Syllabus
of
Bachelor of Computer Application
(BCA)
in
Choice Based Credit System (CBCS)
2021

Siddharth University, Kapilvastu, Siddharth Nagar, U.P.

Bachelor of Computer Application
Semester – wise breakup of course

Semester-I
(L : Lecture ; T-: Tutorial ; P : Practical ; C : Credit)

Course Code	Course Name	External	Internal	Total	L	T	P	C
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-103T	Foundation Course In Mathematics For Computing	75	25	100	3	1	0	4
BCA-104T	Business Communication	75	25	100	3	0	0	3
BCA-105T	Principles of Accounting & Management	75	25	100	3	0	0	3
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
				700				22

Semester-II

Course Code	Course Name	External	Internal	Total	L	T	P	C
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-204T	Numerical Methods & Graph Theory	75	25	100	3	0	0	3
BCA-205T	Software Engineering	75	25	100	3	0	0	3
BCA-201P	Computer Lab based on BCA-201T & BCA-202T	75	25	100	0	0	2	2
BCA-202P	Computer Lab based on BCA-203T & BCA-204T	75	25	100	0	0	2	2
				700				22

Bachelor of Computer Application
Semester – wise breakup of course

Semester-III

Course Code	Course Name	External	Internal	Total	L	T	P	C
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-303T	Data Communication & Computer Network	75	25	100	3	1	0	4
BCA-304T	Statistical Techniques	75	25	100	3	0	0	3
BCA-305T	E-Commerce	75	25	100	3	0	0	3
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
				700				22

Semester-IV

Course Code	Course Name	External	Internal	Total	L	T	P	C
BCA-401T	Computer Graphics & Multimedia Application	75	25	100	3	1	0	4
BCA-402T	Internet & JAVA Programming	75	25	100	3	1	0	4
BCA-403T	Data Warehousing & Data Mining	75	25	100	3	1	0	4
BCA-404T	Soft Computing	75	25	100	3	0	0	3
BCA-405T	Operating System	75	25	100	3	0	0	3
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
				700				22

Bachelor of Computer Application
Semester - wise breakup of course

Semester-V

Course Code	Course Name	External	Internal	Total	L	T	P	C
BCA-501T	Web Technology	75	25	100	3	1	0	4
BCA-502T	Machine Learning	75	25	100	3	1	0	4
BCA-503T	Privacy and Security in Online Social Media	75	25	100	3	1	0	4
BCA-501P	Computer Lab based on BCA-501T	75	25	100	0	0	2	2
BCA-501R	Research Project – I Minor	225	75	300	0	5	3	8
				700				22

Semester-VI

Course Code	Course Name	External	Internal	Total	L	T	P	C
BCA-601T	Cyber Security and Cyber Laws	75	25	100	4	1	0	4
BCA-602T	Mobile Computing	75	25	100	3	1	0	4
BCA-603T	Cloud Computing	75	25	100	3	1	0	4
BCA-601R	Research Project – II Major	300	100	400	0	6	4	10
				700				22

Bachelor of Computer Application

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, Switching between application, 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

Bachelor of Computer Application

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.
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. Let us C-Yashwant Kanetkar.
2. Programming in C-Balguruswamy
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. Pointers in C – Yashwant Kanetkar
7. How to solve it by Computer – R.G Dromy
8. Peter Norton's Introduction to Computers – Tata McGraw Hill

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-103T	Foundation Course In Mathematics For Computing	3	1	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,9thRevisedEdition,2001

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-104T	Business Communication	3	0	0	3

Course outcome:

The learner will come to know about the types of communication and different types of communication methods. By studying this course the learner can know about different formats of written communication.

UNIT-I

Means of Communication Meaning and Definition– Process–Functions–Objectives–Importance– Essentials of good communication – Communication barriers, 7C's of Communication.

Types of Communication: Oral Communication: Meaning, nature and scope–Principle of effective oral communication–Techniques of effective speech– Media of oral communication (Face-to-face conversation – Teleconferences – Press Conference – Demonstration–RadioRecording–Dictaphone– Meetings–Rumour–Demonstration and Dramatization –Public address system–Grapevine–Group Discussion–Oral report–Closed circuit TV).The art of listening – Principles of good listening

UNIT-II

Written Communication : Purpose of writing, Clarity in Writing, Principle of Effective writing, Writing Techniques, Electronic Writing Process.

UNIT-III

Business Letters & Reports: Need and functions of business letters–Planning & layout of business letter–Kinds of business letters– Essentials of effective correspondence, Purpose, Kind and Objective of Reports, Writing Reports.

Drafting of business letters: Enquiries and replies–Placing and fulfilling orders–Complaints and follow-up Sales letters–Circular letters Application for employment and resume

UNIT-IV

Information Technology for Communication: Word Processor – Telex – Facsimile(Fax) – E-mail – Voice mail –Internet – Multimedia – Teleconferencing–MobilePhoneConversation–VideoConferencing– SMS–TelephoneAnswering Machine – Advantages and limitations of these types.

Topics Prescribed for workshop/skill lab

Group Discussion, Mock Interview, Decision Making in a Group

Suggested Readings :

1. Business Communication– K.K.Sinha – Galgotia Publishing Company, New Delhi.
2. Media and Communication Management–C.S.Rayudu– Hikalaya Publishing House, Bombay.
3. Essentials of Business Communication– Rajendra Pal and J.S. Korlhalli- Sultan Chand & Sons, NewDelhi.
4. Business Communication(Principles, Methods and Techniques) Nirmal Singh–Deep& Deep Publications New Delhi.
5. Business Communication– Dr.S.V.Kadvekar, Prin. Dr.C.N.Rawal and Prof .Ravindra Kothavade- Diamond Publications, Pune.
6. Business Correspondence and Report Writing– R.C.Sharma, Krishna Mohan–Tata McGraw-Hill, New Delhi.
7. Communicate to Win – Richard Denny – Kogan Page India Private Limited, New Delhi.
8. Modern Business Correspondence– L. Gartside – The English Language Book Society and Macdonald and Evans Ltd.
9. Business Communication– M. Balasubrahmanyan –Vani Education Books.
10. Creating a Successful CV –Siman Howard – Dorling Kidersley.

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-105T	Principle of Accounting & Management	3	0	0	3

Course outcome:
The learner will learn basic accounting and managerial concepts used in industry. The learner will get aware of different theories and their implementation in the real world for problem solving.

UNIT-I
Basic Accounting: Introduction, importance and scope, concepts and conventions-Generally .accepted accounting principles double entry framework Basic concepts of Journals, ledgers, purchase book, sales book, cashbook.
Preparation of financial statements: Profit and loss account and balance sheet. Nature, scope, advantage and limitations of management accounting.

UNIT-II
Nature of Management: Meaning, Definition, it's nature purpose, importance & Functions, Management as Art, Science & Profession- Management as social System Concepts of management-Administration-Organization, Management Skills, Levels of Management.

UNIT-III
Evolution of Management Thought: Contribution of F.W.Taylor, Henri Fayol, Elton Mayo, Chester Barhard & Peter Drucker to the management thought. Business Ethics & Social Responsibility: Concept, Shift to Ethics, Tools of Ethics.
Functions of Management: Planning – Meaning- Need & Importance, types, Process of Planning, Barriers to Effective Planning. levels– advantages & limitations. Forecasting- Need & Techniques.
Decision making– Types, Process of rational decision making & techniques.

UNIT-IV
Elements of organizing & processes: Types of organizations, Delegation of authority–Need, difficulties Delegation –Decentralization Staffing – Meaning & Importance Direction – Nature – Principles Communication–Types & Importance.
Motivation – Importance – theories, Leadership – Meaning –styles, qualities & function of leader, Controlling-Need, Nature, importance, Process & Techniques, Total Quality Management Coordination–Need, Importance.

Suggested Readings :
1 Bhattacharya & Deaden Accounting for management (Vikas 1986)
2. R L Gupta & V.K Gupta Financial Accounting (Part 1 and Part 11)
3. S.N. Maheshwari Fundamental Accountancy
4. EssentialofManagement–HoroldKoontzandIteinzWeibrich-McGrawhills
5. Principles & practice of management–Dr. L.M.Parasad, Sultan Chand & Sons – New Delhi
6 Business Organization & Management– Dr.Y.K.Bhushan
7. Management. Concept and Strategies By J.S. Chandan, Vikas Publishing
8. Principles of Management, By Tripathi, Reddy Tata McGrawHill

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-101P	Computer Laboratory and Practical Work of Office Automation	0	0	3	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	3	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.

Bachelor of Computer Application

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, 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

Structures: Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules, Defining Functions, Exit function, default arguments.

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

Bachelor of Computer Application

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

Bachelor of Computer Application

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

The concept of data structure, abstract data type, concept of list & array, introduction to stack, stack as an abstract data type, primitive operation on stack, stack's application - infix, postfix, prefix and recursion Introduction to queues, primitive operations on queues, queue as an abstract data type, circular queue, dequeue, priority queue, applications of queue. Introduction to linked list, memory representation of linked list, operations on linked list, linked list representation of stack and queue, header nodes, Types of linked list - doubly linked list, circular linked list, application of linked list.

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 - basic terminology of trees, binary trees, their representations as array & linked list Binary tree representation. Traversal of binary trees - inorder, preorder & postorder, application of binary tree, threaded binary tree, height balanced 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

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-204T	Numerical Methods and Graph Theory	3	0	0	3

Course outcome: The learner will learn about basics of numerical method techniques which may be used for solving advance computational problems.

UNIT-I

Graph theory. Various types of graphics, simple and multigraphs, directed and undirected graphs, Eulerian and Hamiltonian graph, graph connectivity, traversals, graph optimizations. Graph coloring, Trees Spanning trees, rooted trees, binary trees.

UNIT-II

Combinatorics : Multiplication and Addition Principles, Permutations, Permutations of Objects not necessarily Distinct, Circular Permutations, Combinations, Binomial Coefficients
Computer Arithmetic: Fixed and Floating point representation, Normalization of numbers. Errors in numbers. Iterative methods: Bisection method, False position method, Secant method, Newton Raphson method.

UNIT-III

Matrices: Eigen values and vectors, Linear System of Equations: LU decomposition method, Gauss elimination, Gauss Seidal and Gauss Jordan for solving system of equations
Interpolation. Polynomial interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange interpolation formula

UNIT-IV

Method of least squares, Fitting of straight line, parabola, logarithmic, power curves and other simple forms by method of least squares.
Numerical Integration. Trapezoidal rule, Simpson's 1/3 rd and 3/8 th rule, Numerical Differentiation: Euler's, modified Euler's and Runge-Kutta (RK) 2nd order and 4th order.

Reference Books:
1 K E. Atkinson, W. Han, Elementary Numerical Analysis, 3rd Ed., Wiley, 2003.
2. Swami M. N S & Thisiraman E Graphics Networks And Algorithms (John Wiley & Sons)
3 Tremblay J.P. and Manohar R. Discrete Mathematical structure with application to computer science (McGrah Hill).
4 B Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, 2007.
5 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.
6 Computer oriented numerical methods by V Rajaraman

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-205T	Software Engineering	3	0	0	3

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

UNIT-I
Introduction: Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models. Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

UNIT-II
Software Requirement Specifications (SRS): Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model

UNIT-III
Software Design & Testing: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, TopDown and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs. Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top Down and Bottom- Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through,Code Inspection, Compliance with Design and Coding Standards.

UNIT-IV
Software Maintenance and Software Project Management: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models. Software Risk Analysis and Management.

Suggested Readings:

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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.
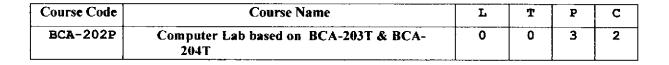6. Ian Sommerville, "Software Engineering", Addison Wesley

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-201P	Computer Lab based on BCA-201T & BCA-202T	0	0	3	2

Practical will be based on BCA-201T using Python Programming and BCA-202T based on hardware lab. 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-203T & BCA-204T	0	0	3	2

Practical will be based on BCA-203T and BCA-204T using C programming Language 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.

Bachelor of Computer Application

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 idendity and behaviour 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",3 rd 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.

Bachelor of Computer Application

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 of 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 A.K Majumdar, P.Bhattacharya," Database Management Systems",TMH,1996.
4. Bipin Desai, "AnIntroductiontodatabasesystems",GalgotiaPublications,1991

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-303T	Data Communication & Computer Networks	3	0	0	3

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

UNIT-I
Computer Communication & Network: Data Communication: Data communication Components and characteristics, Data representation and Data flow, Data Transmission : Analog and Digital - Data, Signals, Transmission Systems, Asynchronous and Synchronous transmission; Analog and Digital Transmission; Bandwidth, Channel Capacity- Nyquist Bandwidth, Shannon Capacity Formula, Baud v/s Bit Rate, Transmission Impairments, Modulation, Multiplexing- FDM, TDM, WDM, Concepts of Frequency Spread Spectrum, Transmission Media (Guided, Unguided), Switching- Message, Circuit, Packet, Frame relay and Cell relay, Asynchronous Transfer Mode(ATM)

UNIT-II
Introduction to Computer Network Types of Network· Based on Topology (Bus, Star, Ring Mesh, Tree); Based on Size Technology and ownership (LAN, MAN, WAN); Based on Computing (Centralized, Distributed and Collaborative), Based on Connection management ; Design Issues for the Layers; Interfaces and Services; ISO-OSI Reference Model and TCP/IP Model.

UNIT-III
Physical Layer. Design Issues, Services provided to Upper Layer. Physical Layer Specification (Mechanical, Electrical, Functional and Procedural)
Data Link Layer Services provided to the Upper Layer, Framing, Error Control, Flow Control; IEEE Standards for
MAC Sublayer; Network Layer: Services provided to the Upper Layer: Routing Algorithms (Centralized, Distributed and Isolated), Congestion Control(Token Based and Non Token Based), Internetworking (Negotiations across Subnet)

UNIT-IV
Upper Layers. Transport Layer: Services provided to the Upper Layers, Elements of Transport Control Protocols- Physical Connection Management, Flow Control, Multiplexing, Host-To-Host Acknowledgement, Crash Recovery; Introduction to TCP and UDP; Introduction of Session Layer; Presentation Layer; Application Layers and their functions.

Suggested Readings:
1. Ahuja H.L., "Business Economics", S.Chand & Co., New Delhi,2001
2. Ferfuson P.R ,Rothchild, Rand FergusenG.J."Business Economics"Mac-millan,Hampshire,1993
3. Karl E.Case & RayC.fair, "Principles of Economics", Pearson Education,Asia,2000
4. Nellis, Joseph.Parker David,"The Essence of Business Economics", Prentice Hall,NewDelhi,1992.

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-304T	Statistical Techniques	3	0	0	3

Course outcome: The learner will learn about basics of statistical techniques to understand the advanced topics of Data Science.

UNIT-I
Introduction to Statistics and Data Science: Role of Data Science in modern era. Data to Decision, Data and information. Characteristics of data- Concept & Types of Measurement –Nominal, Ordinal, Ratio and Interval, Collection Classification, Tabulation of data, Diagrammatic & Graphical Representation of data: Histogram, Frequency polygon, Ogives and Box Plot. Measures of Central tendency: Arithmetic mean, Median, Mode, Geometric Mean and Harmonic Mean, their properties. Partition values : Quartiles, Deciles and Percentiles.

UNIT-II
Measures of Dispersion: range, mean deviation, absolute deviation, variance and standard deviation, quartile deviation, inter quartile range, coefficient of variation. Moments about arbitrary point, central moments, relation between raw moments and central moments, Skewness and Kurtosis, their different measures and significance.

UNIT-III
Probability : Trials, sample Space, events, algebra of events, probability of an event, probability of compound events, conditional probability and independent events, total and compound probability theorems, Bayes theorem and its Applications
Random variable, discrete and continuous random variable, distribution function, probability mass function, probability density function, expectation, moment generating function.

UNIT-IV
Binomial, Uniform and Normal Distributions.
Correlation, Types of relationships, Scatter diagram, Karl-Pearson's Correlation Coefficient and its properties. Rank correlation and its coefficient. Regression analysis through both types of regression equations for X and Y variables. Simple linear regression model.

Reference Books:
1. Fundamentals of mathematical Statistics by V.K Kapoor and S.C. Gupta
2 Statistics Theory and Practice by R S N Pillai, Bagavathi
3 Practical statistics by S P Gupta

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-205T	E-Commerce	3	0	0	3

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

Bachelor of Computer Application

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.

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-401T	Computer Graphics & Multimedia Application	3	1	0	4

Course outcome: The Lerner will come to know about the computer graphics techniques and their use in the real world for solving different types of problems.

UNIT-I

Introduction: The Advantages of Interactive Graphics, Representative Uses of Computer Graphics, Classification of Application Development of Hardware and software for computer Graphics, Conceptual Framework for Interactive Graphics, Overview, Scan· Converting Lines, Scan Converting Circles, Scan Converting Ellipses.

UNIT-II

Hardcopy Technologies, Display Technologies, Raster-Scan Display System, Video Controller, Random-Scan Display processor, Input Devices for Operator Interaction, Image Scanners, Working exposure on graphics tools like Dream Weaver, 3D Effects etc, Clipping : Southland- Cohen Algorithm, Cyrus-Beck Algorithm, Midpoint Subdivision Algorithm

UNIT-III

Geometrical Transformation

2D Transformation, Homogeneous Coordinates and Matrix Representation of 2D Transformations, composition of 2D Transformations, the Window-to-Viewport Transformations, Introduction to 3D Transformations Matrix

Representing Curves & Surfaces: Polygon meshes parametric, Cubic Curves, Quadric Surface;

Solid Modeling: Representing Solids, Regularized Boolean Set Operation, primitive instancing, Sweep Representations, Boundary Representations, Spatial Partitioning Representations, Constructive Solid Geometry Comparison of Representations

UNIT-IV

Introductory Concepts· Multimedia Definition, Concept of Multimedia, Multimedia applications, Advantage of Digital Multimedia, Multimedia system Architecture, Objects of Multimedia., Computer Animation (Design, types of animation, using different functions), Uses of Multimedia, Introduction to making multimedia–The stage of Project, hardware & software requirements to make good multimedia skills and Training opportunities in Multimedia Motivation for Multimedia usage

Suggested Readings:

1. Foley, Van Dam, Feiner, Hughes, Computer Graphics Principles & practice,2000
2. D J.Gibbs & D.C.Tsichritzs: Multimedia programming Object Environment & Framework,2000
3. Ralf Skinmeiz and Klana Naharstedt, Multimedia. computing, Communication and Applications, Pearson, 2001
4. D Haran & Baker. Computer Graphics Prentice Hall ofIndia,1986

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-402T	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.

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-403T	Data Warehousing & Data Mining	3	1	0	4

Course outcome: The learner will learn about Data Warehousing & Data Mining, i.e., knowledge of Data Warehouse and its components, the process of Warehouse Planning and Implementation, the various process of Data Mining and decide best according to type of data.

UNIT-I

Data Warehousing: Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept. Data Warehouse Process and Technology- Warehousing Strategy, Warehouse management and Support Processes, Warehouse Planning and Implementation, Hardware and Software for Data Warehousing

UNIT-II

Data Mining: Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation. Decision Tree.

UNIT-III

Classification: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms.

Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms Hierarchical Clustering- CURE and Chameleon Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE Model Based Method – Statistical Approach, Association rules· Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.

UNIT-IV

Data Visualization and Overall Perspective: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining.

Suggested Readings:

1. Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH.
2 Mark Humphries, Michael W. Hawkins, Michelle C. Dy, "Data Warehousing: Architecture and Implementation", Pearson.
3 I.Singh, "Data Mining and Warehousing", Khanna Publishing House.
4 Margaret H. Dunham, S. Sridhar,"Data Mining:Introductory and Advanced Topics" Pearson Education
5 Arun K. Pujari, "Data Mining Techniques" Universities Press.
6. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-404	Soft Computing	3	0	0	3

Course outcome: The Lerner will come to know about different soft computing techniques including neural network, fuzzy systems and genetic algorithm and their use in solving different problems.

UNIT-I
Introduction To Neural Networks: Neural Networks Neuron, Nerve Structure And Synapse, Artificial Neuron and Its Model, Activation Functions. Neural Network Architecture. Single Layer And Multilayer, Feed Forward Networks, Recurrent Networks. Perception and Convergence Rule Supervised Learning Network & Unsupervised Learning Network.

UNIT-II
Back Propagation Networks: Perceptron Model, Solution, Single Layer, Multilayer Perception Model, Back Propagation Learning Methods, Effect Of Learning Rule Co-Efficient ;Back Propagation Algorithm, Applications

UNIT-III
Fuzzy Logic Introduction. Basic concepts of Fuzzy Logic, Fuzzy Sets And Crisp Sets, Fuzzy Set Theory and Operations, Properties Of Fuzzy Sets. Fuzzy And Crisp Relations, Fuzzy To Crisp Conversion, Membership Functions, Interference In Fuzzy Logic, Fuzzy If-Then Rules, Fuzzy fictions & Defuzzificataions

UNIT-IV
Genetic Algorithm: Basic Concepts, Working Principle, Procedures Of GA, Flow Chart Of GA. Genetic Representations, (Encoding),Genetic Operators, Mutation, Generational Cycle

Suggested Readings:
1   S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications" Prentice Hall of India,2003
2   Anderson, James, "Introduction to Neural Networks", PHI Publication, Delhi, India
3. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press, USA,2005.
4. Simon Haykin,"Neural Netowrks and Learning Machines "Prentice Hall of India, 2005,Third Edition.

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-405T	Operating System	3	0	0	3

Course outcome: The learner will learn about different operating system concepts used for user management process management, memory management etc.

UNIT-I

Introduction, What is an operating system, Simple Batch Systems, Multi-programmed Batch systems, Time-Sharing Systems, Personal – Computer Systems, Parallel systems, Distributed systems, Real- Time Systems.

Memory Management: Background, Logical versus physical Address space, swapping, Contiguous allocation. Paging, Segmentation

Virtual Memory: Dem and Paging, Page Replacement, Page-replacement Algorithms, Performance of Demand Paging, Allocation of Frames, Thrashing, Other Considerations

UNIT-II

Processes: Process Concept, Process Scheduling, Operation on Processes

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple–Processor Scheduling.

Process Synchronization: Background, The Critical–Section Problem, Synchronization Hardware. Semaphores, Classical Problems of Synchronization

UNIT-III

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

UNIT-IV

Device Management: Techniques for Device Management, Dedicated Devices, Shared Devices, Virtual Devices; Input or Output Devices, Storage Devices, Buffering, Secondary Storage Structure Disk Structure, Disk Scheduling, Disk Management, Swap- Space Management, Disk Reliability
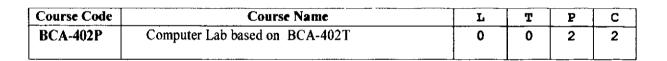
Suggested Readings:

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

Bachelor of Computer Application

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 (Computer Graphics & Multimedia Application). 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 (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.

Bachelor of Computer Application

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

Bachelor of Computer Application

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

Course outcome The learner will come to know about the basics of Artificial Intelligence and Machine learning which also includes different mathematical concepts of mathematics used in machine learning.

UNIT-1
Introduction to Machine Learning: Background, The AI Landscape, Classifications, Understanding How Machines Learn, Artificial Intelligence, Introduction to Other Players, Looking Forward to Future

UNIT-II
Breaking Down Machine Learning
Types of Machine Learning: Supervised, Unsupervised, Reinforced, Robot learning, Self-Learning, Feature Learning, Sparse Dictionary Learning; Elements, Characteristics, Tools, Machine Learning Models, ANN, Deep Learning, Decision Trees, Support Vector Machines, Regression Analysis, Bayesian Networks, Genetic Algorithms, Applications, Use Cases.

UNIT-III
Mathematics behind Machine Learning
Working with Data, Matrix Creation, Operations, Performing Matrix Multiplication, Advanced Matrix, Vectorization, Probabilities, Bayes' theorem, Statistics, Examples

UNIT-IV
Machine Learning & Data
Learning with Data, Defining Data, Data Sources, Building Data Source, Existing Data Sources, Locating Data Sources, Role of Algorithms, Defining Algorithms, Techniques, Defining What Training Means, Setting Up Training.

Suggested Readings:

1. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
2. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007
4. Mevin P. Murphy, "Machine Learning: A Probab
5. Peter Harrington, Machine Learning in Action, Dreamtech Press

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-503T	Privacy and Security in Online Social Media	3	1	0	4

Course outcome: The learner will learn about the working of online social networks, privacy policies of online social media and various privacy issues associated with popular social media.

UNIT-I
Introduction to Online Social Networks: Introduction to Social Networks, From offline to Online Communities, Online Social Networks, Evolution of Online Social Networks, Analysis and Properties, Security Issues in Online Social Networks, Trust Management in Online Social Networks, Controlled Information Sharing in Online Social Networks, Identity Management in Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs; Collecting data from Online Social Media.

UNIT-II
Trust Management in Online Social Networks: Trust and Policies, Trust and Reputation Systems, Trust in Online Social, Trust Properties, Trust Components, Social Trust and Social Capital, Trust Evaluation Models, Trust, credibility, and reputations in social systems; Online social media and Policing, Information privacy disclosure, revelation, and its effects in OSM and online social networks; Phishing in OSM & Identifying fraudulent entities in online social networks.

UNIT-III
Controlled Information Sharing in Online Social Networks: Access Control Models, Access Control in Online Social Networks, Relationship-Based Access Control, Privacy Settings in Commercial Online Social Networks, Existing Access Control Approaches.

UNIT-IV
Identity Management in Online Social Networks: Identity Management, Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-Presentation, Identity thefts, Open Security Issues in Online Social Networks.
Case Study: Privacy and security issues associated with various social media such as Facebook, Instagram, Twitter, LinkedIn etc.

Suggested Readings:
1. Security and Privacy-Preserving in Social Networks, Editors: Chbeir, Richard, Al Bouna, Bechara (Eds.), Spinger, 2013.
2. Security and Trust in Online Social Networks, Barbara Carminati, Elena Ferrari, Marco Viviani, Morgan & Claypool publications.
3. Security and Privacy in Social Networks, Editors. Altshuler, Y., Elovici, Y., Cremers, A.B., Aharony, N., Pentland, A. (Eds.), Springer, 2013
4. Security and privacy preserving in social networks, Elie Raad & Richard Chbeir, Richard Chbeir& Bechara Al Bouna, 2013
5. Social Media Security: Leveraging Social Networking While Mitigating Risk, Michael Cross, 2013.

Bachelor of Computer Application

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 – I Minor	0	5	3	8

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.

Bachelor of Computer Application

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.

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 William Stallings, "Cryptography and Network Security: Principles and Practice," Sixth Edition, Pearson, 2014

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-602T	Mobile Computing	3	1	0	4

Course outcome: The learner will learn about the fundamentals of mobile computing, wireless networking protocols, various data management issues and security issues in mobile computing.

UNIT-I
Introduction, Issues in mobile computing, Overview of wireless telephony, Cellular concept, GSM- air interface, channel structure; Location management- HLR-VLR, hierarchical, handoffs, Channel allocation in cellular systems, CDMA, GPRS, MAC for cellular system.

UNIT-II
Wireless Networking, Wireless LAN Overview- MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, Data broadcasting, Mobile IP, WAP architecture, protocol stack, application environment, applications.

UNIT-III
Data management issues in mobile computing, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

UNIT-IV
Mobile Agents computing, Security and fault tolerance, Transaction processing in mobile computing environment Adhoc networks, Localization, MAC issues, Routing protocols, Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Adhoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Adhoc Networks, applications

Suggested Readings:
1 Schiller J., "Mobile Communications", Pearson
2 Upadhyaya S. and Chaudhury A., "Mobile Computing", Springer
3. Kamal R., "Mobile Computing", Oxford University Press
4 Talukder A. K. and Ahmed H., "Mobile Computing Technology, Applications and Service Creation", McGraw Hill Education
5. Garg K., "Mobile Computing Theory and Practice", Pearson.
6 Kumar S., "Wireless and Mobile Communication", New Age International Publishers
7 Manvi S. S. and Kakkasageri M. S., "Wireless and Mobile Networks- Concepts and Protocols", Wiley India Pvt Ltd

Bachelor of Computer Application

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

Course outcome:

The learner will learn about the concepts of Cloud Computing, key technologies, strengths and limitations of cloud computing. Also develop the ability to understand and use the architecture to compute and storage cloud, service & models and the application in 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. Hadoop – MapReduce – Virtual Box — Google App Engine –Programming Environment for Google App Engine

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. 5. G J. Popek, R.P. Goldberg, "Formal requirements for virtualizable third generation Architectures, Communications of the ACM", No.7 Vol.17, July 1974

Bachelor of Computer Application

Course Code	Course Name	L	T	P	C
BCA-601R	Research Project – II : Major	0	6	4	10

This major project evaluation under.

- Presentation/Seminar
- Dissertation/Project Report
- Viva-Voce

and, evaluated by Internal & External examiners.

Research Project Guidelines for V and VI Semester

1. Objectives of the Project
- To facilitate the student to independently formulate and solve a social, philosophical, commercial, or technological problem and present the results in written and oral form.
- To render students to the real life problems.
- To provide opportunities to students to interact with people and present them confidently.

2. Types of Project
The students are expected to work on:

(1) Application Oriented Project or
(2) Research Oriented Project.

> However, it is not mandatory for a student to work on a real-life project. The student can formulate a project problem with the help of his Guide and submit the project proposal of the same. **Approval of the project proposal is mandatory.** If approved, the student can commence working on it, and complete it. It is upon the student to carry the same project of V semester to VI semester OR choose a new project for VI semester. Use the latest versions of the software packages for the development of the project.

3. Software and Broad Ideas of Application

- **Languages - C, C++, Java, VC++, C#, R, Python**
- **Scripting Languages** - PHP,JSP, SHELL Scripts (Unix), TcL/TK
- **.NET Platform** - F#,C#. Net, Visual C#. Net, ASP.Net
- **Middle Ware(Component) Technologies - COM/DCOM, Active-X, EJB**
- **Front-End/GUI Tools** - .Net Technologies, Java
- **Back-End/DBMS** - Oracle, SQL Plus, MY SQL, SQL Server
- **UNIX Internals** - Device Drivers, RPC, Threads, Socket programming
- **Real time Operating Systems/Embedded Skills** - LINUX, Raspberry Pi, Arduino.
- **Application and Research Areas** - Financial / Insurance / Manufacturing / Multimedia / Computer Graphics / Instructional Design/ Database Management System/ Internet / Intranet / Computer Networking-Communication Software development/ E-Commerce/ ERP/ MRP/ TCP-IP programming / Routing protocols programming/ Socket programming

4. Eligibility of the Guide
Guide should be a regular/approved teacher of the University/College/Higher Education/Institute. Student can also do the project under the guidance of regular/approved teacher of Institute of National Importance .

5. Introduction to the Project

The student should include the details in the project diary, in which they will record the progress of their project throughout the course. The project report should be documented with scientific approach to the solution of the problem that the students have sought to address. The project report should be prepared in order to solve the problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards. The project report should contain enough details to enable examiners to evaluate the work. The important points should be highlighted in the body of the report, with details often referred to appendices.

6. Structure and Format of the Project

Chapter 1 to 4 should be submitted in Semester V in spiral binding and these chapters have also to be included in Semester VI report if same project is carried from V to VI semester. If different projects are taken than complete project report is to be submitted in each semester. Semester VI report has to be hard bound with golden embossing. Students will be evaluated based on the project in V and VI semester independently.

(i)   Title Page:

Sample format of Title page is given below. Students should follow the given format.

(All the text should be in Times New Roman)

<TITLE OF THE PROJECT>
(NOT EXCEEDING 2 LINES, 24 BOLD, ALL CAPS)

A Project Report (12 Bold)

Submitted in partial fulfillment of the
Requirement of the award of the Degree of (Size- 12)

BACHELOR OF COMPUTER APPLICATION (BCA) (14 BOLD, CAPS)

By (12 Bold)

Name of The Student (Size 15, title case)
Roll Number (Size- 15)

COLLEGE LOGO

DEPARTMENT NAME
FACULTY NAME (12 BOLD, CAPS)
UNIVERSITY/COLLEGE NAME (14 BOLD, CAPS)
Affiliated to University Name) (12, Title case, bold, talic)

CITY, PIN CODE(12 bold, CAPS)
UTTAR PRADESH (12 bold, CAPS)
YEAR (12 bold)

(ii)   Original Copy of the Approval Proforma of the Project Proposal:
Sample Proforma of Project Proposal is given below. Students should follow the given format.

PROFORMA FOR THE APPROVAL OF PROJECT PROPOSAL

(Note All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in any respect will be rejected)

Roll no   . ...

1. Name of the Student

.. ..

2. Title of the Project

.   ...

3. Name of the Guide

....

4. Teaching experience of the Guide

. ...

Signature of the Student   Signature of the Guide
Date......   . .   Date .   ...

Signature of the Project Coordinator
Date. .....

(iii)   Certificate of Authenticated work:
Sample format of Certificate of Authenticated work is given below. Students should follow the given format.

UNIVERSITY/COLLEGE NAME (14 BOLD, CAPS)
(Affiliated to University Name) **(13, bold, italic)**
CITY NAME-PINCODE (13 bold, CAPS)

DEPARTMENT NAME (14 BOLD, CAPS)

College Logo

CERTIFICATE (14 BOLD, CAPS, underlined, centered)

This is to certify that the project entitled, **"Title of The Project"**, is bonafied work of **NAME OF THE STUDENT** bearing **Roll No.** submitted in partial fulfillment of the requirements for the award of degree of BCA from University Name
(12, times new roman, justified)

Name of Internal Guide (12 bold)   Name of Coordinator

(Don't write names of lecturers or HOD)

External Examiner

Date: College Seal

(iv) **Certificate from other Institute of National Importance** (to be issued by the HEI and the photocopy of the certificate is to be attach)

(v) **Abstract**

This should be one/two short paragraphs (100-150 words total), summarizing the project work. It will not be a re-statement of the original project outline. A suggested flow is background, project aims and main achievements. From the abstract, a reader should be able to determine if the project is of interest to them and, it should present results of which they may wish to know more details.

> (Project Abstract page format)
>
> **Abstract (20bold, caps, centered)**
>
> Content goes here (12. justified)
>
> Note Entire document should be with 1.5 line spacing and all paragraphs should start with 1 tab space.

(vi) **Acknowledgements**

This should express student's gratitude to those who have helped in the preparation of project.

> **ACKNOWLEDGEMENT (20, BOLD, ALL CAPS, CENTERED)**
>
> The acknowledgement should be in times new roman, 12 font with 1 5 line spacing. Justified.

(vii) **Declaration**

> (Declaration page format)
>
> **DECLARATION (20 bold, centered, allcaps)**
> **Content (12, justified)**
>
> I here by declare that the project entitled, "**Title of the Project'** done at [**name of place where projects is done**] has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me. no one has submitted to any other universiny
>
> The project is done in partial fulfilment of the requirements for the award of degree of BCA to be submitted as [V OR VI] semester
> project as part of our curriculum.
>
> Name and Signature of the Student

(viii) Table of Contents

The table of contents gives the readers a view of the detailed structure of the report. The students would need to provide section and subsection headings with associated pages. The formatting details of these sections and subsections are given below.

TABLE OF CONTENTS (20bold, caps, centered)

Should be generated automatically using word processing software.

(ix) List of Tables

List of all the tables in the project along with their page numbers.

List of Tables (20 bold, centered, Title Case)

Should be generated automatically using word processing software

(x)   List of Figures

List of all the figures, graphs, charts etc. in the project along with their page numbers.

> **List of Figures (20 bold, centered, Title Case)**
>
> Should be generated automatically using word processing software

Chapter 1: Introduction

The introduction has several parts as given below:

- Background: A brief detail of background and framework of project and its relation to work done in the area.
- Objectives: Point wise statement of the aims and objectives of the project
- Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:
  - o Purpose: Describe the topic of the project on the basis of why this project is being done. How this project improve the existing system.
  - o Scope: Describe methodology, assumptions and limitations.
  - o Applicability: State the application of project.
- Achievements: Explain what kind of purpose is achieved after completion of project.
- Organization of Report: Summarize remaining chapters of the project report.

> (Project Introduction page format)
>
> **Chapter 1**
> **Introduction (20 Bold, centered)**
>
> Content or text (12, justified)
>
> Note. Introduction has to cover brief description of the project with minimum 4 pages.

Chapter 2: Literature Review OR Survey of Technologies

In this chapter survey of technologies for application oriented project should demonstrate the student awareness and understanding of available technologies OR literature survey is required for research oriented project. The student should give the detail of all the related literature/technologies that are necessary to complete the project. The student should present a comparative study of all those technologies/literature.

Chapter 3: Requirements and Analysis (For Application Oriented) OR [Title of Research Working Chapter]

Chapter 4: System Design (For Application Oriented) OR [Chapter related to Research Work]

Chapter 5: Implementation and Testing

- **Implementation Approaches:** Define the plan of implementation, and the standards or standard data sets used in the implementation.
- **Coding Details and Code Efficiency:** Students not need include full source code, instead, include only the important codes (design of new data structure, algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way. The student can explain the function of the code with a shot of the output screen of that program code. The student should explain how the code is efficient and how the students have handled code optimization.
- **Testing Approach**
- **Modifications and Improvements**

Chapter 6: Results and Discussion

- **Test Reports:** Student should provide the test results and reports based on the test cases to show that it works fine in different conditions of input.
- **User Documentation:** In this section, working of the software should be explained; also explain its different functions with screen shots. The user document should be like a manual.

Chapter 7: Conclusions and Future Work

The conclusions shall be summarized with in 2 or 3 pages. This chapter mainly focuses on:

- Limitations of the Proposed System OR Research
- Future Scope describes new areas of investigation and parts of the current work that was not completed due to time constraints and/or problems encountered.

(xi)   References

In this, students acknowledge the work of others that they have used or adapted in their own work. Student can follow the given standard for the references for books, journals, and online material. The citation is mandatory in both the reports.

Eg.
Lipson, Charles (2011). Cite right : A quick guide to citation styles; MLA, APA, Chicago, the sciences, professions, and more (2nd ed.). Chicago [u.a.]: University of Chicago Press. p. 187. ISBN 9780226484648.

(xii)   Glossary

If any acronyms, abbreviations, symbols, or uncommon terms is used in the project report then their meaning should be explained where they first occur.

(xiii)   Appendices

Appendix include some further details like results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

7. Evaluation

* During the project work, its progress will be monitored, on fortnightly/monthly basis, by the internal guide.
* 2 copies of Project Report to be submitted to department (1 copy to be retained by department, 1 copy for student)
* End Examination shall be based on Project Report, Presentation, Viva, and Demonstration of the software.

Duration (for each group):

Evaluation in V and VI semester separately		
Type of evaluation	**Total time**	**Max. Marks**
Presentation	10 minutes	25%
Viva	10 minutes	20%
Demonstration	5 minutes	20%
Report checking	5 minutes	35%
Total Time/Max. Marks	**30 minutes**	**100%**

Format of Certificate of Evaluation
Certificate of Evaluation (14 point, Times, Bold)

This is to certify that the undersigned have assessed and evaluated the project work titled "..............................." submitted by the following student(s).
1.
2.
3.

The project report has been accepted/ rejected for the partial fulfillment of BCA progarmme.

Signature of the examiner
Name of the examiner

Stamp of the Department

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8. Project Viva Voice

Student may be asked to write code for some segment of the problem during VIVA to check his coding capabilities. The project can be done in group of at most two or three students. A big project can be modularized and different modules can be assigned as separate project to different students.