algorithms, Substitution Cipher and Transposition Cipher, Single XOR , One-way Pad

UNIT-III

Cryptographic Protocols: Arbitrated and Adjudicated Protocol, One- Way Hash function, Public key cryptography, Digital Signature, Digital Watermarking Technique :Characteristics and Types.

UNIT-IV

Security Policies: Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies- Sample Security Policies, Cyber Laws : Information Security Standards, IT act2000 Provisions, Introduction to digital laws, cyber laws, intellectual property rights, copyright laws, patent laws, software license, Cyber Forensics.

Suggested Readings:

1. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security," Sixth Edition, Cengage Learning, 2017.
2. Douglas J. Landoll, "Information Security Policies, Procedure, and Standards: A Practitioner's Reference," CRC Press, 2016.
3. Harold F. Tipton, and Micki Krause, "Hand book of information security management," Sixth Edition, Archtech Publication, 2007.
4. Ashwini Kumar Srivastava, Karamthoti M B, T N Anitha & Damla M, “Introduction To Cyber Forensics”, Scientific International Publishing, 2023.
5. Barkha, U Rama Mohan, "Cyber Law & Crimes", Asia Law House; 3rd edition 2017.
6. Vivek Sood, "Cyber Laws Simplified", McGraw Hill, Fourth Edition, 2014

Course Code	Course Name	L	T	P	C
BCA-602T	E-Commerce	3	1	0	4

Course outcome: The learner will learn about the need of electronic commerce and different components used in electronic commerce, different paradigms used in electronic commerce.

UNIT-I

Introduction to E-Commerce: The Scope of Electronic Commerce, Definition of Electronic Commerce, Electronic E-commerce and the Trade Cycle, Electronic Markets, Electronic Data Interchange, Internet Commerce, E-Commerce in Perspective.

Business Strategy in an Electronic Age: Supply Chains, Porter's Value Chain Model, Inter Organizational Value Chains, Competitive Strategy, Porter's Model, First Mover Advantage Sustainable Competitive Advantage, Competitive Advantage using E-Commerce, Business Strategy, Introduction to Business Strategy, Strategic Implications of IT, Technology, Business Environment, Business Capability, Exiting Business Strategy, Strategy Formulation & Implementation Planning, E-Commerce Implementation, E-Commerce Evaluation.

UNIT-II

Business-to-Business Electronic Commerce: Characteristics of B2B EC, Models of B2B Ec, Procurement Management Using the Buyer's Internal Marketplace, Just in Time Delivery, Other B2B Models, Auctions and Services from Traditional to Internet Based EDI, Integration with Back-end Information System, The Role of Software Agents for B2B EC, Electronic marketing in B2B, Solutions of B2B EC, Managerial Issues, Electronic Data Interchange (EDI), EDI: The Nuts and Bolts, EDI & Business.

UNIT-III

Internet and Extranet : Automotive Network Exchange, The Largest Extranet, Architecture of the Internet, Intranet and Extranet, Intranet software, Applications of Intranets, Intranet Application Case Studies, Considerations in Intranet Deployment, The Extranets, The structures of Extranets, Extranet products & services, Applications of Extranets, Business Models of Extranet Applications, Managerial Issues.

Electronic Payment Systems : Is SET a failure, Electronic Payments & Protocols, Security Schemes in Electronic payment systems, Electronic Credit card system on the Internet, Electronic Fund transfer and Debit cards on the Internet, Stored – value Cards and E- Cash, Electronic Check Systems, Prospect of Electronic Payment Systems, Managerial Issues.

UNIT-IV

Public Policy: From Legal Issues to Privacy : EC- Related Legal Incidents, Legal Incidents, Ethical & Other Public Policy Issues, Protecting Privacy, Protecting Intellectual Property, Free speech, Internet Indecency & Censorship, Taxation & Encryption Policies, Other Legal Issues: Contracts, Gambling & More, Consumer & Seller Protection in EC, Infrastructure For EC.

Suggested Readings:

1. David Whiteley, " E-Commerce", Tata McGraw Hill,2000
2. Eframi Turban, Jae Lee, David King, K Michale Chung, "Electronic Commerce", Pearson education, 2000

Course Code	Course Name	L	T	P	C
BCA-603T	Cloud Computing	3	1	0	4

Course outcome: The learner will understand the fundamentals of cloud computing, its key technologies, strengths and limitations, cloud architecture for computing and storage, cloud service and deployment models, and applications of cloud computing.

UNIT-I

Introduction: Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing issues in Clouds - Eucalyptus - Nimbus - Open Nebula, CloudSim.

UNIT-II

Cloud Services: Types of Cloud services: Software as a Service Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force. Collaborating using Cloud Services: Email Communication over the Cloud - CRM Management – Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.

UNIT-III

Virtualization for Cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.

UNIT-IV

Security, Standards and Applications: Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud.

Suggested Readings:

1. David E.Y. Sarna, “Implementing and Developing Cloud Application”, CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, “Cloud Computing : A Practical Approach”, Tata McGraw-Hill 2010.
4. Haley Beard, “Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs”, Emereo Pty Limited, July 2008.
5. G. J. Popek, R.P. Goldberg, “Formal requirements for virtualizable third generation Architectures, Communications of the ACM”, No.7 Vol.17, July 1974

Course Code	Course Name	L	T	P	C
BCA-601R	Research Project with Dissertation – II (Major Project)	0	2	4	6

Course Description: To undertake a research-oriented and/or software development–based major project. The project involves identification of a real-world or industry-relevant problem, requirement analysis, system design, software development, implementation, testing, validation, and documentation. The course emphasizes the application of computing principles, programming skills, software engineering practices, research methodology, ethical standards, and professional reporting in alignment with NEP-2020 and outcome-based education.

Evaluation Scheme

- Project Dissertation / Report: Internal Assessment
- Project Evaluation: External Assessment
- Mode of Evaluation: Joint evaluation by Internal and External Examiners

Course Code	Course Name	L	T	P	C
BCA-601P	Presentation/Seminar based on Major Project	0	0	2	2

Course Description: Focuses on the presentation, demonstration, and defense of the major project work. Students shall present the objectives, methodology, software development process, results, and conclusions of their project, followed by a viva-voce examination.

Evaluation Components

- Project Presentation / Seminar
- Viva-Voce Examination
- Mode of Evaluation: Joint evaluation by Internal and External Examiners