

**VIJAYANAGARA
SRI KRISHNADEVARAYA UNIVERSITY
BELLARY**



**SYLLABUS
FOR
BACHELOR OF COMPUTER APPLICATIONS
(B.C.A)**

(New syllabus with effect from 2016-2017)

SCHEME OF EXAMINATION

&

DETAILED SYLLABUS

For

BACHELOR OF COMPUTER APPLICATIONS

(BCA) DEGREE

**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BELLARY,
KARNATAKA, INDIA**

I) Eligibility for Admission

1. A candidate who passed the three year Diploma in the branch of computer science, examination conducted by the board of Technical education, Government of Karnataka, shall be eligible for admission to first semester of BCA degree course.
2. A candidate who passed the two-year Pre-University examination in science/commerce of Karnataka state or any other examination considered as equivalent there to is eligible for admission to the first semester of BCA degree course.
3. If he/she is unable to pass or complete the degree within 6 years he/she should take readmission into BCA for I semester(study all the 6 semesters from first).

II) Claim of Exemption

A candidate who keeps terms for I, II and V semesters be allowed to keep terms for II, IV and VI semesters respectively, subjected to the following conditions:

1. A candidate who passes 50% of theory and practical's put together of I and II semester examinations (at the end of second semester) be allowed to keep terms for III semester.
2. A candidate who passes fully I and II semesters and 50% of theory and practical's put together of III and IV semesters examinations (at the end of IV semester) be allowed to keep terms for V semester.

BCA Regulations

For B.Sc course only students completing PUC or its equivalent examination with science subjects are eligible. For BCA course only students completing PUC or its equivalent examination with science subjects and PUC (Commerce) or its equivalent examination with Mathematics as one of the subjects are eligible.

BCA II Year

Title of the Paper	Teaching/ week/ Hrs.	Practical Per Week/Hrs	Duration of Exam/Hrs	Marks in Examination				
				Theory	IA	Prac	IA	Total
III Semester								
3.1 Basic English	4		3	70	30	-	-	100
3.2 Kannada/any Indian Language	4		3	70	30	-	-	100
3.3 Computer Application	4		3	70	30	-	-	100
3.4 Graph theory	4		3	70	30			100
3.5 Data Structure	4	2	3	70	30	40	10	150
3.6 operating system	4	2	3	70	30	40	10	150
3.7 Co-curricular Activities*	2						50	50
Total	26	04						750
IV Semester								
4.1 Basic English	4		3	70	30	-	-	100
4.2 Kannada/any Indian Language	4		3	70	30	-	-	100
4.3 Data Warehousing and Data Mining	4		3	70	30	-	-	100
4.4 Numerical Methods	4		3	70	30			100
4.5 Visual Basic	4	2	3	70	30	40	10	150
4.6 E-Commerce	4	2	3	70	30	40	10	150
4.7 Co-curricular Activities*	2						50	50
Total	26	04						750

BCA I Semester

(w.e.f. academic year 2014 – 2015 onwards)

BCA1.1	Basic English
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 54 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA1.2	Kannada/Any Indian Language
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 54 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA1.3	Indian Constitution
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 54 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

Teaching : 4 Hrs. / Week (2 Credits)
Total Hours : 52 Hrs

Max. Marks : 70
I. A. Marks : 30

Unit 1: Complex Numbers: Addition and multiplication of complex numbers, Modulus, amplitude and conjugate of a complex number, real and imaginary parts and the conjugate of a complex number. Geometric representation of the sum, difference, product and quotient of two complex numbers as well as of the modulus, De-Moivre's theorem, roots of unity. **12Hrs**

Unit 2: Matrices and Determinants : Matrix, properties of matrices, transpose, multiplication of matrices, inverse of matrix, solution of simultaneous equations, rank of a matrix and its properties, Eigen values and Eigen vectors, Determinants- definition, properties, factor theorem, multiplication of determinants, Cramer's rule for solving simultaneous linear equations. **12Hrs**

Unit 3: Differential Calculus : Constants, Variables, Functions, Value of a function, Kinds of functions, Limit, Left hand and right hand limits, Continuity of a function, Differentiability, Successive differentiation, Applications of differentiation, Rolle's theorem and mean value theorem. Indeterminate form, L' Hospital's rule, Taylor's theorem for a function of two variables. Maxima and Minima of function of one and two variables. Lagrange's method of undetermined multipliers for extreme values. **14Hrs**

Unit 4: Integral Calculus : Definition, Indefinite nature of Integration, Standard Elementary integrals, Theorems, Definite integral, Properties of definite integrals, Geometrical interpretation of a definite integral, Improper definite integrals, Methods of Integration, Integration by substitution, Integration by parts, Integration of algebraic functions of exponent and trigonometric functions. Evaluation of double integrals, applications. **14Hrs**

References

1. M. Shantakumar, Engineering Mathematics – Volume I, Vasundhara Publishers, Mysore.
2. Shanti Narayan, Matrices, S.Chand & Co. N. Delhi
3. Shanti Narayan, Differential Calculus, S. Chand & Co., N. Delhi
4. Shanti Narayan, Integral Calculus , S. Chand & Co., N. Delhi
5. G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry , 9th Edition, ISE Reprint, Addison-Wesley
6. H. K. Das, Engineering Mathematics, S. Chand & Co., N. Delhi.
7. B. S. Grewal, Higher Engineering Mathematics, Kanna Pub. Delhi, N. Delhi
8. A.R.Desai, Engineering Mathematics – II (2007) , Elite Publishers.

BCA 1.4	Accountancy
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Teaching : 4 Hrs. / Week

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1 : Introduction: History and Development of Accounting – Meaning, Objectives and functions of Accounting – Book – keeping V/s Accounting – Users of accounting data – systems of book– keeping and accounting – branches of accounting – advantages and limitations of accounting. **12Hrs**

Unit 2: Accounting Concepts and Convention: Meaning, need and classification, Accounting standards – meaning, need and classification of Indian accounting standards. Accounting principles V/s Accounting standard

Financial Accounting Process: Classification of accounting transactions and accounts, rules of debit and credit as per Double Entry System. Journalization and Ledger posting. **12Hrs**

Unit 3:Preparation of Different Subsidiary Books: Purchase Day book Sales Day Book, Purchase Returns Day Book, Sales Returns Day Book, Cash Book.

Bank Reconciliation Statement: Meaning, Causes of Difference – Advantages –Preparation of Bank Reconciliation Statements. **12Hrs**

Unit 4 :Account Procedure: Honor of the Bill, Dishonor of the Dill, Endorsement, Discounting, Renewal, Bill for collection, Retirement of the Bill, Accommodation Bills, Bill Receivable Book and Payable Book.

Preparation of Trial Balance: Rectification of errors and Journal Proper. **8Hrs**

Unit 5 : Preparation of Final Accounts: Meaning, need and classification, Preparation of Manufacturing, Trading, Profit and loss account and Balance – Sheet of sale-traders and partnership firms. **8Hrs**

ReferenceBooks:

1. S. Ramesh, B.S. Chandrashekar, A Text Book of Accountancy.
2. V.A. Patil and J.S. Korihalli, Book – keeping and accounting, (R. Chand and Co. Delhi).
3. R. S. Singhal, Principles of Accountancy, (Nageen Prakash pvt. Lit. Meerut).
4. M. B. Kadkol, Book – Keeping and Accountancy, (Renuka Prakashan, Hubli)
5. Vithal, Sharma:Accounting for Management, Macmillan Publishers, Mumbai.
6. B.S. Raman, Accountancy, (United Publishers, Mangalore).
7. Tulsian, Accounting and Finacial Management – I: Financial Accounting – Person Education.

BCA1.5	Computer Fundamentals and Office Automation
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1 : Introduction: Brief history of development of computers, Computer system characteristics, Capabilities and limitations, generations of computers, Types of Computers, Basic components of a computer system - Control unit, ALU, Input/output functions and characteristics, memory - RAM, ROM, EPROM, PROM and other types of memory. **8Hrs**

Unit 2 : Input/output & Storage Units: Computer Keyboard, Pointing Devices: Mouse, Trackball, Touch Panel, and Joystick, Light Pen, Scanners, Various types of Monitors, Touch-sensitive screens, Optical Recognition System, Pen based systems, Digitizers, MICR, OCR, OMR, Barcode Reader, digital camera., Hard Copy Devices- Impact and Non- Impact Printers and plotters . **8Hrs**

Unit 3 : Computer Software: Software and its Need, Types of Software - System software, Application software, System Software - Operating System, Utility Program, Programming languages, Assemblers, Compilers and Interpreter, Introduction to operating system for PCs-DOS Windows, Linux, Programming languages Machine, Assembly, High Level, 4GL, their merits and demerits, application, Virus , Types of viruses, virus detection and prevention. **9Hrs**

Unit 4 : Word processing: Office activities and their software requirement , working with MS Word; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts; Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ; Bullets, Numbering, Auto formatting, Printing & various print options, Spell Check, Thesaurus, Find & Replace; Headers & Footers ; Inserting – Page Numbers, Pictures, Files, Auto texts, Symbols etc.; Working with Columns, Tabs & Indents; Creation & Working with Tables including conversion to and from text; Margins & Space management in Document; Adding References and Graphics; Mail Merge, Envelops & Mailing Labels. Headers and footers. Templates, wizards and graphical features. **9Hrs**

Unit 5 : Presentation graphics: Introduction & area of use; Working with MS PowerPoint; Creating a New Presentation; Working with Presentation; Using Wizards; Slides & it's different views; Inserting, Deleting and Copying of Slides; Working with Notes, Handouts, Columns & Lists; Adding Graphics, Sounds and Movies to a Slide; Working with PowerPoint Objects; Designing & Presentation of a Slide Show; Printing Presentations, Notes, Handouts with print options. **9Hrs**

Unit 6 : Spread Sheets: Introduction to spread sheet & Excel, working in Excel, concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Different Views of Worksheets; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook & Worksheets with various options & Macros. **9Hrs**

Reference Books:

1. S. K. Basandra, Computers Today, Galgotia Publications.
2. Leon and M. Leon, Fundamentals of Information Technology, Leon Vikas publishing.
3. Williams, Sawyer, Information Technology, Tata McGraw Hill.
4. Sanjay Saxena, A first course in Computer, Vikas Publishing.
5. Curtin, Foley and Morin, Information Technology, Tata McGraw Hill.
6. Cox, Joyce Et Al., 2007 Microsoft Office System Step By Step, PHI.
7. S. S. Srivatsava, MS Office, Fire Wall Pub.
8. Office Management, Dr. V Balachandran, Dr. S Chandrasekaran, Tata McGraw Hill.

BCA1.6	C Programming
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1: Overview of C: Importance of C, Sample C programs, Basic structure of C Programs, Programming style, executing a C Program. Constants, Variables, and Data Types Character set, C tokens, Keywords and identifiers, Constants, Variables, Data types, Declaration of variables, Assigning values to variables, Defining symbolic constants. **8Hrs**

Unit 2: Operators and Expression: Arithmetic of Operators, Relational operators, Logical operators Assignment operators, Increment and decrement operators, Conditional operator, Bit wise operators, Special operators, Arithmetic expressions, Evaluation of expressions, Precedence of arithmetic operators, Type conversions in expressions, Operator precedence and associativity, Mathematical functions. Managing Input and Output Operations Reading a character, writing a character, formatted input, formatted output. **8Hrs**

Unit 3: Decision Making and Branching, Decision making with IF statement, Simple IF statement, The IF ELSE statement, Nesting of IF ... ELSE statements, The ELSE IF ladder, the switch statement, the?: Operator, The GOTO statement. Decision Making and Looping The WHILE statement, The DO statement, The FOR statement, Jumps in loops. **8Hrs**

Unit 4: Arrays One-dimensional arrays, Two-dimensional arrays, Initializing two-dimensional arrays. Handling of character strings Declaring and initializing string variables, Reading strings from terminal, Writing strings to screen, Arithmetic operations on characters, Putting strings together Comparison of two strings, String-handling functions, Table of strings. **8Hrs**

Functions: Definition, function definition and prototyping, types of functions, type of arguments, recursion, passing arrays to functions, storage class in C-automatic, register, external and static variables. **6 Hrs**

Structures and Unions: Definition, declaration, accessing structure elements, Array of structure in a structure, Pointers and structures, Unions – definition, declaration, accessing union elements, typedef, enum Bit fields. **6 Hrs**

Pointers: Definition, notation, pointers and arrays, array of pointers and functions – call by value and call by reference, Pointers to pointers. Files: File opening modes, creating a data file, processing a data file. , C Preprocessor: Types of C preprocessor directives, Macros, File Inclusion. **6 Hrs**

Reference Books:

1. E. Balaguruswamy, Programming in ANSI C, 5th edition.
2. P.B. Kottur, computer concepts, & C Programming 17th edition.
3. Yashavant Kanetar Let us C 10th edition.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd Edition., PHI

BCA1.7	Co-Curricular Activities		
Teaching	: 2 Hrs. / Week		I. A. Marks: 40

Practicals for B.C.A Ist Sem:-

Practical-I	BCA1.5 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Exercises in MS Office	I.A: 10 Exam: 40

Practical-II	BCA1.6 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in C	I.A: 10 Exam: 40

BCA II Semester
(w.e.f. academic year 2014 – 2015 onwards)

BCA2.1	Basic English
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA2.2	Kannada/Any Indian Language
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA2.3	Environmental Studies
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA2.4	Discrete mathematics
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

UNIT – 1

Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, A First Word on Probability, Countable and Uncountable Sets. **8Hrs**

UNIT – 2

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems **10Hrs**

Unit-3

Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. **12Hrs**

UNIT – 4

Relations and Functions: Cartesian Products and Relations, Functions –Plain and One-to-One, Onto Functions – Stirling Numbers of the Second Kind, Special Functions, The Pigeon-hole Principle, Function Composition and Inverse Functions Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. **10Hrs**

UNIT – 5

Groups: Definitions, Examples, and Elementary Properties, Homeomorphisms, Isomorphism's, and Cyclic Groups, Co-sets, and Lagrange's Theorem. **Coding Theory and Rings:** Elements of Coding Theory, The Hamming Metric, The Parity Check, and Generator Matrices. **12Hrs**

Reference Books:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill, 2010.
2. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
3. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Cengage Learning, 2004.
4. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

BCA2.5	Database Management System (DBMS)
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

UNIT – 1

Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems. **10 Hrs**

UNIT – 2

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two. **10 Hrs**

UNIT – 3

Relational Model and Relational Algebra : Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping. **10 Hrs**

UNIT – 4

SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM. **10 Hrs**

UNIT – 5

Database Design – 1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form, Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms **12 Hrs**

Reference Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007. except SQLJ, 9.4, 10).
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003. (Chapters 16, 17.1, 17.2, 18).
3. Silberschatz, Korth and Sudharshan: Data base System Concepts, 6th Edition, Mc-Graw Hill, 2010.
4. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.

Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1

Principles of Object-Oriented Programming: Object-Oriented Programming paradigm, basic concepts of object-oriented programming, benefits of OOPs, object-oriented languages, applications of OOP, C++ statements, class, structure of C++ program, creating the source file, compiling and linking. Tokens, keywords, identifiers, data types, symbolic constants, type compatibility, variables, reference variables, operators in C++, Input/output, manipulators, type cast operator, expressions and implicit conversions, operator precedence, control structures. Function prototyping, call by reference, return by reference, inline functions, default argument, const. arguments, function overloading. **14 Hours**

Unit 2

Classes and Objects: Specifying a class, defining member functions, making an outside function inline, nesting of member functions, private member function, arrays within a class, memory allocation for objects, static data member, static member functions, arrays of objects, object as function arguments. Constructors, parameterized constructors, multiple constructors with default arguments, dynamic initialization of objects, copy constructors, dynamic constructors, and destructors. **14 Hours**

Unit 3

Friend functions, operator overloading, overloading operators using friends, manipulation of strings using operators, type conversions. Inheritance: single inheritance, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance. **12 Hours**

Unit 4

Compile time polymorphism, run time polymorphism, pointers to objects, this pointer, pointers to derived classes, virtual functions, and pure virtual functions. C++ stream classes, template functions, template class, exception handling features of C++. **12 Hours**

Reference Books:

1. E. Balaguruswamy, Object Oriented Programming with C++, Tata Mc. Graw Hill.
2. Robert Lofore, OOP in Turbo C++, Golgotia Publication.
3. B. A. Forouzon, R. F. Gilberge, Computer Science: A Structured Approach Using C++, Thomson Learning.
4. Bjarne Strastrup, "The C++ Programming Language", Addison- Wesley Publication Co.
5. Herbert Schildt, C++-The Complete Reference, TMH.

BCA2.7	Co-Curricular Activities	
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Teaching : 2 Hrs. / Week

I. A. Marks :40

Practicals for B.C.A II Sem:-

Practical-I	BCA2.5 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in DBMS	I.A: 10 Exam: 40

Practical-II	BCA2.6 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in C++	I.A: 10 Exam: 40

BCA III Semester
(w.e.f. academic year 2015 – 2016 onwards)

BCA3.1	Basic English
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA3.2	Kannada/Any Indian Language
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA3.3	Computer Applications
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Teaching : 4 Hrs. / Week(2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1:

Computer Electronics: Number System: Binary, octal, decimal & Hexadecimal number system . Binary arithmetic: Addition, Subtraction-using 1's and 2's complement. Digital Logic: AND, OR, NOT, NAND, NOR, Universal Gates. Boolean algebra: Basic postulates, principle of duality theorems, simplifications of expressions using postulates. **14Hrs**

Unit 2:

Computing Environment, Evolution of languages-Machine, Assembly and HLL Translators-Assembler, Compiler, Interpreter, Loader, Linker **8Hrs**

Unit 3:

Fundamentals of network :Computer networks, advantages and disadvantages of computer networks. Types of computer network. Data transmission, topologies. **8Hrs**

Unit 4:

Internet Applications and E-commerce. Introduction, some definitions of internet, internet services. Creating E-mail id, E-commerce, advantages and disadvantages of E-commerce. Types of E-commerce. **10Hrs**

Unit 5:

HTML: Introduction, a html document, markup tags, heading, paragraphs, text formatting, list, inline images, linking Executing html programs. **12Hrs**

References:

P.B. Kottur, Computer concepts & C Programming 17th edition.

Rajaraman, V. Fundamentals of Computers, 2nd Edition. Prentice Hall India Limited

Sanjay Saxena, A first course in Computer, Vikas Publishing.

BCA 3.4	Mathematics(Graph Theory)
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Teaching : 4 Hrs. /Week (2 Credits)
Total Hours : 54 Hrs

Max. Marks : 70
I. A. Marks : 30

UNIT - 1

Introduction to Graph Theory: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits Planar Graphs, Hamilton Paths and Cycles, Graph Colouring and Chromatic Polynomials. **Trees:** Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes **12Hrs**

UNIT - 2

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalan Numbers **10Hrs**

UNIT - 3

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials **10Hrs**

UNIT - 4

Generating Functions: Introductory Examples, Definition and Examples –Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator **10Hrs**

UNIT - 5

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions **10Hrs**

Reference Books:

1. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism,2005.
2. Chartrand Zhang: Introduction to Graph Theory, TMH, 2006.
3. Richard A. Brualdi: Introductory Combinatorics, 4th Edition,Pearson Education, 2004.
4. Geir Agnarsson & Raymond Geenlaw: Graph Theory, Pearson Education, 2007.

BCA3.5	Data Structure using C/C++
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Teaching : 4 Hrs. / Week(2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1

Introduction: Basic terminologies, operations of data structure, classification of data structure, time complexity and space complexity, O-notation, Omega notation and theta notation

Linear Data Structures-Arrays: Representation of arrays: single and multidimensional arrays, address calculation using column and row major ordering, operations on arrays, application of arrays: Matrix multiplication

Linear Data Structures – Lists: Singly linked list, circular linked lists, doubly linked lists, operations on linked list, applications of linked list: Sparse Matrix representation and polynomial representation **16 Hrs**

Unit 2

Stacks: representation of stacks in memory using arrays and linked list, operations on stacks, Applications of stacks: Conversion from infix to postfix, Evaluation of postfix expression and tower of Hanoi problem.

Queues: representation of queues in memory using arrays and linked list, circular queues, priority queue and d-queue, Applications of queues: CPU scheduling and Round Robin scheduling. **16 Hrs**

Unit 3

Nonlinear Data Structures-Trees: Tree Terminology, representation of Trees in memory using arrays and linked list , Binary tree traversal methods: Preorder, In-order, Post-ordered traversal. Types of binary trees: threaded binary trees, Binary search tree, Height balanced (AVL) tree, B-trees, Applications of trees:

Graphs: Graph representation: representation of graphs in memory using arrays and linked list , traversal schemes: Depth first search, Breadth first search, Shortest Path algorithms (Prime's and Kruskal's). **10 Hrs**

Unit 4

Searching and Sorting: sequential search, binary search, indexed sequential search, bubble sort, selection sort, Insertion sort, shell sort, heap sort, Radix sort, merge sort, quick sort, Merge sort and efficiency of sorting and searching algorithms. **10 Hrs**

Reference Books:

1. Schaums outline series TMH publication.
2. Langsam Yedidyah, Augenstein Moshe J., Tenenbaum Aaron M., Data Structures Using C and C++, PHI/Pearson Education.
3. R. F. Gilberg and B. A. Forouzan, Data Structures-A Pseudocode Approach with C, Thomson Learning.
4. Trembley, J.P. And Sorenson P.G., An Introduction To Data Structures With Applications, Mcgrraw- Hill International Student Edition.
5. Samanta. D., Classic Data Structures, PHI.

BCA3.6	Operating System
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

UNIT – 1

Introduction to Operating Systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. **12 Hours**

UNIT – 2

Process Management Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling. **10 Hours**

UNIT – 3

Memory Management: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **10 Hours**

UNIT – 4

File System, Implementation of File System: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **10 Hours**

UNIT – 5

Secondary Storage Structures, Protection : Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

10 Hours

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009. (Listed topics only from Chapters 1 to 12, 17, 21).
2. D.M Dhamdhare: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
3. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.
4. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.

BCA3.7	Co-Curricular Activities
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Teaching : 2 Hrs. / Week

I. A. Marks :40

Practicals for B.C.A III Sem:-

Practical-I	BCA3.5 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in Data Structure	I.A: 10 Exam: 40

Practical-II	BCA3.6 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in Operating System	I.A: 10 Exam: 40

BCA IV Semester
(w.e.f. academic year 2015 – 2016 onwards)

BCA 4.1	Basic English
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA4.2	Kannada / Any Indian Language
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Teaching : 4 Hrs. / Week(2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

The syllabus will be decided by the respective BOS

BCA4.3	Data Warehousing and Data Mining
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Teaching : 4 Hrs. / Week (2 Credits)
Total Hours : 52 Hrs

Max. Marks : 70
I. A. Marks : 30

UNIT-1

Introduction: What is Data Warehouse? Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Implementation, Data Mining, What kinds of Data can be Mined, What kinds of patterns can be Mined, Data cleaning, Data integration: (Entity, Identification Problem, Redundancy & Correlation Analysis), Data Reduction: (Wavelet Transforms, Attribute Subset Selection, Histogram, Clustering, Sampling, Data Cube Aggregation),Data Transformation: Strategies Overview, Data Transformation by Normalization. **18 Hrs**

UNIT-2

Mining Frequent Patterns, Associations & Correlations: Basic Concept, Frequent Item set mining methods,pattern evaluation methods. Classification, Decision tree Induction, Attribute Selection Measures, Tree Pruning, Bays Classification Methods. **18 Hrs**

UNIT-3

Cluster Analysis: What is a cluster analysis? Requirement for Cluster Analysis, Partitioning methods,

Hierarchical methods. **Data Mining Applications & Trends:** Mining Sequence Data; Time Series, Symbolic, Biological; Statistical Data Mining, Visual & Audio Data Mining, Data Mining Applications, Data Mining Trends. **16 Hrs**

Reference Books:

1. Jiawei Micheline Kamber, 'Data Mining Concepts and Techniques', Morgan Kauf Mann Publishers.
2. George M. Marakas, 'Modern Data Warehousing, Mining and Visualization', Pearson Education, 2003.
3. W.H. Inmon, 'Building the Data Warehouse', Wiley dreamtech, 3rd Edition.
4. Mastering Data Mining – Michael J.A. Berry & Gordon S. Linoff (Wiley Pub.).
5. Data Warehousing (Pearson Ed.) – Sam Anahory & Dennis Murray.

BCA4.4	Numerical Methods
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

UNIT-1

Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalization, consequences of normalized floating point representation of numbers, Errors in numbers
Finding the roots of an equation: Iterative method: Introduction, Beginning an iterative method, Bisection method, Newton Raphson method, Regula Falsi method, Secant Method. Comparison of Iterative methods, Order of Convergence of Newton Raphson Method and Secant Method.

Ordinary differential equations: Euler's method, Taylor series method, Range Kutta II and IV order methods. **18Hrs**

UNIT-2

Numerical Integration: Simpson's 1/3 and 3/8 rule, Trapezoidal rule.

Solving simultaneous linear equations: Introduction, Gauss Elimination method, pivoting, illconditioned equations, Gauss Jordan method, LU Decomposition method and Gauss-Seidel iterative method. Comparison of direct and iterative methods.

Interpolation: Introduction Lagrange interpolation, Difference Tables- Newton-Gregory Forward And backward interpolation, Truncation error in interpolation. **18Hrs**

UNIT-3

Statistical methods: Introduction, definitions, classifications, frequency distribution, mean arithmetic mean for grouped and ungrouped data, continuous frequency distribution (step deviation method), Geometric mean for grouped and ungrouped data. Standard deviation - meaning standard deviation for actual mean method, assumed mean method and step deviation method using discrete series and continuous series.

Coefficient of variation – meaning and problems

Median – meaning, calculations of median for ungrouped, Discrete series, continuous series

Mode- meaning calculations of mode for discrete series and continuous series

Correlation – meaning, types, rank correlations and problems.

16Hrs

Reference Books:

1. Computer Oriented Numerical Methods by Rajaraman. V.
2. Fundamentals of Mathematical Statistics by Gupta and Kapoor (Sultan Chand).
3. Probability and Statistics for engineers and scientists by Ronald E. Walpole and Raymond H Mayers.
4. Mathematical Statistics by John Freund (Prentice Hall India Pvt. Ltd.)
5. Numerical Methods by Jain M.K., S.R.K. Iyengar and R.K. Jain

BCA4.5	Visual Basic
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1

Introduction: Need of visual languages, integrated development environment (IDE), advantage of Visual Basic, characteristics and features of Visual Basic – IDE, Projects, user interface, objects oriented, visual development and event-driven programming, forms/graphic controls, data processing, sharing with windows and internet applications. **12 Hrs**

Unit 2

Visual Basic programming and tools: An introduction to Visual Basic programming, simple program construction, statements, input/outputs, comments, editor, subroutines, controls flow statements, objects and variants. **10 Hrs**

Unit 3

Designing user interface – elements of user interface, understanding forms, menus and toolbars, designing menus and toolbars, building dynamic forms, drag and drop operations, working with menus, customizing the toolbars. **10 Hrs**

Unit 4

Controls – textbox, combo box, scroll bar and slider control operations, generating timed events, drawing with Visual Basic using graphics controls, coordinate systems and graphic methods, manipulating colors and pixels with Visual Basic, working with ActiveX controls. **10 Hrs**

Unit 5

Menus: Creating a menu system, Creating and accessing pop-up menu, Modifying menus at runtime, adding menu items at run-time, data access methods, creating, reading and writing text files, data controls, creating queries. Report generation. **10 Hrs**

Reference Books:

1. David Schneider, Introduction to Programming using Visual Basic, PHI.
2. Mohammed Azam, Programming with Visual Basic 6.0, Vikas Publications.
3. Dietel & Dietel, Visual Basic Programming, Pearson Education.
4. David I. Schneider, An Introduction To Programming Using Visual Basic .Net®, PHI.
5. C Muthu , Visual Basic.Net, Tata Mc Graw Hill Year of Publication.

BCA4.6	E-COMMERCE
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit-1:

Introduction to Electronic Commerce: The meaning, benefits, impact, Classification, application of Electronic Commerce technologies.

Electronic Commerce Business models: meaning of business model **14Hrs**

Unit-2:

Electronic Data Interchange: conventional trading process, meaning of EDI, building blocks of EDI system, layered architecture, value added networks, benefits and application of EDI

Electronic Commerce: Architectural framework:

Electronic Commerce: Information distribution and messaging: FTP application, Email, WWW server, HTTP, Web Servers implementation. **14Hrs**

Unit-3

Electronic Commerce : Network infrastructure: LAN, Ethernet LAN, WANs, Internet, TCP/IP reference model, Domain Name systems, Internet industry structure

Electronic Commerce: securing the business on Internet: Vulnerability of information on Internet, security policy, procedures and practices, site security, protecting the network

14Hrs

Unit-4

Electronic Commerce: securing the business on Internet: transaction security, cryptography, digital signature, email security

Electronic Payment System: Introduction to payment system, Online payment system, prepaid electronic payment systems, requirement metrics of a payment system

Mobile Commerce: Introduction, Framework and models: meaning, benefits, impediments, framework **10 Hrs**

Reference Books:

1. David Whiteley, **E-Commerce: Strategy, Technologies and Applications**, Tata McGraw Hill Education Private limited, 2004

2. Ravi Kalakota, Andrew B. Whinston, **Frontiers of Electronic Commerce**, Addison-Wesley Publications,

2003. C. S. V. Murthy, **E-commerce: Concepts, Models, Strategies**, Himalaya Publishing House, 2011

BCA4.7	Co-Curricular Activities
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Teaching : 2 Hrs. / Week

I. A. Marks :40

Practicals for B.C.A IV Sem:-

Practical-I	BCA4.4 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in Numerical methods	I.A: 10 Exam: 40

Practical-II	BCA4.5 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in VB	I.A: 10 Exam: 40

BCA V Semester

(w.e.f. academic year 2016 – 2017 onwards)

BCA5.1	SOFTWARE ENGINEERING
Teaching : 4 Hrs. / Week (2 Credits)	Max. Marks : 70
Total Hours : 52 Hrs	I. A. Marks : 30

Unit 1:

Introduction: Definition of Software engineering, Software product and software process, Software attributes, Software Engineering challenges, Software development life cycle, Process model: Water fall model, Bohemia's Spiral model, Iterative enhancement model, Overview of risk management, Project management, Process visibility, Professional and ethical responsibility.

12 Hrs

Unit 2:

System Engineering: System and their environment, System Procurement, System Engineering Process, System Architecture modeling, Human Factors, System Reliability Engineering. Software Requirements – Functional and Non Functional, Requirement elicitation and Analysis, SRS document, Requirement specification, requirement Engineering Process, Requirement Validation, Requirement Management. Social 7 organizational factors, System Models – Types of models, Metrics. **10 Hrs**

Unit 3:

Software Design: Design types, Design principles – Problem partitioning, Abstraction, Modularity, Top-Down and Bottom-up, Design process, Design Strategies, Design quality, Coupling and Cohesion, Design notation and specification, Design methodologies, Domain Specific architecture. **10 Hrs**

Unit 4:

Reliability and reusability: Software reliability metrics, software reliability specifications, statistical testing, reliability growth modeling, fault avoidance, fault tolerance, exception handling and defensive programming, software development with reuse, reuse landscape, design patterns, Generator based reuse, Application system reuse – COTS product reuse, software product lines. **10 Hrs**

Unit5:

Testing: Testing fundamentals – error, fault and failure, Test cases and test criteria, process, test plan and strategies, Types of testing – Black box, White box, structural and interface testing, Program inspection, Levels of testing, Mathematically based verification, Static analysis tool, Metrics. **10 Hrs**

Reference Books

- 1. Roger S. Pressman** - Software Engineering, A Practitioner's approach, 5th Edition, McGraw-hill book company
- 2. Richard Fairly** – Software Engineering Concepts, First Edition, TATA Mcgraw Hill Publishing Co Ltd.
- 3. Pankaj Jalote** – An integrated approach to Software Engineering – Narosa Publishing house.
- 4. Jawadekar**- Software Engineering: A Primer TMH 200

BCA5.2	Computer Networks
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Teaching : 4 Hrs. / Week (2 Credits)
Total Hours : 52 Hrs

Max. Marks : 70
I. A. Marks : 30

UNIT1:

Introduction: Data Communications, Networks, The Internet, Protocols & Standards, Layered Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing

Physical Layer-1: Analog & Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital-digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog-to-digital conversion (only PCM), Transmission Modes, Digital-to-analog conversion **14Hrs**

UNIT2:

Physical Layer-2 and Switching: Multiplexing, Spread Spectrum, Introduction to switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks **14Hrs**

UNIT3:

Data Link Layer-1: Error Detection & Correction: Introduction, Block coding, Linear block codes, Cyclic codes, Checksum.

Data Link Layer-2: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy channels, HDLC, PPP (Framing, Transition phases only)

Multiple Access & Ethernet: Random access, Controlled Access, Channelization, Ethernet: IEEE standards, Standard Ethernet, Changes in the standard, Fast Ethernet, Gigabit Ethernet **12Hrs**

UNIT4:

Wireless LANs and Cellular Networks: Introduction, IEEE 802.11, Bluetooth, Connecting devices, Cellular Telephony

Network Layer: Introduction, Logical addressing, IPv4 addresses, IPv6 addresses, Internetworking basics, IPv4, IPv6, Comparison of IPv4 and IPv6 Headers. **12Hrs**

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

BCA5.3	Artificial Intelligence
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1

General issues and overview of AI, AI Techniques, AI problems, AI Techniques, importance and areas of AI, problem solving state space search-DLF, BFS Production system, problem characteristics. **12Hrs**

Unit 2

Heuristic Search Techniques: Generate and Test, Hill Climbing, Best First Search, Problem reduction, Constraint satisfaction- Cryptarithmic and problems. **12Hrs**

Unit 3

Knowledge representation & mapping, approaches to knowledge to representation, issues in knowledge representation, Representing simple facts in logic, representing instance and relationships, Resolution and natural deduction Representing knowledge using rules, Procedural v/s Declarative knowledge, Logic programming, Forward v/s Backward chaining Matching & control knowledge. **18Hrs**

Unit 4

AI programming language: Prolog- objects, relationships, facts, rules and variables, Prolog: Syntax and data structures, representing objects & relationships by using “trees” and “lists”, use of cut, I/O of characters and structures. **10Hrs**

References:

1. Rich & Knight , Artificial Intelligence, TMH
2. Cloksin & Mellish , Programming In Prolog, Narosa Publishing House.
3. Nillson Harcourt, Principles of Artificial Intelligence, Asia & Morgan.
4. Janakiraman, Sarukesi & Gopal Krishnan Macmillan. Foundation Of Artificial Intelligence & Expert System, MacMillan

Teaching : 4 Hrs. / Week (2 Credits)

Total Hours : 52 Hrs

Max. Marks : 70

I. A. Marks : 30

UNIT – 1

Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator; Operator Precedence; Logical expression; Type casting; Strings Control Statements: Selection statements, iteration statements, Jump Statements. **20Hrs**

UNIT – 2

Classes, Inheritance, Exceptions, Applets : Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading. Exception handling: Exception handling in Java. The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLETTAG tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console. **20Hrs**

UNIT – 3

Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producerconsumer problems.

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. **12Hrs**

Reference Books:

1. Programming with Java – A PRIMER by E.Balagurusamy, Tata McGraw-Hill 3rd Edition
2. The Complete Reference - Java-2 by Patrick Naughton and Herbert Schildt Published by Tata McGraw-Hill India.
3. The Complete Reference – J2EE by Jim Keogh, published by Tata McGraw-Hill.

BCA5.5	Operational Research
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Teaching : 4 Hrs. / Week(2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1:

Definition of the term Operation Research – Nature , Management Application , Modeling , Principles of modeling , features , Different Phases , scope , Advantages and Limitations of O.R. General method for solving O.R models and Role o O.R in decision making. Some important definitions – solutions to LPP, feasible solution, basic solutions, Basic feasible solution, Optimum basic feasible solution, unbounded solution. Assumptions in LPP, Limitations of LPP, Applications of LPP and advantages of LPP. Standard Linear Programming – Formulation of a Linear Programming Solving L.P.P. by Graphical Method Problem. And Simplex Method.

18Hrs

Unit 2

Artificial Variable Technique – two phase method and Big M method, Duality – Meaning definitions of primal problem, General rules for converting any primal problem into its dual. Characteristics of Dual problem, Advantages of Duality, Dual formulation procedure and Problems to obtain the dual of LPP. Fundamental Duality theorems, Primal and Dual correspondence. **18Hrs**

Unit 3

Transportation Problems – Method of finding initial basic feasible solution to Transportation problem-Northwest Corner, Least Cost Method and Vogel’s Method. Method of finding initial basic feasible solution to Assignment Problem using Hungarian Method. Sequencing Problems – Definitions, terminology and notations, Principle assumptions, Processing ‘n’ jobs through two machines Travelling Salesman (Routing) Problems - FormulationS of TSP as an assignment problem **16 Hrs**

Reference Books:

1. Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Cengage Learning, 2003.
2. Hamdy A Taha: Operations Research: An Introduction, 8th Edition, Pearson Education, 2007.

Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

UNIT 1:

Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance Characteristics Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications.

The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting Implicit Functions **14Hrs**

UNIT2:

Input and Interaction: Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations

Geometric Objects and Transformations-I: Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling. **14Hrs**

UNIT3:

Geometric Objects and Transformations-II: Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three dimensional applications; Quaternion's.

Viewing : Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows. **14Hrs**

UNIT4:

Lighting and Shading: Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

Implementation: Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations. **10Hrs**

Reference Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008.
2. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education, 2004.
3. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rd Edition, PHI, 2009.
4. James D Foley, Andres Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

Practicals for B.C.A V Sem:-

Practical-I	BCA5.4 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in Java	I.A: 10 Exam: 40

Practical-II	BCA5.5 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Mini Project in JAVA	I.A: 10 Exam: 40

Practical-III	BCA5.6 Lab	26 hours
Practical/Week: 2 Hrs Credits:1	Programming exercises in Computer Graphics	I.A: 10 Exam: 40

BCA VI Semester
(w.e.f. academic year 2016 – 2017 onwards)

BCA 6.1	IMAGE PROCESSING
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Teaching : 4 Hrs. / Week (2 Credits)
Total Hours : 52 Hrs

Max. Marks : 70
I. A. Marks : 30

UNIT 1

Digitized Image and its properties: Basic concepts, Image digitization, Digital image properties

Image Preprocessing: Image pre-processing: Brightness and geometric transformations, local preprocessing.

Segmentation – 1: Thresholding, Edge-based segmentation.

Segmentation – 2: Region based segmentation, Matching. **12Hrs**

UNIT 2

Image Enhancement: Image enhancement in the spatial domain: Background, Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/ logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing Frequency-Domain filters, Sharpening Frequency Domain filters, Homomorphism filtering. **12Hrs**

UNIT 3

Image Compression: Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression. **10Hrs**

UNIT 4

Shape representation: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes. **10Hrs**

UNIT 5

Morphology: Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds **8 Hrs**

Reference Books:

1. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI, 1997, Indian Reprint 2009.
2. B.Chanda, D Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2002.

BCA 6.2	SYSTEM SOFTWARE
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Introduction: System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples. **6Hours**

Assemblers: 12 Hours

Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation. Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - One-Pass Assembler, Multi-Pass Assembler, Implementation Examples - Misassemble.

Loaders and Linkers : 10 Hours

Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

Editors And Debugging Systems 6 Hours

Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship With Other Parts Of The System, User-Interface Criteria

Macro Processor 8 Hours

Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine-Independent Macro Processor Features –Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor

Compilers 10 Hours

Basic Compilers Functions- Grammars, Lexical Analysis, Syntactic Analysis, Code Generation. Machine Dependent Compiler Features- Intermediate Form of the Program, Machine dependent code Optimization. Machine Independent Compiler Features- Structured variables, Machine Independent code Optimization. Compiler Design Options-Division into passes, Interpreters, P-code Compilers, Compiler-Compilers.

Reference Books:

1. D.M.Dhamdhare: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999

BCA 6.3	Multimedia
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Teaching : 4 Hrs. / Week (2 Credits)
Total Hours : 52 Hrs

Max. Marks : 70
I. A. Marks : 30

UNIT 1:

Introduction, Media and Data Streams, Audio Technology: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases. Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete & Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams. Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission. **14Hrs**

UNIT2:

Graphics and Images, Video Technology, Computer-Based Animation: Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options. Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language. **14Hrs**

UNIT3:

Optical Storage Media: History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROMBased Developments; Compact Disc Recordable; Compact Disc Magneto- Optical; Compact Disc Read/Write; Digital Versatile Disc. **14Hrs**

UNIT4:

Content Analysis: Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

Data and File Format Standards: Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indio File Format; MPEG Standards; TWAIN **10Hrs**

Reference Books:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1- Media Coding and Content Processing, 2nd Edition, PHI, Indian Reprint 2008.
2. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.
3. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education, 2002.
4. Nalin K Sharad: Multimedia Information Networking, PHI, 2002.

BCA 6.3	Multimedia
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Teaching : 4 Hrs. / Week (2 Credits)
Total Hours : 52 Hrs

Max. Marks : 70
I. A. Marks : 30

UNIT 1:

Introduction, Media and Data Streams, Audio Technology: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases. Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete & Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams. Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission. **14Hrs**

UNIT2:

Graphics and Images, Video Technology, Computer-Based Animation: Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options. Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language. **14Hrs**

UNIT3:

Optical Storage Media: History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROMBased Developments; Compact Disc Recordable; Compact Disc Magneto- Optical; Compact Disc Read/Write; Digital Versatile Disc. **14Hrs**

UNIT4:

Content Analysis : Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

Data and File Format Standards: Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN **10Hrs**

Reference Books:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1- Media Coding and Content Processing, 2nd Edition, PHI, Indian Reprint 2008.
2. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.
3. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education, 2002.
4. Nalin K Sharad: Multimedia Information Networking, PHI, 2002.

BCA6.4	C# & .Net Framework
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Teaching : 4 Hrs. / Week (2 Credits)

Total Hours : 52 Hrs

Max. Marks : 70

I. A. Marks : 30

UNIT1:

Interfaces and Collections: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (Enumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (I Comparable), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type). **14Hrs**

UNIT2:

Callback Interfaces, Delegates, and Events, Advanced Techniques: Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, , Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using)Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer . Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines **14Hrs**

UNIT3:

Understanding .NET Assemblies: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly ,Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly **14Hrs**

UNIT4:

Object- Oriented Programming with C#: Forms Defining of the C# Class, Definition the "Default Public Interface" of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The " Protected" Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between .

Exceptions and Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System. System Exception), Custom Application- Level Exception(System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of "new", The Basics of Garbage Collection,, Finalization a Type, The Finalization Proces Buildin an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

10Hrs

Reference Books:

1. Andrew Troelsen: Pro C# with .NET 3.0, 4th Edition, Wiley India, 2009.
2. E. Balagurusamy: Programming in C#, 2nd Edition, Tata McGraw Hill, 2008. .
3. Tom Archer: Inside C#, WP Publishers, 2001.
4. Herbert Schildt: C# The Complete Reference, Tata McGraw Hill, 2004.

BCA 6.5	UNIX & SHELL PROGRAMMING
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Teaching : 4 Hrs. / Week (2 Credits)

Max. Marks : 70

Total Hours : 52 Hrs

I. A. Marks : 30

Unit 1:

Introduction

History, salient features, Unix system architecture, Unix command format, Unix internal and external commands, Directory commands, File related commands, Disk related commands, general utilities.

Unix File System Boot inode, super and data block, in-core structure, Directories, conversion of pathname to inode, inode to a new file, Disk block allocation. **14Hrs**

Unit 2:

Process Management

Process state and data structures of a Process, User vs. kernel node, context of a Process, background processes, Process scheduling commands, Process terminating and examining commands.

Secondary Storage Management Formatting, making file system, checking disk space, mountable file system, disk partitioning, file compression. **14Hrs**

Unit 3:

Special Tools and Utilities

Filters, Stream editor SED and AWK, Unix system calls and library functions, Processes, signals and Interrupts, storage and compression facilities. **12Hrs**

Unit 4:

Shell Programming

Vi editor, shell types, shell command line processing, shell script features, executing a shell script, system and user-defined variables, expr command, shell screen interface, read and echo statement, command substitution, escape sequence characters, shell script arguments, positional parameters, test command, file test, string test, numeric test. Conditional Control Structures – if statement, case statement Looping Control Structure – while, until, for, statements. Jumping Control Structures – break, continue, exit.

Unix System Communication

Introduction, write, read, wall commands, sending and handling mails.

12Hrs

References

- 1) Glass, Unix for Programmers and Users, 3/e Pearson Education
- 2) Kernighan, The Unix Programming Environment
- 3) Sobell G, A practical Guide to Unix System.
- 4) Kochan, Unix Shell Programming, Pearson
- 5) Sumithaba Das – UNIX: Concepts and Applications 4.e

Teaching : 4 Hrs. / Week (2 Credits)**Total Hours : 52 Hrs****Max. Marks : 70****I. A. Marks : 30****UNIT – 1**

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox. XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links. **XHTML – 2, CSS:** XHTML (continued): Lists, Tables, Forms, Frames CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and <div> tags, Conflict resolution. **18 Hrs**

UNIT – 3

Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Example **Javascript and HTML Documents, Dynamic Documents with Javascript:** The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification. Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements. **18 Hrs**

UNIT – 5

XML: Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, Displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors, Web services. **Perl, CGI Programming:** Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies. Database access with Perl and MySQL **16 Hrs**

Reference Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008. (Listed topics only from Chapters 1 to 9, 11 to 15).
2. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
3. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
4. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

Practicals for B.C.A VI Sem:-

Practical-I	BCA6.4 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in C# & .Net	I.A: 10 Exam: 40

Practical-II	BCA6.5 Lab	26 hours
Practical/Week: 2 Hrs Credits: 1	Programming exercises in Unix & Shell Programming	I.A: 10 Exam: 40

Practical-III	BCA6.6 Lab	26 hours
Practical/Week: 2 Hrs Credits:1	Mini Project On C# & .Net / Unix & Shell Programming	I.A: 10 Exam: 40

MODEL QUESTION PAPER FOR SEMESTER EXAMINATION

BCA104: Title of the Paper

Time: 3 Hours

Max. Marks:70

SECTION – A

Answer all the questions. Each question carries 2 marks (10x2 =20)

Q. 1.

Q. 2.

Q. 3.

Q. 4.

Q. 5.

Q. 6.

Q. 7.

Q. 8.

Q. 9.

Q. 10.

SECTION – B

Answer any 4 questions. Each question carries 5 marks (4x5 =20)

Q. 11.

Q. 12.

Q. 13.

Q. 14.

Q. 15.

Q. 16.

SECTION – C

Answer any 4 questions. Each question carries 10 marks (3x10 =30)

Q. 17.

Q. 18.

Q. 19.

Q. 20.

Q. 21.

Q. 22.

MODEL QUESTION PAPER FOR INTERNAL ASSESSMENT TEST

Internal Assessment Test-I

Paper: _____

Time: 1 hour

Max. Marks: 30

Section – A

Answer all the questions (05 x 2 = 10 marks)

Q. 1.

Q. 2.

Q. 3.

Q. 4.

Q. 5.

Section – B

Answer any one full question. Each question carries 5 marks (02 x 1 = 10 marks)

Q. 6.

Q. 7.

Section – C

Answer any one full question. Each question carries 10 marks (01 x 10 = 10 marks)

Q. 8.

Q. 9.

BCA Practical Question Paper Pattern

- Maximum marks for practical is 80.
- There shall be two question in the lab question paper from the syllabus prescribed for the lab for each practical examination.
- The student is expected to write algorithm, flowchart and program for the I & II semesters only.
- Object Oriented diagram, control charts should be drawn where ever necessary (ex VB)
- Implementation of both the programs shall be carried out.
- There shall be viva-voce for practical during the examination.
- The distribution of the marks for practical exam is as follows:

Flowchart/Object Oriented diagram, algorithm: 10marks (10 for each assignment)

Program code: 10 marks (10 for each assignment)

Execution of the program: 15 marks (15 for each assignment)

Viva-voce and journal: 05 marks

Total 40 marks