

SYLLABUS, TEACHING & EXAMINATION SCHEME
For MCA WEF FROM SESSION 2019-20, 20-21, 21-22

MCA - I Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA111	C Programming	3	4	3 hrs	20	80	100
MCA112	Web Designing	3	4	3 hrs	20	80	100
MCA113	Data Structures	3	4	3 hrs	20	80	100
MCA114	Computer Oriented Numerical & Statistical Methods	3	4	3 hrs	20	80	100
MCA115	Digital Logic	3	4	3 hrs	20	80	100
MCA121	C Programming Lab	4	2	3 hrs	20	80	100
MCA122	Web Designing Lab	4	2	3 hrs	20	80	100
MCA123	Data Structures Lab	4	2	3 hrs	20	80	100
MCA124	CONM Lab	4	2	3 hrs	20	80	100
	TOTAL		28				900
MCA - II Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA211	Visual Programming with .NET	3	4	3 hrs	20	80	100
MCA212	Programming in Java	3	4	3 hrs	20	80	100
MCA213	Microprocessor and Applications	3	4	3 hrs	20	80	100
MCA214	Computer Networks and Data Communications	3	4	3 hrs	20	80	100
MCA215	Discrete Structures	3	4	3 hrs	20	80	100
MCA221	.NET Lab	4	2	3 hrs	20	80	100
MCA222	Java Lab	4	2	3 hrs	20	80	100
MCA223	Microprocessor Lab	4	2	3 hrs	20	80	100
MCA224	Soft Communication /Report Writing Lab	4	2	3 hrs	20	80	100
	TOTAL		28				900

For MCA WEF FROM SESSION 2019-20

MCA - III Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA311	Theory of Computation	3	4	3 hrs	20	80	100
MCA312	ASP.NET	3	4	3 hrs	20	80	100
MCA313	Database Management System	3	4	3 hrs	20	80	100
MCA314	Computer Graphics	3	4	3 hrs	20	80	100
MCA315	Operating System	3	4	3 hrs	20	80	100
MCA321	Python Lab	4	2	3 hrs	20	80	100
MCA322	ASP.NET Lab	4	2	3 hrs	20	80	100
MCA323	DBMS Lab	4	2	3 hrs	20	80	100
MCA324	Computer Graphics Lab	4	2	3 hrs	20	80	100
	TOTAL		28				900
MCA - IV Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA411	Advance Java	3	4	3 hrs	20	80	100
MCA412	Artificial Intelligence & Machine Learning	3	4	3 hrs	20	80	100
MCA413	Software Engineering	3	4	3 hrs	20	80	100
MCA421	Advanced JAVA Lab	4	2	3 hrs	20	80	100
MCA422	Colloquium Lab	4	2	3 hrs	20	80	100
MCA423	System Design Project Lab	4	2	3 hrs	20	80	100
	Elective Group 1						
MCA414A	System Programming	3	4	3 hrs	20	80	100
MCA415A	LINUX Operating System	3	4	3 hrs	20	80	100
MCA424A	System Programming Lab	4	2	3 hrs	20	80	100

	Elective Group 2						
MCA414B	Data Warehousing & Data Mining	3	4	3 hrs	20	80	100
MCA415B	Advanced DBMS	3	4	3 hrs	20	80	100
MCA424B	Advanced DBMS Lab	4	2	3 hrs	20	80	100
	Elective Group 3						
MCA414C	Internet Programming in PHP	3	4	3 hrs	20	80	100
MCA415C	Cloud Computing	3	4	3 hrs	20	80	100
MCA424C	PHP Programming Lab	4	2	3 hrs	20	80	100
	TOTAL						900

For MCA WEF FROM SESSION 2019-20

MCA - V Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA511	Analysis & Design of Algorithms	3	4	3 hrs	20	80	100
MCA512	Information Protection & Security	3	4	3 hrs	20	80	100
MCA521	Information Protection & Security Lab	4	4	3hrs	20	80	100
MCA522	Software Project Lab	4	2	3 hrs	20	80	100
MCA523	Seminar	4	2	3 hrs	20	80	100
	Elective Group 1						
MCA513A	Advance Computer Architecture	3	4	3 hrs	20	80	100
MCA514A	Compiler Design	3	4	3 hrs	20	80	100
MCA515A	Embedded System	3	4	3 hrs	20	80	100
MCA524A	Compiler Design Lab	4	2	3 hrs	20	80	100
	Elective Group 2						
MCA513B	BigData Analytics	3	4	3 hrs	20	80	100
MCA514B	Bioinformatics Database	3	4	3 hrs	20	80	100
MCA515B	Geographical Information Systems	3	4	3 hrs	20	80	100
MCA524B	Bio informatics Lab	4	2	3 hrs	20	80	100
	Elective Group 3						
MCA513C	AJAX & XML	3	4	3 hrs	20	80	100
MCA514C	Programming in Android	3	4	3 hrs	20	80	100
MCA515C	Wireless Technology	3	4	3 hrs	20	80	100
MCA524C	Android Programming Lab	4	2	3 hrs	20	80	100
	TOTAL						900
MCA - V Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA 611	Practical Training	-	25	3 hrs	-	200	200

MCA - I Semester							
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MCA111	C Programming	3	4	3 hrs	20	80	100
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MCA115	Digital Logic	3	4	3 hrs	20	80	100
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MCA124	CONM Lab	4	2	3 hrs	20	80	100
	TOTAL		28				900

Unit	MCA111: C Programming
I	About C, Evolution of C, Programming languages, Structure of a C program, Compiling a C program, Character set in C, Keywords in C, Hierarchy of operators, Basic data types, Qualifiers used with basic data types, Variables in C, Type declaration, Output function, Input function and format specifiers, arithmetic operators, Unary operators, Relational and logical operators.
II	Control statements, if statement, if else statement, for statement, while loop, do while statements, break statements, continue statements, switch statement, goto statement, ternary operators. Arrays, types of arrays, array declaration, array initialization, multidimensional arrays, string and character handling, working with string and string function.
III	Functions, advantages of functions, declaring a function, calling a function, variables, passing arguments to a function, nested functions, passing array to functions, recursion in functions, Call by value and Call by reference. Pointers and function, Array of pointers, Pointer and Strings, Pointer to structure, Pointers within structures.
IV	Structure, declaration of structure, Union, difference between structure and union, Pointers, pointers operators, pointer arithmetic, Introduction of Static and Dynamic memory allocation, The process of Dynamic memory allocation, DMA functions malloc() function, Sizeof() operator, Function free(), Function realloc(), Preprocessor, # define, defining functions like macros, # error, #include, creating header files ,include user defined header files, Conditional compilation directives.
V	Introduction File handling, :-File structure, File handling function, File types, Streams, Text, Binary, File system basics, The file pointer, Opening a file, Closing a file, Writing a character, Reading a character, Using fopen(), getc(), putc(), and fclose(), Using feof(), Command line arguments.

Suggested Readings

- The Complete Reference C, Herbert Schildt, TMH
- Let Us C, Yashavant P. Kanetkar , BPB Publications
- Programming in ANSI C, Balaguruswamy, Mc Graw Hill

Unit	MCA112: Web Designing
I	Publishing Web Content, Understanding HTML and XHTML Connections, Understanding Cascading Style Sheets, Understanding JavaScript, Working with Fonts, Text Blocks, and Lists, Using Tables to Display Information
II	JavaScript using External and Internal Links, Working with Colors, Images, and Multimedia, Advanced Web Page Design with CSS - Working with Margins, Padding, Alignment, and Floating
III	Understanding the CSS Box Model and Positioning, Using CSS to Do More with Lists, Text, and Navigation, Creating Fixed or Liquid Layouts.
IV	Dynamic Web Sites - Understanding Dynamic Web Sites, Getting Started with JavaScript Programming, Working with the Document Object Model (DOM), Using JavaScript Variables, Strings, and Arrays
V	Using JavaScript Functions and Objects, Controlling Flow with Conditions and Loops, Responding to Events, Using Windows and Frames.

Suggested Readings

- Sams Teach Yourself HTML, CSS, and JavaScript All in One by Julie Meloni

Unit	MCA113: Data Structures
I	Data, Structured data, Data Structure, Types of data structures : Linear and Nonlinear, Arrays: One dimensional and Multidimensional array, Memory representation of array, Operations on one dimensional and multi-dimensional array, Sparse matrix, Application of arrays, Advantages and Disadvantages of arrays.
II	Linked List: Static and Dynamic representation, Different operations on linked list : Traversal, Insertion, Deletion and Search. Circular linked list, Doubly linked list, Applications of linked list.
III	Stacks: Push and Pop operations on stack, Implementation of stack using arrays and linked list, Applications of Stack: Conversion of Infix to Prefix and Postfix expression, Evaluation of Postfix expression, Recursion. Queue: Linear and Circular queue, Operations: Insertion, Deletion and Update, Application of queue: Priority queue.
IV	Trees : Basic concepts, Binary trees, Representation of binary tree, Traversal: Preorder, In order and Post order, Searching, Insertion and Deletion in binary trees, Binary Search Tree. Graphs : Basic concepts, Representation of graph, Traversing a graph, DFS and BFS, Spanning tree, Warshall's algorithm, Dijkstra's algorithm, Prim's algorithm, Kruskal's algorithm, Applications of graph.
V	Searching: Linear and Binary search Algorithm. Internal and External Sorting. Sorting algorithms: Insertion, Selection, Merge, Radix, Bubble, Quick, Heap, Merging.

Suggested Readings

- Schaum's outline Data Structures with C, Seymour Lipschutz, Tata McGraw Hill

Unit	MCA114: Computer Oriented Numerical & Statistical Methods
I	Representation of numbers, operations, floating point numbers, normalization, pitfalls of floating point representation, errors in numerical computation. Concepts of roots synthetic division, value and values of derivative of a polynomial by synthetic division, Descarte's Rule of sign.
II	Iterative Methods - Bisection, Regula-Falsi, Newton Raphson, Secant, Baristow's method for finding complex roots, rate of convergence (without proof). Simultaneous Linear Equations - Solutions of system of Linear equations, Gauss Elimination method, pivoting, Ill Conditioned system of equations, refinement of solution. Iterative method – Gauss Seidal, Jacobi, Gauss-Jorden method.
III	Solution of ordinary differential equations - Taylor's method, Euler's method, Runge Kutta methods, Picard's method, modified Euler's method. Numerical Integration -Introduction, Trapezoidal rule, Simpson's rules.
IV	Interpolation: Finite differences, forward, backward and divided differences, difference table, Newton's forward and backward formula. Interpolation with unequal intervals -Lagrange's Interpolation, Newton Divided difference formula. Curve fitting - Method of least squares, fitting of straight lines, polynomials, exponential curves.
V	The basic concepts: Variables and Attributes, Statistics, Population and sample, complete enumeration vs sample surveys, probability and purposive sampling, simple random sampling Frequency distributions: Frequency distributions, histograms, Frequency polygons, frequency curves, cumulative frequency, distributions, ogives, Measure of Central Tendency, Median, mode, arithmetic mean, geometric mean, harmonic mean, partition values: quartiles, deciles and percentiles.

Suggested Readings

- Computer Oriented Numerical Methods, R S Salaria, Khanna Publication
- Computer Oriented Numerical Methods, P Thangaraj, PHI Publication
- Computer Oriented Numerical Methods, V Rajaraman, Prentice Hall India

Unit	MCA115: Digital Logic
I	Number Systems and Codes: Number Systems - decimal, binary, octal, Hexadecimal, base-n, inter-conversion methods. Binary Arithmetic: addition and subtraction. Compliment Arithmetic: Base Compliment, Base-1 Compliment. Binary Codes: Weighted and Non-Weighted Codes, 8421 BCD Code, Excess-3 Code, Gray Code, ASCII and EBCDIC. Boolean Algebra: Introduction to Logic, basic logic Operations. Principle of Duality, laws of Boolean algebra and De-Morgan's Theorem.
II	Digital Circuits - Introduction to Combinational and Sequential Circuits, classification of gates: basic gates, universal gates and exclusive gates, minterms and maxterms, Representation of gates using Sum of Products (SOP) & Products of Sum (POS). Introduction to Level Circuits - zero, one and two. AND-OR circuit, OR-AND circuit, NAND-NAND circuit, NOR-NOR circuit.
III	Combinational Circuits : Arithmetic Circuits - Half-Adder, Half-Subtractor, Full Adder, Full Subtractor, Parallel Adder, 2's Compliment Adder-Subtractor. Multiplexers, De-Multiplexers, Decoders, Encoders, Magnitude Comparator (2-1 Bit, 2-2 Bit & 2-4 Bit). Reduction Techniques: Need of Reduction. Reduction by Boolean Algebra, Karnaugh Maps: 2, 3, and 4 Variable.
IV	Sequential Circuits: Flip-Flops: RS, D using NAND and NOR gates, Introduction to clock & timing diagrams. Gated Flip-Flops (Latches). J-K Flip-Flop, T-Flip-Flop, J-K Master Slave Flip-Flop. Characteristic equation of Flip Flops,

	transition table of Flip Flops, Registers - SISO, SIPO, PISO, PIPO, SHL, SHR. Counters - Asynchronous and Synchronous, Ripple Up, Ripple Down Counters, Modulo Counters. Design of Synchronous Counters.
V	PLD-ROM, PLA & PAL, Memories: Memory Hierarchy, Memory Technologies; Magnetic, Semiconductor, Optical. RAM & ROM addressing techniques and Expansion. Introduction to VHDL.

Suggested Readings

- Kumar Anand. A., Fundamentals of Digital Circuits, PHI New Delhi
- Jain R. P., Modern Digital Electronics, Tata Mc Graw Hill , New Delhi
- Mano Morris, M. Digital Design, PHI, New Delhi
- Bartee Thomas, C., Digital Computer Fundamentals, Mc Graw Hill

MCA121: C Programming Lab	
Practical Exercises	
Exercises based on control statements, looping statements, functions, arrays (searching and sorting), pointers with its arithmetic, structure and union, dynamic memory allocation, macros and file handling.	

MCA122:Web Designing Lab	
Practical Exercises	
Exercises based on Understanding HTML and XHTML Connections, Understanding Cascading Style Sheets, Understanding JavaScript, Working with Fonts, Text Blocks, and Lists, Using Tables to Display Information, Using External and Internal Links, Working with Colors, Images, and Multimedia.	
Exercises based on Working with Margins, Padding, Alignment, and Floating, Understanding the CSS Box Model and Positioning, Using CSS to Do More with Lists, Text, and Navigation, Creating Fixed or Liquid Layouts.	
Exercises based on Working with the Document Object Model (DOM), Using JavaScript Variables, Strings, and Arrays, Using JavaScript Functions and Objects, Controlling Flow with Conditions and Loops, Responding to Events, Using Windows and Frames.	

MCA123:Data Structures Lab	
Practical Exercises	
Exercises based on Heap, Hash Tables, Sorted Array, Sparse Matrix, addition of two large Numbers, stacks, queues, linked list, circular linked list	

MCA124:CONM Lab	
Practical Exercises	
Exercise based on Bisection Method, False position Method, Newton Raphson Method, Euler's Method, Modified Euler's Method, Runga Kutta Methods, Trapezoidal Method and Simpsons Method, Gauss Seidel Method, Gauss Jordan Method, Gauss Elimination Method, Jacobi Method, curve fitting.	

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MCA215	Discrete Structures	3	4	3 hrs	20	80	100
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MCA223	Microprocessor Lab	4	2	3 hrs	20	80	100
MCA224	Soft Communication /Report Writing Lab	4	2	3 hrs	20	80	100
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MCA211: Visual Programming with .NET	
I	DOT NET Framework: Framework classes, Overview and Base Class Library, Common Language Runtime (CLR): Loading and Executing code, Common Type System and Common Language Specification ,name spaces and DLL, Windows Application v/s Web Application, Installing Visual.NET IDE, Creating a simple Application.
II	VB.NET: Data Types and Variables, Constants, Scope of variables, Expression, Type Conversions, Operators, Structures, Arrays: Array Class Members and Array of Arrays. Control Structures: if-then-else, Select Case, for-next, for Each....Next, Do loop, While...End While. Use of Classes and Objects, Procedures and functions , Debugging of Application
III	C#.NET: Data Types, Variables, Operators Expression, Statements, Decision Statements, Iterative Statements, Creating Objects with Class. Constructors, this Keyword, Static and Instance Members, Destroying Objects, Method Overloading, Passing Arguments and Objects, Passing by Value, Passing by Reference. Arrays and String, Inheritance, Interfaces and Polymorphism, Exception Handling.
IV	Components of VS.NET, Design Window, Code Window, Server Explorer, Toolbox, Docking Windows, Properties Explorer, Solution Explorer, Object Browser. Adding Controls, Adding an Event Handler, Adding Controls at Runtime, Attaching an Event Handler at Runtime, Creating a Menu, Adding a New Form, Creating a Multiple Document Interface, Creating a Dialog Form, Using Form Inheritance, Adding a TabControl, Changing the Startup Form, Connecting the Dialog
V	Introducing ADO.NET, ADO.NET Architecture, Understanding the Connection Object, Building the Connection String, Understanding the Command Object, Understanding DataReaders, Understanding DataSets and DataAdapters, DataTable, DataColumn, DataRow, Differences between DataReader Model and DataSet Model, Working with System.Data.OleDb and Sql Server 2008.

Suggested Readings

- The Visual Basic .NET Bible by Bill Evjen, Jason Beres

MCA212: Programming in Java	
Unit	
I	Object Oriented Concepts in Java, Java features like security, portability, byte code, java virtual machine, object oriented, robust, multithreading, architectural neutral, distributed and dynamic. Java Source File Structure, Compilation, Execution, Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, Operators, Assignments, Command line argument, Control structures.
II	Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, Abstract Class, Interfaces, Implementing Interfaces, Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion, Static Members, Finalize() Method, use of this keyword, Modifiers with Classes & Methods, Array, Initializing & Accessing Array, Multi –Dimensional Array.
III	Inheritance - Benefits of Inheritance in OOP, Types of Inheritance, Inheriting Data Members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, use of super keyword, Polymorphism in inheritance, Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Naming Convention For Packages.
IV	Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, JVM reaction to Exceptions, Use of try, catch, finally, throw, throws in Exception Handling. In-built and User Defined Exceptions, Checked and Un-Checked Exceptions. Threads, Need of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Input/output Operation in Java (java.io Package), Streams, Classes for Input and Output, Standard Streams.
V	AWT Classes, Window fundamentals, frame windows, Applets, Execution of applet with different methods, frame window in applet, parameter passing in applet, Graphics class, use of color, fonts and text. Event Handling Mechanisms, Delegation Event Model, Event Class, Event Listener Interfaces, Adapter Classes. JDBC – Basic steps to JDBC, setting up a connection to database, Creating and executing SQL statements, Resultset and ResultSet MetaData Object.

Suggested Readings

- Herbert Schildt: JAVA 2 - The Complete Reference, Fifth Edition TMH, Delhi.
- Database Programming With JDBC And Java by George Reese.

MCA213: Microprocessor and Applications	
I	Evolution of microprocessors, Microprocessor based system, microcontroller architecture, MCS-51 family. General architecture of 8051 family. Pins of 8051 microcontroller
II	8051 assembly language programming: Register & memory organization. Introduction to 8051 assembly language, directives, registers and stack. Addressing modes of 8051. I/O ports and SFR
III	8051 Instructions: Data transfer, Arithmetic, logic, branching, subroutines, stack & Boolean variables manipulation. Advanced instruction of 8051

IV	Programming in 8051: basic I/O programming, timer, counter programming. Serial communication programming. Interrupt programming. Time delays and loops.
V	Interfacing 8051: LED, LCD, keyboard interfacing. ADC/DAC interfacing. Sensor Interfacing. Stepper/Servo/DC motor interfacing and driver circuits.

Suggested Readings

- 8051 Microcontroller internals, instructions, programming and interfacing, Subrata Ghosal, Pearson.
- The 8051 Microcontroller and Embedded Systems using assembly and C II Ed. Mazidi Muhammad Ali, PHI

Unit	MCA214: Computer Networks & Data Communications
I	Introduction to Communication, Introduction to Networking. Basic Modes of Communication. DTE-DCE communication system. Connecting Devices: Repeater, Hubs, Switch, Bridge, Routers and Gateways. Network architecture, ISO-OSI architecture, IBM SNA architecture, their functions and implementations.
II	Signal conversion methods. A/D, D/A, A/A and D/D. Unipolar, Polar and Bipolar methods of signal representation. Multichannel Data Communication, TDM, FDM and WDM. Introduction to Network Topologies. Introduction to Ethernet and Cabling standards.
III	Error detecting and correcting code, Hamming code, parity generation and detection, single error detection and correction, single error correction code. Transmission media, twisted pair, coaxial cable, optical fiber. LAN topologies: bus, ring, and star etc. LAN access techniques: ALOHA, CSMA, CSMA/CD, token-ring and token-bus.
IV	Introduction to Network Security. Model of Network Security. Ceaser Cipher, Transposition Cipher. DES. Issues related to Network reliability and security. SSL and VPN. Introduction to Firewalls. Introduction to TCP/IP protocol Family, IPV4 and IPV6 representation of addresses. Routing Algorithms; Distance Vector Routing, Link State Routing. Cyber Laws in India.
V	Flow Control Protocols, Stop-and-wait Flow Control, Sliding – Window Flow Control, Error Control, Stop-and-wait ARQ, Go-back-N, Selective-repeat, Introduction to Switching Theory; Circuit, Packet and Network Switching.

Suggested Readings

- Stalling, Data & Computer Communication.
- Tanenbaum, Computer Network, Pearson.Ed., Pearson.
- Kurose, Computer Networking, Pearson.
- Youlu Zheng, Shakil Akhtar, Networks for Computer Scientists and Engineers, Oxford Press.

Unit	MCA215: Discrete Structures
I	Sets, sequences, empty set, power set, operations on sets, Venn diagram, ordered pair, Relations, matrix and graph representation of relation, properties of relations, partitions. Equivalence Relations, Compatibility Relations, Composition of Binary Relations, Transitive and symmetric closures, partially ordered set, lattices
II	Functions, Matrix representation of functions, composition of function, inverse function. Algebraic Structures, General properties of algebraic systems, groupoids, semi group, monoids, group, rings. Applications of algebra to control structure of a program. Homomorphism, congruence, admissible partitions. Groups and their graphs.
III	Combinatorics: Permutations and Combinations, Mathematical Induction, principle of inclusion and exclusion, Pigeonhole Principle.
IV	Introduction to mathematical logic, statements and notations, well-formed formulas, tautologies, tautological implications, normal forms, the theory of Inference for statement calculus, predicate logic. Recurrence relations and Generating functions
V	Graph Terminology, Degrees of Nodes, Isomorphic Graphs, Dijkstra's Shortest Path Algorithm, Planar Graphs, Eulerian Graphs, Hamiltonian Graphs, Traveling Salesman Problem

Suggested Readings

- Discrete Mathematical Structure : Chowdhary K R , Printice Hall India, Edition
- Discrete Mathematical Structure : Tremblay and Manohar, McGraw Hill
- Discrete Mathematical Structure : Kolman, Busby and Ross, Printice Hall India, Edition 3
- Elements of Discrete Structures : C.L. Liu

MCA221: .NET Lab
Practical Exercises
Exercises based on Events such as Click, Index changed etc., Controls like button, textbox, checkbox, etc., on Control structures like for..next, while etc., Assignment on Numeric Parsing and System, functions and subroutines, Use of File, FileInfo, Directory and DirectoryInfo classes, Use of Multithreading and Exception Handling, Creation of Databases and insert update select and delete

MCA222: Programming In Java Lab
Practical Exercises
Exercises based on Command line argument, Control structures, Class Fundamentals, Object & Object reference, Constructor, Abstract Class, Interfaces, Methods, Argument Passing Mechanism, Method Overloading, Recursion, Static Members, Finalize() Method, this keyword, Array, Inheritance, Overriding Super Class Methods, use of super keyword, Polymorphism in inheritance, Package as Access Protection, CLASSPATH Setting for Packages, Exceptions & Errors, Threads, Thread Priorities, AWT Classes, Window fundamentals, frame windows, Applets, parameter passing in applet, Graphics class, use of color, fonts and text. JDBC – setting up a connection to database, Creating and executing SQL statements, Resultset and Resultset MetaData Object.

MCA223: Microprocessor Lab
Practical Exercises
Exercises based on I/O examples of 8051: switch and relays, Interrupt handling examples, Driving a stepper motor, LCD display programming, Serial communication: polled and interrupt based, Sensor interfacing.

MCA224: Soft Skills And Report Writing Lab
Practical Exercises
<p>Essentials of Grammar: Parts of Speech, Tenses, Modals, Phonetics</p> <p>Letter and Resume writing: Types of Letters Formal / Informal, Drafting the Applications, Preparation of the Resume, Do and Don'ts of Resume</p> <p>Presentation Skills: Importance of Presentation Skills. Guidelines to make Presentation Interesting, Body Language, Voice Modulation, Audience Awareness, Presentation Plan, Visual Aids, Styles of Presentation.</p> <p>Group Discussion – Definition, Process Guidelines, Helpful Expressions, Evaluation.</p> <p>Interview Preparation: Types of Interview, Preparing for the interviews, attending the Interview. Interview Process, General Etiquettes, Dressing Sense, Postures and Gestures.</p>

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MCA315	Operating System	3	4	3 hrs	20	80	100
MCA321	Python Lab	4	2	3 hrs	20	80	100
MCA322	ASP.NET Lab	4	2	3 hrs	20	80	100
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MCA324	Computer Graphics Lab	4	2	3 hrs	20	80	100
	TOTAL		28				900

Unit	MCA311: Theory of Computation
I	Sets: Specification of Sets, identity and cardinality, subsets, multisets, relations. Functions. Graphs and Trees: type of graphs: connected, directed, weighted, cyclic, planar, multigraph, pseudograph, complete graph. Properties of Trees.
II	The Central concepts of automata theory: Alphabet, Strings: empty, null, Kleene star(closure), concatenation of strings, reverse of a string, substring, palindrome. Propositions or statements: connectives: AND, NOT, OR, IF..THEN, IFF, well-formed-formulas (WFF), tautology. Introduction to Chomsky classification.
III	Finite automata: designing of finite automata, Transition graphs, transition table, DFA, string processing by DFA, NFA, differences between DFA and NFA, equivalence of DFA and NFA, minimization of Finite automata.

IV	Automata with output: Moore machine, Mealy machine, difference between Moore and Mealy machine, Equivalence of Moore and Mealy machine, Conversion from Moore to Mealy and Mealy to Moore machine. Minimization of a finite automata with output
V	Pushdown Automata: Methods for designing PDA: Numerical Method; operations on stack, PDA moves, representation of PDA, acceptance by PDA. Deterministic PDA, difference between FA and PDA Turing machine: Representation moves in TM. Universal Turing Machine

Suggested Readings

- Mishra, Chandrasekaran "Theory of Computer Science (Automata, Languages and Computation) PHI

Unit	MCA312: ASP.NET
I	Introduction to .NET Framework: Features of .NET, Microsoft Intermediate Language, Meta Data, .NET types and .NET name spaces, Common Language Runtime, Common Type System, Comparison of ASP and ASP.NET.
II	Introducing ASP .NET – Creating the ASP .NET applications, Web forms and Web controls, working with events, Web controls such as Rich web controls, Custom web controls and Validation controls, Application level and Page level Tracing, Debugging ASP .NET pages.
III	Advanced ASP .NET : ASP .NET configuration ,Creating and using the Business objects , HTTP Handlers ,ASP .NET caching ,ASP .NET security , Deployment projects, Localizing ASP .NET applications
IV	Web Services: Introduction to web services, Web services Infrastructure, SOAP with HTTP, Building, Deploying and publishing web services, Finding web services, Consuming web services as a consumer.
V	ADO .NET: Basics of ADO .NET , ADO v/s ADO.NET , Data Table, Data Views, Data Set, Data Relation Type, ADO .NET Managed Providers, OLEDB and SQL Managed Providers , OleDb Data Adapter Type. XML and ADO.NET, Using XML Reader: Reading XML documents using Data Reader, Using Data Set and XML: Loading XML into Data Sets

Suggested Readings

- Web Standards Programmer's Reference: Steven M. Schafer

Unit	MCA313: Database Management System
I	Entity Relationship Model: Entities, attributes, relationship, constraints, keys, E-R diagram, concept of strong and weak entity sets, generalization, specialization and aggregation. RDBMS – Basic concept, Codd's rule for RDBMS. Functional dependencies and Normalization for relational databases - design guidelines for relational schema, functional dependencies, normal forms (1NF, 2NF and 3NF).
II	SQL data definition and data types – create schema, create table, attribute data types and domains. Basic constraints in SQL – attribute and attribute defaults, key and referential integrity, naming, tuple constraints. Schema change statements in SQL – DROP, ALTER. Basic queries in SQL – select-from-where structure, ordering of query results.
III	Complex SQL queries – comparison involving NULL and three valued logic, nested queries, tuples and set comparison, joined tables. Aggregate functions, grouping – GROUP BY and HAVING clause. Insert, delete and update statements. Assertions and views.
IV	PL/SQL: Basics concepts, advantages, variables, constants, data types, comments, output function, control structures – conditional, iterative and sequential control, database access with PL/SQL, transaction management.
V	Cursor – basic concept, types, Procedures & Functions - advantages, creation, execution, deletion, overloading, stored procedures and functions. Packages – creation and execution. Triggers - use, types, creating, deleting.

Suggested Readings

- Database Concepts, Korth, Silbertz, Sudarshan, McGraw Hill
- Fundamentals of Database Systems, Elmasri, Navathe, Addison Wesley

Unit	MCA314: Computer Graphics
I	Introduction: mathematical elements of graphic system: point and line, graphics coordinate system, display adapters, concepts of video memory & frame buffer. Algorithms: Line drawing algorithms- DDA Algorithm, Bresenham's Line Algorithm, Circle and Eclipse generating algorithms, Midpoint Circle Algorithm. 2-D Viewing- The viewing pipeline. Viewing co-ordinate, Reference Frame. Window to viewports co-ordinate transformation
II	Graphics Primitives: Primitive Operations, The display file interpreter, Normalized Device Coordinates, Display-File structure. Display – file algorithm. Polygons: polygon representation; absolute and relative, inside-outside test, polygon drawing algorithms. Polygon fill algorithms: Scan fill, Boundary fill & Flood fill Algorithm.
III	Geometric Transformations: Matrices, translation, Scaling & Rotation Transformations. Homogeneous transformations, Rotation and scaling about an arbitrary point. Composite Transformations. Inverse Transformations.

	Clipping: Point clipping, Cohen- Sutherland Line Clipping algorithm, Sutherland Hodgemann polygon clipping algorithm.
IV	Introduction to 3D: 3D geometry, 3D primitives, basic 3D transformations. Projections: Parallel and Perspective, 3D viewing Transformation. Visible surface detection, hidden surface removal, depth buffer and painters algorithm. Segments-Segment Table, Segment Creation, Closing a Segment, Deleting a Segment, Renaming a segment.
V	Curve -Curve Generation, Interpolation, B-Splines, Bezier Curves. Animation: Animation design sequence, animation programming, and applications of animation. Introduction to morphing. Introduction to Virtual Reality Color: Properties of Color, Color models; RGB, HSV and CMYK. Half-toning, Dithering.

Suggested readings

- Madasu Hanmandlu ,PBP publications.
- Herrington ,Tata McGraw-Hill Education private Limited,New Delhi.
- Gautam Roy,Khanna publications.
- Donald D Hearn, M. Pauline Baker, Pearson Education
- Fundamentals of Computer Graphics & Multimedia, D. P. Mukherje
- S Gokul: Multimedia Magic, BPB Publication.
- Jeffcoate : Multimedia in Practice, Pretice-Hall.
- Bufford: Multimedia Systems, Addison Wesley.

Unit	MCA315: Operating System
I	BASICS OF OS :Architecture of Operating System ,Objectives and functions of OS, Evolution of OS (Batch, Multiprogramming, Multitasking, Multiuser, Parallel, Distributed and Real time operating systems). Computer Hardware review: Processor, Memory and IO. OS Shell and kernel architecture.
II	Process Management: Process, Process state, Process state transitions, PCB, Process hierarchy, operations on a process, multitasking. Scheduling policies: FCFs, SJF (preemptive and non-preemptive), priority scheduling, round robin, multi-level feedback queue scheduling.
III	Memory management: Introduction, contiguous real, non- contiguous real, non-contiguous virtual. Virtual memory management system, page replacement policies: LRU, NRU, FIFO, Second chance, optimal page replacement, Working set. Belady's anomaly. Memory allocation techniques: first fit, best fit, worst fit, next fit. Demand paging. Buddy system.
IV	Process synchronization: race condition, critical region. Semaphores, P&V mutex routines. Inter-process communication: the producer-consumer problem. Classical problems: readers-writes, dining philosophers, sleeping barber. Message passing: Inter-process messages, mailboxes. Threads.
V	Deadlocks: introduction, deadlock detection and recovery, deadlock avoidance, banker's algorithm, deadlock prevention. Introduction to operating protection and security, access matrix, implementation of access matrix.

Suggested Readings

- Operating Systems: Donovan & Madnick, Mc Graw Hill
- Modern Operating Systems, Tanenbaum, Pearson Publications.

MCA321:Pytohn LAB
Practical Exercises
Exercises based on variables, assignments; immutable variables; conditions, Boolean logic, logical operators; ranges; Control statements, string module, tuples, sets, and dictionaries: basic list operators, replacing, inserting, array in Python Regular Expressions, Recursive functions, scope and global statements, Lambda expressions, Importing Modules, creating own module. Exception Handling: Exceptions, except clause, try and finally clause user defined exceptions, File Handling: manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; Simple Graphics, Database, Using GUI to access Database. Object Oriented Programming: Concept of OOP: Abstraction, Encapsulation, Inheritance, and Polymorphism in Python

MCA322: ASP.NET Lab
Practical Exercises
Exercises based on Events such as Click, Indexchanged etc, Controls like button, textbox, checkbox, etc and Rich Web Controls, Validation Controls and Tracing, on Creation of Business Objects(UI centric), Caching Implementations and use of caching, implementing Concept of Localization, Creation of web service, Database connectivity and essential operations like select, insert , update and delete

MCA323: DBMS Lab
Practical Exercises
Exercises based on creating table, inserting data into tables, viewing data in tables, sorting data in table, deleting tuples from table, updating the contents of a table, modifying the structure of table, applying primary key, foreign key and unique key constraints, computations on table data, oracle functions, grouping data from tables, subqueries, Joins etc.

MCA324: Computer Graphics Lab
Practical Exercises
Exercises based on inbuilt graphic functions, line drawing algorithms, polygon fill algorithms, transformation(translation, scaling, rotation), simple animation

MCA - IV Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA411	Advance Java	3	4	3 hrs	20	80	100
MCA412	Artificial Intelligence & Machine Learning	3	4	3 hrs	20	80	100
MCA413	Software Engineering	3	4	3 hrs	20	80	100
MCA421	Advanced JAVA Lab	4	2	3 hrs	20	80	100
MCA422	Colloquium Lab	4	2	3 hrs	20	80	100
MCA423	System Design Project Lab	4	2	3 hrs	20	80	100
	Elective Group 1						
MCA414A	System Programming	3	4	3 hrs	20	80	100
MCA415A	LINUX Operating System	3	4	3 hrs	20	80	100
MCA424A	System Programming Lab	4	2	3 hrs	20	80	100
	Elective Group 2						
MCA414B	Data Warehousing & Data Mining	3	4	3 hrs	20	80	100
MCA415B	Advanced DBMS	3	4	3 hrs	20	80	100
MCA424B	Advanced DBMS Lab	4	2	3 hrs	20	80	100
	Elective Group 3						
MCA414C	Internet Programming in PHP	3	4	3 hrs	20	80	100
MCA415C	Cloud Computing	3	4	3 hrs	20	80	100
MCA424C	PHP Programming Lab	4	2	3 hrs	20	80	100
	TOTAL						900

Unit	MCA411: Advanced Java
I	Introduction to Java Enterprise, J2EE Technologies, client server technology, web server technology. Movement to Server-Side Java. Definition of a Java Servlet. Practical. Applications for Java Servlets. Java Servlet Alternatives. Reasons to Use Java Servlets. The Java Servlet Architecture. JNDI, Web Applications in J2EE.
II	JDBC – JDBC Drivers, Products, JDBC Design considerations, Two Tier and Three Tier client server model, J2EE multi-tier architecture, Introduction to Data Source and Connection pooling. JavaMail and Internet E-mail. Preparing to Use JavaMail. A JavaMail Example. Using JavaMail in a Servlet.
III	Servlets - Static and Dynamic contents, Servlet life Cycle and Life cycle methods, Servlet Request and Response Model, Deploying a Servlet, Servlet State Transitions, ServletConfig and ServletContext, Servlet Redirection and Request Dispatch, Servlet Synchronization and Thread Model.

IV	Reading and writing data from client using Servlets, Maintaining Client State - Cookies, URL rewriting, hidden form fields, Session Tracking. Inter servlet communications –JDBC connection pool, servlet security and different packages of servlets.
V	JSP fundamentals, JSP architecture, lifecycle of a JSP, Model View Controller (MVC) architecture, JSP tags and JSP expressions, data sharing among servlets & JSP. JSP implicit objects, request application, session and page scope, JSP standard actions, JSP errors.

Suggested Readings

- Developing Java Servlets, by James Goodwill, SAMS.

Unit	MCA412: Artificial Intelligence and Machine Learning
I	Artificial Intelligence (AI) Introduction, Definitions, Basic elements of AI, AI's Application areas, Turing test. Production Systems, Inference Engine, Rule Based Systems, Forward & Backward Chaining, Concepts of Expert System (ES), need, components and architecture of ES. Sub-shells/stages in the development of an ES.
II	Concept of knowledge, Knowledge acquisition, rote learning, discovery, analogy. Monotonic reasoning, logical reasoning, induction and natural deduction. Problems, Problems spaces: Problem characteristics, state space, Production- rules. Non-monotonic reasoning- default reasoning, minimalist reasoning
III	Problems Search: Depth first, Breadth first search methods, A* Algorithms and their analysis. Heuristic search method, generate and test, hill climbing, best first method, constraint satisfaction and backtracking. Statistical reasoning - Baye's theorem, certainty factors, Concepts of Dempster-Shafer theory and Fuzzy logic
IV	Concepts of AI:-Logic, propositional and predicate calculus, Clausal form, Resolution, Unification, Inference, mechanisms. Semantic nets, frames, conceptual dependency, Blackboard architectures, scripts. Introduction to Genetic Algorithms.
V	Neural networks, NN Architectures. Understanding Machine Learning: Big data, hybrid cloud, descriptive analytics, predictive analytics. Machine learning: supervised, unsupervised, reinforcement, neural networks and deep learning. Introduction to statistical methods for machine learning with examples.

Suggested readings

- E. Rich and K. Knight, "Artificial Intelligence", Tata McGraw Hill.
- George F Luger, "Artificial Intelligence", Fifth Edition, Addison-Wesley Publishing Company.
- E. Charniak and D. McDermott, "Introduction to artificial Intelligence", Addison-Wesley Publishing Company.
- Stuart Russel and Peter Norvig., Artificial Intelligence a Modern Approach, 2nd ed., Pearson Education.
- Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI.
- Nils J. Nilson, "Principles of Artificial Intelligence", Narosa Publishing Co.
- M. Chandwick and J.A. Hannah, "Expert Systems for Personal Computers", Galgotia Publications

Unit	MCA413: Software Engineering
I	Software Problem - Cost, Schedule and Quality, Scale and Change. Software Processes -Process and Project, Component Software Processes, Software Development Process Models, Project Management Process.
II	Software Requirements Analysis and Specification - Value of a Good SRS, Requirement Process, Requirements Specification, functional Specification with Use Cases, And Other Approaches for Analysis, Validation. Software Architecture - Role of Software Architecture, Architecture Views, Component and Connector View, Architecture Styles for C&C View, Documenting Architecture Design, Evaluating Architectures.
III	Planning a Software Project - Effort Estimation, Project Schedule and Staffing, Quality Planning, Risk Management, Planning, Project Monitoring Plan, Detailed Scheduling., Design - Design Concepts, Function-Oriented Design, Object-Oriented Design, Detailed Design, Verification, Metrics.
IV	Coding and Unit Testing - Programming Principles and Guidelines, Incrementally Developing Code, Managing, Evolving Code, Unit Testing, Code Inspection, Metrics. Testing - Testing Concepts, Testing Process, Black-Box Testing, White-Box Testing, Metrics.
V	Introduction to UML, Development Process, Class Diagrams, Sequence Diagrams, Object Diagrams, Package Diagrams, Deployment Diagrams, Use Cases, State Machine Diagrams, Activity Diagrams, Communication Diagrams, Composite Structures, Component Diagrams, Collaborations, Interaction Overview Diagrams, Timing Diagrams.

Suggested Readings

- Pankaj Jalote's Software Engineering: A Precise Approach, By Pankaj Jalote
- UML Distilled Third Edition, A Brief Guide to the Standard Object Modeling Language, by Martin Fowler, Addison Wesley.

Unit	MCA414A: System Programming
I	Systems Programming: Software layered structure & bare machine. Language processor: fundamentals, specifications & language development tools. Systems software and Machine architecture.

II	Macro Processors: Macro Instructions, Features of Macro facility; Macro instruction arguments, conditional macro expansion, macro calls within macros, Macro instruction defining macros. Two pass macro processor. Introduction to MASM macro processor, ANSI C macro language
III	Assemblers: Elements of Assembly language. A simple assembly scheme, Pass structure of Assemblers. Designs of two pass assembler.
IV	Introduction to Loaders and Linkers, functions of a loader. Loader Schemes: Compile-&-go, General Loader, Absolute Loader, Subroutine Linkages, Relocating Loaders, Direct Linking loaders. Introduction to Binders, Overlays and dynamic binders.
V	Software tools: Software tools for program development, editors, Debug monitors, Programming environments, User Interfaces. Introduction to translators

Suggested Readings

- System Software, Beck Leland L, Pearson Education.
- Systems Programming and Operating Systems, Dhamdhare D M, Tata Mc Graw Hill.
- Systems Programming, Donovan John J. Tata Mc Graw Hill.

Unit	MCA414B: Data Warehousing & Data Mining
I	Introduction to Data Warehousing and its building blocks: Definition, Need for Data Warehousing, Operational versus Decision-Support Systems, Scope and Purposes, Features of Data Warehousing :Subject Oriented Data, Integrated Data, Time Variant Data, Non Volatile Data, Data Granularity, Data Warehouses and Data Marts :Their Difference, Top-Down Versus Bottom-Up Approach, Overview of various components: Source Data Component, Data Staging Component, Data Storage Component, Information Delivery Component, Meta Data Component, Management and control Component ,Metadata in the Data warehouse.
II	Warehousing Strategy, Warehouse Management and Support Process: Strategy Components, Determine Organizational Context, Conduct Preliminary Survey Of Requirements, Conduct Preliminary Source System Audit, Identify External Data Sources, Define Warehouse Rollouts, Preliminary Data Warehouse Architecture, Issue Tracking and Resolution Process, Perform Capacity Planning, warehouse Purging Rules, Security Management, Backup and Recovery Strategy.
III	What is Data Mining? Motivating Challenges; The origins of data mining; Data Mining Tasks. Types of Data; Data Quality, Data Pre-processing; Measures of Similarity and Dissimilarity. Classification: Preliminaries; General approach to solving a classification problem; Decision tree induction; Rule-based classifier; Nearest-neighbour classifier
IV	Association Analysis : Problem Definition; Frequent Item set generation; Rule Generation; Compact representation of frequent item sets; Alternative methods for generating frequent item sets, FP-Growth algorithm, Evaluation of association patterns; Effect of skewed support distribution; Sequential patterns, Cluster Analysis: Overview, K-means, Agglomerative hierarchical clustering, DBSCAN, Overview of Cluster Evaluation.
V	Applications: Data mining applications; Data mining system products and research prototypes; Additional themes on Data mining; Social impact of Data mining; Trends in Data mining.

Suggested Readings

- Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education, 2007
- Data Mining – Concepts and Techniques - Jiawei Han and Micheline Kamber, 2nd Ed, Morgan Kaufmann, 2006.
- Insight into Data Mining – Theory and Practice - K.P.Soman, Shyam Diwakar, V.Ajay, PHI, 2006.
- Data Warehousing Fundamentals: Paulraj Ponniah, S. Nagabhushana, Sam Anahory, Dennis Murray.
- Data Mining: Richard J.Roiger and Michael W. Geatz, Margaret H. Dunham

Unit	MCA414C: Internet Programming in PHP
I	Introduction to PHP, Control Structures, Arrays and Functions: Application: To understand the basics of PHP and MySql Introducing PHP: Why PHP and MySQL Side Scripting Overview: Static HTML, Client-Side Technology, Server-Side Scripting and Escaping from HTML Learning PHP Syntax and Variables: PHP's Syntax, Comments, Variables, Types in PHP, Type Summary, The simple types, Output
II	Features of PHP Application: To understand the major features needed to work with php applications Php Control Structures and Functions: Boolean Expression, Branching, Looping and Using functions. Passing Information with PHP: HTTP is Stateless; GET and POST Arguments, Formatting Form Variables. String Handling: Strings in Php, String Functions Learning Arrays: Php Arrays, Creating arrays, Retrieving values, multidimensional arrays, inspecting arrays, deleting arrays Number Handling: Numerical types, Mathematical operators, mathematical functions.
III	MySQL Database Integration and Query Processing and Web Forms: Application: To understand and implement MySql database with Php Introducing Database and MySQL: Integrating PHP and MySQL: Connecting to MySQL, Making MySQL Queries, Fetching Data, Multiple connections, Building in error-checking, Creating MySQL database with PHP, MySQL functions. Performing Database Queries: HTML Tables and Database Tables, Complex Mapping. Integrating Web Forms and Databases: HTML Forms, Basic Form Submission to a Database, Self-Submission, Editing Data with an HTML Form.

IV	Advanced PHP and PHP CMS: Application: To understand and implement the concept of cookies and sessions. To create blogs and websites using WordPress Working with Cookies and Sessions: What is a Session? How Session works in PHP, Session Functions, Cookies. Exception with PHP: Error Handling in PHP. WordPress: About WordPress: Why WordPress? Sites Built with WordPress, Installing and Upgrading WordPress, Dashboard and Settings Working with Content: Post, Pages, Posts vs. Pages, Media Files, Links, Feeds Importing Content: Importing Blogs, Importing HTML Files, Creating a Basic Theme.
V	PHP Framework: Application: To learn and implement php framework using Laravel Laravel – What is Laravel? Installation Quick start: Creating your first web application: Database configuration, Creating the users table using migrations, Creating an Eloquent user model, Routing to a closure, Creating users with Eloquent, The users controller, Creating the users index view, Passing data from a controller to a view, Adding our dynamic content to the view, RESTful controllers, Creating a form for adding users, Routing POST requests to a controller action, Receiving form input and saving to the database, Creating links with the HTML helper, Deleting user records with Eloquent, Updating a user with Eloquent, Creating the update form with the form helper.

Suggested Readings

- PHP Bible, (Author) Tim Converse , Joyce Park.
- Beginning PHP5(Author) David Mercer, Allan Kent , Steven Nowicki, Clark Morgan, Wankyu Choi.

Unit	MCA415A: LINUX Operating System
I	Introduction to concept of Open source software, Linux Architecture, Linux file system, Kernel, Process Management in Linux, Signal Handling, System call, and System call for Files, Processes and Signals.
II	Command Structure, cal, date, echo, printf, bc, script, passwd, PATH, who, uname, tty, stty, pwd, cd, mkdir, rmdir. The File System, cat, cp, rm, mv, more, file, ls, wc, pg, cmp, comm, diff, gzip, tar, zip, df, du, mount, umount. Filtering commands: head, tail, cut, paste, sort, grep, sed.
III	Shell Programming– Introduction to Shell, Various Shell of Linux, Shell Commands, I/O Redirection and Piping, Vi and Emacs editor. The Logical operators && and conditional Execution, Shell control statements, Variables, if-then-else, case-switch, While, Until, Find, Shell Meta-characters, Shell Scripts, Shell keywords, Built in Commands, Shell Procedures and Reporting, Handling documents.
IV	File listings, Ownership and Access Permissions, File and Directory types, Managing Files, User and its Home Directory, Booting and Shutting down. Installing and upgrading the package. Configure IP and telnet, ping. Installing apache web server for Linux operating system.
V	BootLoaders, LILO, GRUB, Bootstrapping, init Process, System services, Internet and Web service tools, E-mail, Remote Login and FTP, Networks and server setup, LAN, Connection with Internet, Setting up routers, Proxy Servers, Print Servers, File Server, Mail server, FTP server, Web server, DHCP.

Suggested Readings

- Linux: The Complete Reference, Sixth Edition by Richard Petersen (Author)
- Design of the UNIX Operating System Maurice J. Bach, AT&T Bell Labs.
- Yashwant Kanetkar, Unix shell programming,(BPB).

Unit	MCA415B: Advanced DBMS
I	Transactions and Concurrency Control: Transaction Concept, Transaction State, Implementation of Atomicity & Durability, Concurrent Executions, Serializability, Lock-Based Protocols, Timestamp-Based Protocols, Deadlock Handling.
II	Database Security and Authorization: Introduction to Database Security Issues, Discretionary Access control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based Access Control for Multilevel Security, Introduction to Statistical Database Security, Encryption and Public Key Infrastructures.
III	Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Distributed Query Processing.
IV	Object Orientated Database: Features of an Object-Orientated DBMS, Object-Oriented Database Design, How OO Concept has Influenced the Relational Model, Object Oriented Languages, Persistent Programming Languages, Nested Relations, Complex Types, Inheritance, Reference Types, Querying with Complex Types, Object-oriented data model.
V	Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Design of Parallel Systems

Suggested readings:

- Database Concepts, Korth, Silbertz, Sudarshan, McGraw Hill.
- SQL/ PL/SQL The Programming Language of Oracle, Ivan Bayross, BPB Publications
- Database Management Systems, Ramakrishnan, Gehrke, McGraw Hill

Unit	MCA415C: Cloud Computing
I	Enterprise computing: a retrospective – Introduction, Mainframe architecture, Client-server architecture, 3-tier architectures with TPmonitors, The internet as a platform - Internet technology and web-enabled applications, Web application servers, Internet of services. Software as a service - Emergence of software as a service architectures and cloud computing, Successful SaaS architecture.
II	Enterprise architecture: role and evolution - Enterprise data and processes, Enterprise components, Application integration and SOA, Enterprise technical architecture, Data center infrastructure: coping with complexity. Cloud computing platforms - Infrastructure as a service: Amazon EC2, Platform as a service: Google App Engine, Microsoft Azure. Cloud computing economics - Is cloud infrastructure cheaper?, Economics of private clouds, Software productivity in the cloud, Economies of scale: public vs. private clouds.
III	Data in the cloud - Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo, Cloud data stores: Datastore and SimpleDB. MapReduce and extensions - Parallel computing, The MapReduce model, Parallel efficiency of MapReduce, Relational operations using MapReduce, Enterprise batch processing using MapReduce.
IV	Enterprise software: ERP, SCM, CRM - Anatomy of a large enterprise, Partners: people and organizations, Products, Orders: sales and purchases, Execution: tracking work, Billing, Accounting, Enterprise processes, build vs. buy and SaaS. Custom enterprise applications and Dev 2.0 - Software architecture for enterprise components, User interface patterns and basic transactions, Business logic and rule-based computing, Inside Dev 2.0: model driven interpreters, Security, error handling, transactions and workflow.
V	Enterprise cloud computing ecosystem - Public cloud providers, Cloud management platforms and tools, Tools for building private clouds. Roadmap for enterprise cloud computing - Quick wins using public clouds, Future of enterprise cloud computing.

Suggested Readings

- Enterprise Cloud Computing Technology, Architecture, Applications by GautamShroff. Cambridge University Press.

MCA421: Advanced Java Lab	
SNo	Practical Exercises
1	Assignments based on basic Java Servlets.
2	Assignments based on JDBC and Servlets , Data Source and Connection pooling, JavaMail in a Servlet.
3	Assignments based on Servlet Request and Response Model, Deploying a Servlet, Servlet State Transitions, ServletConfig and ServletContext, Servlet Redirection and Request Dispatch, Servlet Synchronization and Thread .
4	Assignments based on Reading and writing data from client using Servlets, Maintaining Client State - Cookies, URL rewriting, hidden form fields, Session Tracking. Inter servlet communications –JDBC connection pool.
5	Assignments based onJSP fundamentals, JSP tags and JSP expressions, data sharing among servlets & JSP. JSP implicit objects, request application, session and page scope, JSP standard actions, JSP errors.

MCA422: Colloquium Lab	
Practical Exercises	
The aim of the subject is to develop ability of a student to be able to discuss and speak about various issues/subjects/topics/matters. The students in the group will discuss the topics and present their views. The evaluation will be carried out by the examiners based on their thoughts, language proficiency, presentation skills etc.	

MCA423: System Design Project Lab	
Practical Exercises	
Students in a group of 3-4 shall prepare a system design of their choice, in guidance of teacher.	

MCA424A: System Programming Lab	
SNo	Practical Exercises
1	Implementation of word recognizer
2	Basic parser, syntax and semantic analyzer
3	Problems related to Macros
4	Assembler POT and MOT construction
5	Generating machine Code for assembly program
6	Implementation of basic functions of Loaders and linkers
7	Overlay memory computations.

MCA424B: Advanced Database Lab
Practical Exercises
The practical exercises based on MCA415B

MCA424C:PHP Programming Lab
Practical Exercises
Exercise based on how to install and configure server with execution of php files, passing information between pages, operators in php, loops in php, get values form different types of control in php, dynamic control generation in php, array used in php, associative array used in php, multi dimension array used in php, in built array functions, file handling functions, login and logout with session, cookies use, database MySql connection. Insert, Update, delete and select records from table, String and regular expression function.

MCA - V Semester							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA511	Analysis & Design of Algorithms	3	4	3 hrs	20	80	100
MCA512	Information Protection & Security	3	4	3 hrs	20	80	100
MCA521	Information Protection & Security Lab	4	2	3hrs	20	80	100
MCA522	Software Project Lab	4	2	3 hrs	20	80	100
MCA523	Seminar	4	2	3 hrs	20	80	100
	Elective Group 1						
MCA513A	Advance Computer Architecture	3	4	3 hrs	20	80	100
MCA514A	Compiler Design	3	4	3 hrs	20	80	100
MCA515A	Embedded System	3	4	3 hrs	20	80	100
MCA524A	Compiler Design Lab	4	2	3 hrs	20	80	100
	Elective Group 2						
MCA513B	BigData Analytics	3	4	3 hrs	20	80	100
MCA514B	Bioinformatics Database	3	4	3 hrs	20	80	100
MCA515B	Geographical Information Systems	3	4	3 hrs	20	80	100
MCA524B	Bio informatics Lab	4	2	3 hrs	20	80	100
	Elective Group 3						
MCA513C	AJAX & XML	3	4	3 hrs	20	80	100
MCA514C	Programming in Android	3	4	3 hrs	20	80	100
MCA515C	Wireless Technology	3	4	3 hrs	20	80	100
MCA524C	Android Programming Lab	4	2	3 hrs	20	80	100
	TOTAL						900

Unit	MCA511: Analysis and Design of Algorithms
I	Introduction: Need of algorithm, specification of algorithm, Design of Algorithms, Finding time and Space units of algorithms. Performance analysis: Complexity of Algorithms: time complexity, space complexity, calculation of time and space complexity, Asymptotic Notations: Big O, Small o, Omega, Theta, Growth of function, Recurrences.
II	Divide – and – conquer: Basic concept, binary search (recursive and iterative both), MinMax problem, merge sort, Quick sort. Greedy method:-Basic concept, knapsack problem : Binary and Fractional, minimum cost spanning tree: Prim's algorithm, Kruskal's algorithm, Dijkstra.
III	Dynamic Programming – general method of dynamic programming, multistage graphs , all pair shortest path ,

	optimal binary search trees, Travelling salesman problem, flow shop scheduling, Matrix chain multiplication, Longest common sequence.
IV	Backtracking: Basic concept of Backtracking, 8-Queens problem, sum of subsets, graph colouring, Hamiltonian cycles, knight tour, puzzle. Branch and bound: Basic Method of branch and Bound, 0/1 Knapsack, Problem, travelling salesperson.
V	Parallel models:-Basic concepts, performance Measures, Parallel Algorithms, Parallel complexity, Analysis of Parallel Addition, Parallel Multiplication and parallel division, parallel Evaluation of General Arithmetic Expressions, First-Order Linear recurrence. Introduction of NP problems.

Suggested Readings

- Fundamentals of COMPUTER ALGORITHMS : Ellis Horowitz Sartaj Sahni, Sanguthevar, Rajshekaran.

Unit	MCA512: Information Protection & Security
I	History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Mobile Devices: Security Implication for organizations.
II	Information security management (ISM) in organizations, Security policy, standards, guidelines and procedures, Information security management system (ISMS). Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles.
III	Overview of physical security for Information Systems- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Perimeter security for physical protection, Biometrics controls for security- Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues.
IV	Model of Cryptographic Systems, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN.
V	Cyber Crime, Information Security and Law, Types & overview of Cyber Crimes, Overview of Indian IT Act., Understanding Ethical hacking. Understanding Intellectual property rights, Copy Right, Patents, Trademark, Trade Secret, Trade Name and Trademark, Domain Name. Software Piracy, Plagiarism

Suggested Readings

- Godbole, "Information Systems Security", Wiley

Unit	MCA513A: Advance Computer Architecture
I	Introduction to Parallel Processing. Trends towards parallel processing. Parallelism in uniprocessor systems. Parallel processing mechanisms. Parallel computer Structures: pipeline, array and multiprocessor systems.
II	Architectural classification schemes: Flynn's classification. Serial vs. Parallel processing. Parallelism vs. pipelining. Applications of Parallel Processing. RISC, CISC & VLIW architecture
III	Principles of Pipelining and vector processing: linear pipelining. Classification of pipeline processors. General pipelines and reservations tables. Interleaved memory organization. Introduction to arithmetic pipeline.
IV	Memory: Introduction to Virtual and Cache memory. Multiprocessor memory interface techniques: multiport, cross-bar, timeshared and dual bus structure. Cache Memory mapping: associative, direct & set-associative mappings. Cache writing methods. Cache coherence problems. Snoopy bus protocol
V	Dataflow architecture: Control flow vs. data flow computers. Static and dynamic data flow computer organization. Data flow graphs and languages. Data flow design alternatives.

Suggested Readings

- Computer system architecture. Mano Morris M. PHI
- Computer Architecture and parallel processing. Briggs & Hwang. Mc Graw Hill International.

Unit	MCA513B: BigData Analytics
I	Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis –Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools -Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.
II	MINING DATA STREAMS - Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing -Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –

	Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.
III	HADOOP - History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFSBasics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features
IV	HADOOP ENVIRONMENT - Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud
V	FRAMEWORKS - Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

Suggested Readings

- Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
- Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
- Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012
- Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
- Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, JohnWiley & sons, 2012.
- PeteWarden, “Big Data Glossary”, O’Reilly, 2011.
- Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.
- Da Ruan,Guoqing Chen, Etienne E.Kerre, GeertWets, Intelligent Data Mining, Springer,2007.
- Paul Zikopoulos ,Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles, David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.
- Michael Minelli, Michele Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Businesses,Wiley Publications,2013.
- Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011

Unit	MCA513C: AJAX & XML
I	Introducing Ajax, Ajax in Action - flickr, Basecamp, Amazon (A9.com), Google Suggest and Google Maps, Other Sites, Bad Examples, Ajax- The Acronym, XHTML and CSS, The Document Object Model (DOM), JavaScript, XML, XSLT, and XPath, The XMLHttpRequest Object, Server-Side Technologies, The Ajax Application Model, Advantages of Ajax - Partial Page Updating, Invisible Data Retrieval, Constant Updating, Smooth Interfaces, Simplicity and Rich Functionality, Drag and Drop, Disadvantages of Ajax - Poor Responsiveness, Breaks the Back Button on Your Browser, Breaking Bookmarks and Blocking Search Engine Indexes, Strain on the Browser.
II	JavaScript Refresher - Core JavaScript,Syntax, Variables,Primitive Datatypes, Reference Datatypes, Operators, Assignment Operator, Arithmetic Operators, Comparison Operators, Logical Operators,Increment and Decrement Operators, Statements, Conditional Statements, Loops, Functions, Object-Oriented JavaScript, Built-in Objects, Browser Objects, User-Defined Objects, Constructors, Prototypes, Destroying Objects, The Document Object Model, The Document as a Family Tree, The Document as a Node Tree, DOM Methods for Accessing Objects, getElementById, getElementsByTagName, Creating Nodes, The innerHTML Alternative, JavaScript and Events, Event Models, Event Registration, The Internet Explorer Event Registration Model, The W3C DOM Event Registration Model, Event Objects.
III	Ajax and Server-Side Technologies - Forms and HTML Controls, The Forms Model of Submission, The Ajax/JavaScript Model of Submission, Submitting Data to the Server, The Server Receives the Request,, The XMLHttpRequest Object, The Callback Function, The responseText Property, The responseXML Property, Debugging responseXML, Debugging responseXML in IE, Using the Data, ASP.NET - Example Using AJAX and ASP.NET, PHP - Example Using AJAX and PHP, Java Servlets - Example Using AJAX and JavaServlets. Ajax Techniques - The XMLHttpRequest Object, Creating an XMLHttpRequestObject,Synchronous Usage, Asynchronous Usage, The readyState Property, XMLHttpRequest Properties and Methods, The POST Method, Advantages and Disadvantages of Using the POST and GET Methods. Other Ajax Techniques - Hidden Frames, Hidden Inline Frames, Dynamic Script Loading, Images and Cookies.
IV	Working with XML - XML Basics , Creating Tags , XML Syntax ,Well-Formed and Valid XML Documents , Extracting XML Data with JavaScript , Using Nodes , Accessing XML Elements by Name , Accessing Attribute Values , Using CSS with XML Data , Using CSS with XML Documents , Using CSS with Ajax , The style Property , The className Property . XSLT and XPath - XSLT and Its Purpose ,XSLT Elements ,xsl:stylesheet , xsl:output , xsl:includes , xsl:template, xsl:apply-templates, and xsl:call-template , The Match Attribute , The Name Attribute , XSLT Parameters , xsl:if , xsl:choose , Escaping XSLT Special Characters , xsl:for-each , xsl:value-of ,

	xsl:sort , xsl:variable , XSLT Support in the Main Browsers , Performing a Transform , Performing a Transform Using IE , Performing a Transform in Firefox , Performing a Transform on the Server Side , Creating an XSLT Style Sheet for a Shopping Cart, XPath and Its Purpose, Basic XPath Functionality , XPath Expressions , Current Context , Document Root , Root Element , Recursive Descent , Specific Elements or Items , XPath Functions , The number Function ,The position Function , The count Function , String Formatting , Arithmetic Functions , Logical Functions , Querying in an XML Document Using XPath, Amending the Shopping Cart Example to Use XSLT and Ajax
V	Debugging and Error Handling - JavaScript Error Handling ,Handling Exceptions , The onerror Event Handler , Mozilla JavaScript Console , Microsoft Script Debugger , Firebug , DOM Inspectors ,Firefox DOM Inspector ,IE DOM Inspector, Mouseover DOM Inspector (MODI) , Troubleshooting Ajax , Using the Firebug Console with XMLHttpRequest , Live HTTP Headers , ieHTTPHeaders Explorer Bar.

Suggested Readings

- Beginning Ajax, By Chris Ullman, Lucinda Dykes, Wrox Publication.

Unit	MCA514A: Compiler Design
I	Introduction to translators: assemblers, interpreters, compilers & cross-compilers. Analysis & Synthesis phases of a compiler. Intermediate code representation: Polish notation, quadruples, triples, indirect triples, abstract syntax tree. Classification of Grammars (Chomsky Classification).
II	Finite automata and lexical analysis: The role of lexical analyzer, Regular expressions. Recognition of tokens, Introduction to Finite Automata & NFA, From regular expression to Finite automata, Conversion from NFA to DFA. Minimization of DFA. Introduction to LEX
III	Parsers: Introduction to Parsing. Top-down & Bottom up Parsers. Introduction to LL, LR, RL and RR parsers. Top Down Parsers: Brute Force & Recursive descent. Bottom Up Parsers: Table driven parser, Shift-reduce parser; LR parser, Action-goto table construction & parsing. Operator precedence Parser.
IV	Semantic Analysis: Symbol tables, Syntax directed translation schemes, Synthesized and Inherited attributes. Code optimization: Basic blocks, DAG, local optimization, copy propagation, folding, redundant sub-expression elimination, dead code removal. Optimization within iterative loops. Global optimization through flow graphs.
V	Code generation: Generic issues in code generation, machine dependent code optimization. Introduction to Peephole optimization. Run time storage management. Object and executable code generation. Introduction to Compiler-compilers: YACC.

Suggested Readings

- Compilers principles and practice, Dave and Dave, Pearson Publications.
- The theory and practice of Compiler writing, Trembley & Sorenson. Mc Graw Hill International Editions.
- Principles of Compiler Design, Aho & Ullman, Narosa Publishing.

Unit	MCA514B: Bioinformatics Databases
I	Fundamentals of Bioinformatics: Introduction, principles and scope of bioinformatics, Fundamentals of molecular biology: DNA sequences, Gene structure, Gene expression and gene mutations. Genomics, proteomics, transcriptomics and metabolomics. Biological data: Nucleotide and protein sequences, genetic code and their interpretations. Macromolecular structures: Primary, secondary, tertiary and quaternary structures and its significance.
II	DNA Sequence analysis: Features of sequence analysis, sequence alignment (Local alignment, global alignment, FASTA, BLAST and similarity searching scores and their statistical interpretation. Pairwise alignment techniques, Multiple sequence alignment), sequence comparison algorithms, sequence scoring schemes. Introduction, database searching, alphabets and complexity, algorithms and programs, comparing two sequences a simple case, sub-sequences, identity and similarity, the dot plot, local and global similarity,
III	Archives and Information Retrieval: Introduction, biological databases, primary sequence databases, composite protein sequence database, secondary databases, structure classification databases, web addresses. Genome information resources: Introduction, DNA sequence databases, specialised genomic resources. Secondary database searching: Introduction, secondary database searches. Biological databases: EMBL, GenBank, DDBJ, TrEMBL, SWISS-PROT, PIR; primary and secondary composite databases; SCOP, CATH, Overview of web servers: NCBI, EBI, PDRB; Search engines: Pub Med, ENTREZ, Expasy and SRS.
IV	Genome annotation, Computational evolutionary biology, Analysis of gene expression, gene regulation, protein expression and mutations, Modeling biological systems, High-throughput image analysis, Prediction of protein structure, Molecular Interaction and Docking algorithms. Bioinformatics tools: Visualisation of sequence data, Building a sequence search protocol: Introduction, a practical approach, when to believe a result, structural and functional interpretation. Analysis packages: Introduction, what's in an analysis package, commercial software, comprehensive packages, packages specialising in DNA analysis, intranet packages, and internet packages.
V	Applications and commercial aspects of Bioinformatics: Drug discovery, genetic basis of disease, personalised medicine and gene-based diagnostics, legal, ethical and commercial ramifications of bioinformatics.

	Macromolecular Modelling and Chemoinformatics : Acquisition of chemical information, including molecular structure from databases visualisation of molecules simulation of molecular interaction introduction to industry standard modelling software.
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Unit	MCA514C: Programming in Android
I	Introduction to the Development Framework: Understanding the Android Software Stack, The Dalvik Virtual Machine, Android Application Architecture, Android Libraries. Developing with Eclipse, Using the Eclipse Plug-In, Creating Your First Android Application, Starting a New Android Project, Creating a Launch Configuration, Running and Debugging Your Android Applications, Types of Android Applications: Foreground Applications, Background Applications, Intermittent Applications, and Widgets.
II	Hardware-Imposed Design Considerations for mobile devices. The Android Virtual Device and SDK Manager, Android Emulator, SDK Manager, The Android Emulator, Dalvik Debug Monitor Service (DDMS), The Android Debug Bridge (ADB). Externalizing Resources, Creating Resources, Simple Values, Styles and Themes, Drawables, Layouts, Animations, Menus. Introducing the Application Manifest, The Android Application Life Cycle, Understanding Application Priority and Process States, Introducing the Android Application Class and Activity Class, Extending and Using the Application and Activity Class, Overriding the Application Life Cycle Events.
III	Assigning User Interfaces to Activities, Introducing Views, Introducing Layouts: Using Layouts, Optimizing Layouts. Creating New Views, Drawable. Android UI Controls: TextView, EditText, Button, CheckBox, RadioButton and RadioGroup. Introducing Adapters for binding controls like ListView and Spinner. Event Listeners & Event Handlers methods in Android.
IV	Saving Simple Application Data, Creating and Saving Preferences, Retrieving Shared Preferences, Saving and Loading Files, Including Static Files as Resources, File Management Tools. Introducing Android Databases, Introducing SQLite, Cursors and Content Values, Working with SQLite Databases, Creating a New Content Provider, adding, Deleting, and Updating Content. Native Android Content Providers. Introduction to Services, Broadcast Receiver Fragments and Intents.
V	Creating and Using Menus, Defining Menu Hierarchies in XML, Updating Menu Items Dynamically, Handling Menu Selections, Creating Submenus, Using Context Menus and Popup Menus. Creating a Dialog, Using the Alert Dialog Class, Using Activities as Dialogs, Customizing Toasts, Creating Notifications.

Suggested Readings

- PROFESSIONAL Android™ 4 Application Development by Reto Meier

Unit	MCA515A: Embedded System
I	Introduction to Embedded systems: what are Embedded systems? , Embedded systems architectures, Special challenges with embedded systems: Real time execution, Physical size, power consumption, user interface, multirate operations, cost, hardware software trade-offs. Application of embedded systems.
II	Hardware architecture: Processors, microcontrollers, DSP, graphic processors. Memory: Primary, secondary and auxiliary memories. Interfaces: Output & input; LED, LCD displays, actuators, Sensors and keypads. Touch and haptic inputs. Introduction to ADC and DAC. Introduction to Watch dog timers.
III	The AVR microcontroller: History and features. AVR architecture & variants of AVR. AVR assembly language programming: list of registers, RAM, Status registers, ROM, Data directives.
IV	AVR instruction set: I/O port programming. Arithmetic, logic, branch call and bit manipulation instructions. Addressing modes in AVR. Introduction to AVR programming in C
V	Interfacing: Timer programming, Interrupt programming, Serial port programming, LCD, Keyboard, ADC, DAC, Sensor Interfacing, Relay, motors and stepper driving. Basic introduction to Arduino boards and programming.

Suggested Readings

- Embedded Systems Architecture, Noergaard, Elsevier.
- Embedded Systems, Barret& Pack, Pearson publications.
- Embedded Systems, Rajkamal, Mc Graw Hill.
- Programming for Embedded Systems, Dreamtech software team. Wiley publications.
- The AVR microcontroller and embedded systems, using assembly and C.Mazidi, Naimi & Naimi. Pearson publications.

Unit	MCA515B: Geographical Information Systems
I	Introduction to GIS and Geographical Information: Basic concepts, Socioeconomic Challenges, Benefits of Computerizing Information, Users of GIS. From Real world to GIS: The real world, Real-world model, Data model, from database to GIS to Map, Application of GIS.
II	Basic Data models: Introduction, Vector data model, raster data models, conversion between vector and raster models, vector vs raster models. Attribute data. Advanced data models: surface representation, three dimensional objects, representation of time. Global Positioning System: Introduction, History, GPS System Description, Structure of GPS system, GPS Accuracy and Error, Introduction to DGPS.
III	Data collection: Introduction, digitizing maps, scanning, aerial photographs and photo interpretation, Remote sensing. Surveying, satellite positioning systems, photogrammetric mapping, collection of attribute data, text data. Data input: data pre-processing, methods of data capture, digitization and scanning methods, commonly used map projections and ellipsoids.
IV	Basic spatial analysis: Analysis of spatial information, logic operations, general arithmetic and statistical operations. Report generation from attribute data. overlays, buffer zones, raster data overlay. Integrated data analysis.
V	Digital Elevation Model (DEM): need, methods, data sources and products of DEM - Digital Terrain Modelling (DTM) - Input verification, storage and methods of data analysis for Spatial modelling - Methods of GIS and Spatial interpolation.

Suggested Readings

- Geographical Information System for Geoscientists by Bonham-Carter G.F., Pergamon Press, Tarrytown, New York.
- Principles of Geographical Information System for Land Resources Assessment by Burrough, PA., Clarendon, Press, Oxford.
- Geographical Information System by Fraser Taylor, D.R., The Microcomputer and Modem Cartography, Pergamon Press.
- Mathematical Geography by Jameson, A.H. and Mormsby, M.t. Mormsby., Vol I and II, Sir Issac Pitman and Sons Ltd. London.

Unit	MCA515C: Wireless Technology
I	Introduction to Wireless Communication Systems - Evolution of Mobile Radio Communications. Mobile Radiotelephony in the U.S. Mobile Radio Systems Around the World. Examples of Wireless Communication Systems. Trends in Cellular Radio and Personal Communications. Modern Wireless Communication Systems - Second Generation (2G) Cellular Networks. Third Generation (3G) Wireless Networks. Wireless Local Loop (WLL) and LMDS. Wireless Local Area Networks (WLANs). Bluetooth and Personal Area Networks (PANs).
II	Modulation Techniques for Mobile Radio - Frequency Modulation vs. Amplitude Modulation. Amplitude Modulation. Angle Modulation. Digital Modulation: An Overview. Line Coding. Pulse Shaping Techniques. Geometric Representation of Modulation Signals. Linear Modulation Techniques. Constant Envelope Modulation. Combined Linear and Constant Envelope Modulation Techniques. Spread Spectrum Modulation Techniques. Modulation Performance in Fading and Multipath Channels.
III	Multiple Access Techniques for Wireless Communications - Introduction. Frequency Division Multiple Access (FDMA). Time Division Multiple Access (TDMA). Spread Spectrum Multiple Access. Space Division Multiple Access (SDMA). Packet Radio. Capacity of Cellular Systems.
IV	Wireless Networking - Introduction to Wireless Networks. Differences Between Wireless and Fixed Telephone Networks. Development of Wireless Networks. Fixed Network Transmission Hierarchy. Traffic Routing in Wireless Networks. Wireless Data Services. Common Channel Signaling (CCS). Integrated Services Digital Network (ISDN). Signaling System No. 7 (SS7). An Example of SS7 Ñ Global Cellular Network Interoperability. Personal Communication Services/Networks (PCS/PCNs). Protocols for Network Access. Network Databases. Universal Mobile Telecommunication System (UMTS).
V	Wireless Systems and Standards - AMPS and ETACS. United States Digital Cellular (IS-54 and IS-136). Global System for Mobile (GSM). CDMA Digital Cellular Standard (IS-95). CT2 Standard for Cordless Telephones. Digital European Cordless Telephone (DECT). PACS Ñ Personal Access Communication Systems. Pacific Digital Cellular (PDC). Personal Handyphone System (PHS). US PCS and ISM Bands. US Wireless Cable Television.

Suggested Readings

- Wireless Communications: Principles and Practice, by Theodore S. Rappaport

MCA521: Information Protection & Security Lab
Practical Exercises
Exercises based on different encryption and decryption algorithm, different cryptography algorithms, password encryption and protection, document security like digital signature and digital watermarking

MCA524A: Compiler Design Lab

Practical Exercises

Exercises based on Basic parser structure, Syntax analyzer, Semantic Analyzer, Expression evaluation using stacks, Intermediate code representation, Code optimization, Code generation.

MCA524B: Bio Informatics Lab

Practical Exercises

Exercises based on Usage of NCBI resources, Retrieval of DNA and Protein sequences and structures from databases, BLAST exercises, Visualization of structures

MCA524C: Android Programming Lab

Practical Exercises

Exercises based on Android UI design, Controls, their events, Menus, Dialog and local storage.

Practical Examination [80] Marks Breakup

Practical Hands on TWO Exercises	60
Viva-voce	20
Total Marks	80

MCA - V Semester

Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA 611	Practical Training	-	25	3 hrs	-	200	200

SYLLABUS, TEACHING & EXAMINATION SCHEME
For BCA WEF FROM SESSION 2019-20

Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA111	Programming in C	3	3 hrs	20	80	100
BCA112	Web Designing	3	3 hrs	20	80	100
BCA113	Fundamentals of Computer	3	3 hrs	20	80	100
BCA114	Mathematics I	3	3 hrs	20	80	100
BCA115	Communicative Skills	3	3 hrs	20	80	100
BCA121	C Language Lab	4	3 hrs	20	80	100
BCA122	Communicative English Lab	4	3 hrs	20	80	100
BCA123	Web Design Lab	4	3 hrs	20	80	100
	TOTAL					800
BCA - II Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA211	Mathematics II	3	3 hrs	20	80	100
BCA212	Data Structure	3	3 hrs	20	80	100
BCA213	Object Oriented Programming With C++	3	3 hrs	20	80	100
BCA214	Communicative English	3	3 hrs	20	80	100
BCA215	Principles of Management	3	3 hrs	20	80	100
BCA231	Environmental Science	3	3 hrs	20	80	100
BCA221	C++ Lab	4	3 hrs	20	80	100
BCA222	Office Automation Lab	4	3 hrs	20	80	100
BCA223	Data Structure Lab	4	3 hrs	20	80	100
	TOTAL					800
BCA - III Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA311	Java Programming	3	3 hrs	20	80	100
BCA312	Computer Networks	3	3 hrs	20	80	100
BCA313	Database System	3	3 hrs	20	80	100
BCA314	E-commerce and Cyber Law	3	3 hrs	20	80	100
BCA315	Digital Electronics	3	3 hrs	20	80	100
BCA321	Java Programming Lab	4	3 hrs	20	80	100
BCA322	Database Lab	4	3 hrs	20	80	100
BCA323	Digital Electronics Lab	4	3 hrs	20	80	100
	TOTAL					800
BCA - IV Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA411	VB.NET	3	3 hrs	20	80	100
BCA412	Computer Oriented Numerical & Statistical Methods	3	3 hrs	20	80	100
BCA413	Operating System	3	3 hrs	20	80	100
BCA414	Computer Graphics	3	3 hrs	20	80	100
BCA415	Computer Architecture	3	3 hrs	20	80	100
BCA421	VB.NET Lab	4	3 hrs	20	80	100

BCA422	Computer Graphics Lab	4	3 hrs	20	80	100
BCA423	Computer Architecture Lab	4	3 hrs	20	80	100
	TOTAL					800
BCA - V Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA511	ASP.NET	3	3 hrs	20	80	100
BCA512	Organization Behaviour	3	3 hrs	20	80	100
BCA513	LINUX Operating System	3	3 hrs	20	80	100
BCA514	Internet Programming	3	3 hrs	20	80	100
BCA515	System Analysis and Design	3	3 hrs	20	80	100
BCA521	ASP.NET Lab	4	3 hrs	20	80	100
BCA522	LINUX Lab	4	3 hrs	20	80	100
BCA523	Internet Programming Lab	4	3 hrs	20	80	100
	TOTAL					800
BCA - VI Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA611	Software Engineering	3	3 hrs	20	80	100
BCA612	Information System Management	3	3 hrs	20	80	100
BCA621	Colloquium Lab	4	3 hrs	20	80	100
BCA622	Major Project	4	3 hrs	40	160	200
	TOTAL					500

BCA Program

BCA - I Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA111	Programming in C	3	3 hrs	20	80	100
BCA112	Web Designing	3	3 hrs	20	80	100
BCA113	Fundamentals of Computer	3	3 hrs	20	80	100
BCA114	Mathematics I	3	3 hrs	20	80	100
BCA115	Communicative Skills	3	3 hrs	20	80	100
BCA121	C Language Lab	4	3 hrs	20	80	100
BCA122	Office Automation Lab	4	3 hrs	20	80	100
BCA123	Web Design Lab	4	3 hrs	20	80	100
	TOTAL					800

Unit	BCA111: Programming in C
I	Concept of programming, algorithms and flowcharts, data types, structure of C program, constants and variables, arithmetic operators, library functions, expressions, input/output statements, compound statements and blocks.
II	Operators - relational, logical, bit wise, unary, hierarchy of operators. Control statements - if-else, nested if, switch case, goto and labels, looping statements - while, do-while and for, nested loops, break and continue.
III	Introduction of arrays - one-dimensional and multidimensional arrays, structures – simple and compound, unions, processing a structure. Pointers – declaration, increment and decrement operation, pointer to array, array of pointers, pointers to structures
IV	Functions - defining and accessing a function, function arguments, call by value, call by reference, calling functions with arrays, external, state and register variables, scope of variables, local and global variables, type conversion, block structure, recursion
V	Introduction of strings, library functions of strings - strlen, strcpy, strcat, strcmp. File handling – file input/output statements, creating, reading, writing and modifying files

Suggested Readings

- Let Us C, Yashavant P. Kanetkar , BPB Publications
- Programming in ANSI C, Balaguruswamy, Mc Graw Hill

Unit	BCA112: Web Design
I	Internet: History of the World Wide Web, difference between internet and intranet, web browser and its functions, URLs, web sites, domain names, search engines. Brief introduction to internet protocols – TCP/IP and UDP
II	Introduction of HTML: markup language features, uses and versions, elements of html: syntax, head and body sections, DOCTYPE tag, character formatting tags: B,U,I,SUB,SUP etc. Drawing ruler with HR tag. Creating lists: OL tag and its attributes START, TYPE and VALUE, UL tag and its attribute TYPE, LI tag. Using font: FONT tag and attributes like SIZE, COLOR and FACE. Inserting texts, text alignment.
III	Image Element: IMG tag and its attributes SRC, ALT, ALIGN, BORDER, WIDTH and HEIGHT. Presenting information in Table: Tags like TABLE, TR, TD and TH, Use of ROWSPAN and COLSPAN. Frames: Dividing window with frames using FRAME and FRAMESET tag, inline frame using IFRAME tag
IV	Anchor tag A and its various attributes HREF, TITLE, NAME ACCESSKEY and TARGET, Images and Text as hyper link. Hyperlink and table elements. Forms: Use or FORM tag, Understanding of widgets, <INPUT> Tag, use of Submit and Reset Buttons, Forms processing (Action and Method).
V	Dynamic HTML: CSS: Introduction – inline styles, creating style sheets with the style element, Conflicting styles, linking external style sheets, user style sheets.

Suggested Readings

- HTML Complete, BPB Publication (Sybex)
- Internet and World Wide Web, H.M.Deitel, P.J.Deitel, A.B.Goldberg, Pearson -Prentice Hall

Unit	BCA113: Fundamentals of Computer
I	Introduction to Computer, Characteristics of Computers, Generation of Computers, Classification of Computer, Basic Computer Organisation, Applications of Computers, Input Devices, Output Devices, Soft Copy Devices, Hard Copy Devices
II	Introduction to Computer Memory, Memory Hierarchy, Processor Registers, Cache Memory, Primary Memory, Secondary Memory, Storage Devices- Hard Disk, Optical Drives, USB Flash drive, Memory Card, Mass Storage Devices, Introduction to Computer Software, Classification of Computer Software- System, Application, Firmware, Middleware.

III	Introduction to Operating System, Evolution, Process Management, Memory Management, File Management, Device Management, Security Management, Command Interpreter, Algorithm, Control Structures, Flowcharts, Pseudocode, Programming Languages, Generation of Programming Languages, Categorization of High level Languages, Popular High Level Languages
IV	Introduction to Networking, Connecting Media, Data Transmission Mode, Data Multiplexing, Data Switching, Data Routing Techniques, Networking Topologies, Type of Network, Networking Devices, Introduction to Internet, Internet Services, Types of Internet Connections, Internet Security
V	Introduction to Emerging Computer Technologies, Distributed Networking, Peer-to-Peer Computing, Grid Computing, Cloud Computing, Utility Computing, On-demand Computing Wireless Network, Bluetooth

Suggested Readings

- Fundamentals of Computers – Reema Thareja, Oxford Publications

Unit	BCA114: Mathematics I
I	Sets:-definition of sets, Representation of sets, Type of sets i.e. empty set, equal set, finite and infinite set, subset, power set, universal set, operations on sets, intersection of sets, properties of operation on sets, complement of a set, properties of complement of set. Relations:- Definition of relation, Types of relations Functions:- Definition of function Types of functions, Cartesian product of sets, Binary operations.
II	Matrix:- Definition of matrix, Types of matrixes i.e. Row matrix, column matrix, equal matrix, square matrix, Diagonal matrix, Scalar matrix etc., operation on matrixes i.e. addition, subtraction and product of matrixes. Determinant:- Definition of determinants, expansion of determinants, operation on determinants, minors, cofactor, singular and non-singular matrix, Ad joint of matrix, Inverse of a matrix.
III	Quadratic equations:-Definition of quadratic equation, solution of quadratic equation by factorization method and shridharacharya's formula, relation between the roots of a quadratic equation, Formation of quadratic equation from given roots. Sequence & series: Introduction, Arithmetic progression (AP), General term of a AP, sum of n terms of a AP, Arithmetic mean, Geometric progression (GP), general term of G.P., Sum of a G.P., Geometrical mean.
IV	Trigonometry:- Angles, Degree measures, radian measures, Relation between radian and real number, Relation between degree and radian, trigonometric functions and identities, sign of trigonometric functions, sum and Difference of two angles of trigonometric functions.
V	Coordinate Geometry: The number plane, distance formula, area of a triangle, section formula, slope of a line, equation of a straight line: introduction, point form, slope form, two point form, intercept form, normal form, distance of a point from a line, distance between two parallel lines, angle between two lines.

Suggested readings

- Matrices and Determinants; Kapoor & Gupta
- NCERT mathematics book

Unit	BCA115: Communicative skills
I	Comprehension: Comprehension includes understanding the language by reading and writing. Passages will be given to read and question will be asked to evaluate the level of comprehension.
II	Text: Remedial Course in English Book II Short questions based on the passage from the text will be given.
III	Functional Grammar: Grammar will be taught in a functional, integrated and informal way, laying stress more on the usage rather than defining them Modal verbs (Can, could, may, might, shall / will, should, must would, ought to, need and dare) Tenses : Simple Present, Progressive, Present Perfect and perfect continuous, Simple past, progressive, past perfect and perfect continuous. Indication of Futurity, future continuous and future perfect. Active and Passive Voice (Simple present & Past, Present & Past perfect and to infinitive structure) Antonyms, synonyms, prefix and suffix
IV	Writing Skills Letter Writing :- (Formal and Informal), Various types of business and social letters and Applications Report Writing:- (Newspaper Report and Factual Reports)
V	Paragraph Writing (Descriptive and Factual) Précis Writing

BCA121: C LANGUAGE LAB
Practical Exercises
Exercises based on data types, constants and variables, arithmetic operators, library functions, expressions, input/output statements, compound statements and blocks, relational, logical, bit wise, unary operators, Control statements, arrays - one-dimensional and multidimensional arrays, structures, Pointers – declaration, increment and decrement operation, pointer to array, array of pointers, pointers to structures, Functions - call by value, call by reference, calling functions with arrays, recursion, strings, file input/output statements, creating, reading, writing and modifying files

BCA122: COMMUNICATIVE ENGLISH LAB
Practical Exercises
Essentials of Grammar, Conversational Skills

BCA123: WEB DESIGN LAB	
SNo	Practical Exercises
1	Demonstrate the character formatting Tags like , <I>, <U>, <STRIKE>, <SUB>, <SUP> and <KBD>
2	Create a page with a link at the top of it that when clicked will jump all the way to the bottom of the page. At the bottom of the page there should be a link to jump back to the top of the page.
3	Design a Web page which show's Special Character like (© , ® , > , @ etc) with the help of ASCII Codes.(Start from 34 to 132).
4	Demonstrate how to make a navigation frame. This navigation frame contains a list of links with the second frame as the target.

BCA - II Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA211	Mathematics II	3	3 hrs	20	80	100
BCA212	Data Structure	3	3 hrs	20	80	100
BCA213	Object oriented programming with C++	3	3 hrs	20	80	100
BCA214	Communicative English	3	3 hrs	20	80	100
BCA215	Principles of Management	3	3 hrs	20	80	100
BCA231	Environmental Science	3	3 hrs	20	80	100
BCA221	C++ Lab	4	3 hrs	20	80	100
BCA222	Communicative English Lab	4	3 hrs	20	80	100
BCA223	Data Structure Lab	4	3 hrs	20	80	100
	TOTAL					800

Unit	BCA211: Mathematics II
I	Limits:-Definition of limit of a Function, Right hand limit(RHL), Left hand limit(LHL), evaluation of limits of a function by method of factors, method of substitution. Continuity:- Definition of continuity, continuity of function at a point Differentiability: differentiability of function at a point.
II	Standard formulae of derivatives, differentiation of product and quotient of two functions, Differentiation of a function of a function, logarithmic differentiation, differentiation of implicit and parametric functions.
III	Maclaurins theorem, expansion of some standard functions i.e. e^x , $\sin x$, $\cos x$ etc., Taylor's theorem and simple problems, Maxima and minima of functions of one variables and simple problems based on it.
IV	Integrations : Integration by standard formula, Integration by substitution, integration by parts.
V	Definite integral : Evaluation of definite integrals, properties of definite integrals and simple problems based on it.

Suggested Readings

- NCERT Mathematics book

Unit	BCA212: Data Structure
I	Elementary data structure: Data types, Arrays and their representation, records and record structures. Linked lists: Representation of linked list in memory, insertion, deletion and searching of linked list, circular linked list, doubly linked list,
II	Stacks: Definition, array and linked implementation, operations on stack, application of stack, arithmetic expressions and recursion, prefix and postfix notations, evaluation of polish notation using stack. Queues: Queue data structure, implementation, operation on queues, operations on circular queue, priority queues.
III	Trees: Concept and terminology, Binary trees, linear and linked representation of binary trees, binary search tree, insertion and deletion operations on a binary search tree, Tree traversal techniques- In order, Preorder, Post order traversal and their recursive algorithms.
IV	Graphs and their representations, adjacency matrix, path matrix, graph traversal, breadth first search and depth first search algorithms.
V	Sorting and Searching: Sequential, Binary Search, Internal and external sorting techniques, Bubble sort, Insertion sort, Selection sort, Merge sort and quick sort algorithms.

Suggested Readings

- Schaum's outline Data structure.
- E.Horowitz and S.Sahani, " Fundamentals of Data structures", Galgotia Book source Pvt. Ltd., 2003
- R.S.Salaria, " Data Structures & Algorithms" , Khanna Book Pblishing Co. (P) Ltd.,2002

Unit	BCA213: Object Oriented Programming with C++
I	Principles of Object-Oriented Programming - Basic concepts of Object-Oriented programming, Benefits of OOPS(Object-Oriented Language), Structure of C++ program, Tokens, Keywords, Identifiers, constants, Basic data types, user-defined data types, derived data type. Declaration of Variables, Reference variable, various types of operators in C++, Scope resolution operator, type cast operator. Implicit conversion, operator precedence, control structure: If, If-else, Loops: for, while and do-while. Functions in C++:- Function prototype, call by reference, call by value, default arguments, const argument.
II	Classes and Objects:- Specifying a class, Defining member function, C++ program with class, Making an outside function inline, Nesting of member functions, access modifier, memory allocation for object, static data member, static member function. Array of objects, objects as function argument, Friend function, Friend class, returning objects.
III	Polymorphism: Types of polymorphism, Virtual functions, Function overloading, Operator Overloading:- Concepts, overloading unary operators, overloading binary operators, overloading binary operators using friend, Manipulation of string using operator, rules for overloading operators , type conversion.
IV	Constructors:- Constructors, parameterize constructor, Multiple constructor in a class, constructors with default argument, Dynamic initialization of object, copy constructor, dynamic constructor, constructing two dimensional array, const object, Destructors and its concepts.
V	Inheritance: - Concepts of inheritance, defining derived classes, types of inheritance: Single inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Multipath inheritance. Virtual base classes, Abstract classes, Constructor in derived classes, Member classes: Nesting of classes, Template: Concepts and introduction to friend and function templates.

Suggested Readings

- Object- Oriented Programming with C++ by E Balagurusamy, Tata McGraw hill

Unit	BCA214: Communicative English
I	Unseen Passage for analysis (Question answers, vocabulary, one word, sentence formation, synonyms and Antonyms)
II	Subject verb concord : (Rules regarding the concord will be discussed and Exercises will be given) Reported Speech : (Declarative sentences, Imperatives, Interrogatives – wh- questions yes / no questions, exclamation sentences) Non Finite verbs : (Gerunds, infinitives and participles)
III	Idioms, Common Errors (Involving the use of Articles, Prepositions and Tenses) One word substitution.
IV	Writing skills: Formal Letters Various types of Business letters related to Job Application and Resume Writing Report writing, Project Report
V	Essay writing and short composition.

Unit	BCA215: Principles of Management
I	Introduction to Management- Meaning & Definition, Nature, Scope and Functions of Management, Roles and Responsibilities of a Manager, System and Contingency Approach for understanding organizations,

II	Planning – Concept, Nature, Importance, Advantages & Limitations, Essentials of Planning, Types of planning. Objectives- Definition, Characteristics, Essentials of Objectives, Management by Objectives (MBO).
III	Fundamentals of Organizing- Meaning and definition -Nature and purpose, Types of Organizations: line, staff and matrix. Delegation of Authority- Centralization & Decentralization, Span of Management.
IV	Decision Making- Concept, Process, Types, Direction & Co-ordination- definition and Meaning - Importance, Management by Exception.
V	Controlling: Concept and Process, Control Techniques, Control as a Feedback System and Feed Forward Control. Span of control.

Suggested Readings

- Management & Organization- Louis A. Allen, McGraw Hill, publications
- Management: A Global Perspective, Koontz & Weirich, McGraw Hill publications
- Management- Koontz & O' Donnel, Tata McGraw Hill publications

Unit	BCA231: Environmental Science
I	The multidisciplinary Nature of Environment Studies – Definition, Scope & Importance, Need for public awareness, Natural Resources & Its conservation – Energy resources – Growing energy needs renewable & Nonrenewable energy Resources, Use of alternative energy resources – solar and wind energy, Forest Resources – Use & over-exploitation, deforestation & their effects on forest & tribal people, Land resources – Land as resource, land degradation, soil Erosion & Desertification.
II	Natural resources and its conservation- Water resources : Use and over utilization of surface and ground water, Floods, Drought, Conflicts over water, Mineral resources : Use and exploitation, Effect of extracting and using mineral resources on environment, Food resources: World food problem, Strategies of modern agriculture to increase food production, Effect of fertilizers and chemical pesticides on food.
III	Concept of an ecosystem, Structure of an ecosystem, Energy flow in the ecosystem, Food chains, food web and ecological pyramid, Brief idea about terrestrial ecosystem and aquatic ecosystem
IV	Biodiversity & Its conservation - Introduction – Definition : genetic, species & ecosystem, Diversity - Value of Biodiversity, Biodiversity at global, national & local levels, Threats to Biodiversity - habitat loss, poaching of wildlife, Important Endangered species of India
V	Environmental pollution –Causes, effect and control measures: Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management, Socio-Legal Issues related to Environment Protection, Role of NGO's and individual in prevention of pollution, Environmental protection Act

BCA221: C++ LAB
Practical Exercises
Exercises based on Class, Namespace, Function, Operator Overloading, Binary Operator Overloading, Constructor, Copy Constructor, Exception Handling Divide by zero, Multiple Catch, Friend Function, Function Overloading, Function Template, Inline Function, Multiple Inheritance, File Operation – read, write, Inheritance, Static Data and Member Function, Unary Operator Overloading, Virtual Base Class, Virtual Functions

BCA222: OFFICE AUTOMATION LAB
Practical Exercises
Exercises based on Creating and Formatting a simple document (using bulleted and Numbered list, adding Headers, Footers and Page numbers, Tables (create tables, editing tables, formatting tables, converting), Mail Merge.
Exercises based on Formatting the worksheets(Formatting the cell, rows and columns), Working with functions and formulae, Presenting Data with Charts
Exercises based on Presentation using Text, animation, images, media, Creating a graph in a PowerPoint slides, Creating self running presentations

BCA223:DATA STRUCTURE LAB
Practical Exercises
Exercises based on Linear array and Multidimensional array, Linked list: insertion, deletion ,searching a item, Stack implementation using Array, Stack implementation using Linked lists, Queue implementation, Tree traversal, Searching : Linear, Binary, Sorting: Bubble, Insertion, Selection

BCA - III Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA311	Java Programming	3	3 hrs	20	80	100

BCA312	Computer Networks	3	3 hrs	20	80	100
BCA313	Database System	3	3 hrs	20	80	100
BCA314	E-commerce and Cyber Law	3	3 hrs	20	80	100
BCA315	Digital Electronics	3	3 hrs	20	80	100
BCA321	Java Programming Lab	4	3 hrs	20	80	100
BCA322	Database Lab	4	3 hrs	20	80	100
BCA323	Digital Electronics Lab	4	3 hrs	20	80	100
	TOTAL					800

Unit	BCA311: JAVA Programming
I	Object Oriented Concepts in Java, Comparison of Java and C++, Java features like security, portability, byte code, java virtual machine, object oriented, robust, multithreading, architectural neutral, distributed and dynamic. Java Source File Structure, Compilation, Execution
II	Class Fundamentals, Object & Object reference, Creating and Operating Objects, Use of Tokens, Identifiers, Keywords, Literals, Comments, Primitive Data Types, Operators-precedence and associativity, Type conversion, Command line argument, accepting input from keyboard, decision making – if, if..Else, switch; loops – for, while, do...while; special statements–return, break, continue.
III	Array – single and two dimension array. Object Life time & Garbage Collection, Access Modifiers, Constructors , Object Life time & Garbage Collection, Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion, Finalize() Method, Use of this keyword
IV	Inheritance – Advantages of Inheritance in OOP, types of Inheritance, constructors in inheritance, use of super keyword, polymorphism; Interfaces - defining an interface, implementing and applying interfaces, using variables in interfaces, extending interfaces; Method overriding – use, need, advantage. Use of super, final and static keyword
V	Package - Organizing Classes and Interfaces in Packages, Package as Access Protection, defining Package, CLASSPATH Setting for Packages and Naming Convention for packages. Applets, Applet security restrictions, the class hierarchy for applets, Life cycle of applet, HTML Tags for applet. Difference between application and applet. Exception Handling: try..catch..throw..throws...finally, Throwing your known exception

Suggested Readings

- Programming with Java IV Edition – E Balagurusamy IV Edition

Unit	BCA312: Computer Networks
I	Principles of Data Communication: Evolution of computer networks, General features and tasks of a communication system, Fundamentals of signals, carrier waves, modes of transfer : simplex , half duplex ,full duplex, types of networks : LAN, WAN, MAN, SAN, PAN, CAN, VPN, EPN. Introduction to serial communication.
II	Networking Architecture : ISO-OSI, IBM SNA architecture –their functions of each layer and implementation. Concepts of circuit switching, packet switching and message switching. Fundamentals of datagrams. Flow and Error Control – Stop and Wait, Sliding Window, Automatic Repeat Request
III	Data communication concepts: Connecting devices, hub, switch, bridge, routers and gateways, Signal encoding and decoding techniques - Amplitude Modulation, Frequency Modulation, Phase Modulation, signal bandwidth requirements, signal formats used in LAN, Network Protocols: LAN cabling standards : IEEE LAN standards.
IV	Error detection and correction codes: Parity bit, Checksum, Hamming codes, CRC, single error detection and correction. Introduction to Network security Model, concepts of key, Ceaser cipher, transposition cipher, DES.
V	Transmission media - twisted pair, coaxial cable, optical-fibre. LAN topologies: STAR, BUS and RING network, LAN access techniques: ALOHA, CSMA, token ring and token bus. Issues related with network reliability and fault redundant network systems.

Suggested Readings

- Stalling, Data & Computer Communication
- Tanenbaum, Computer Network, Pearson.Ed., Pearson
- Kurose, Computer Networking, Pearson
- Peterson, Davie; Computer Networks, Elsevier

Unit	BCA313: Database System
I	Introduction to Database: Need for DBMS, advantages of DBMS, views of data, instances and schema data independence, database administrator, database manager, database languages, overall structure of DBMS.
II	Entity Relationship Model: Entities, attributes, relationship, constraints, keys, E-R diagram. Concept of strong and weak entity sets, generalization and specialization and aggregation.
III	Relational Model: Structure of Relational Databases, Relational Databases, Modification of the Databases, Tuple Relational Calculus, Domain Relational Calculus.

IV	SQL – Basic structure – Clauses, data types, creating tables. Modification of the database – deletion, insertion, updates. Retrieving data from tables, ordering, set operations – union, intersect, except, concept of NULL values, nested subqueries – set membership, set comparison, exist and not exist operator, unique, not unique construct.
V	Joins, equi-joins, non-equi-joins, self joins, outer joins. Aggregate functions – group by and having clause. Math functions, string functions, group by clause. Indexes, views, granting and revoking permissions.

Suggested Readings

- Database Concepts, Korth, Silbertz, Sudarshan, McGraw Hill
- Fundamentals of Database Systems, Elmasri, Navathe, Addison Wesley

Unit	BCA314: E-Commerce and Cyber Law
I	Electronic Commerce, Scope of the Internet and Web, Using the web to reach the customer, Benefits of E-Commerce markets, Type of E-Commerce Technology, Types of E-Business Models and Markets, Types of E-Commerce Providers and Vendors
II	E-Commerce Website Creation, Managing E-Commerce Website Development- Website Server, Developing Commerce Site, Requirement for Site, Building the Site, Implementation of Site, Building Shopping Cart Application, Mobile E-Commerce, Enhancing a Web Server with E-Commerce Application Development.
III	Implementing and Managing E-Commerce Site- Strategies, Techniques and Tools, Implementing merchandising strategies, E-Commerce Databases, Applying and Managing E-Business Intelligence Tools for application development, Types of Security Techniques, Building E-Commerce Trust Infrastructure.
IV	E-Payments Technology- Payment Technologies Issues, E-payment through Smart Cards, E-payment system, Digital Currencies, International E-Commerce Solutions- Auction resources, Smart Cards, Digital Wallets, Person to Person payments, Micropayment System (eCash), Token value and store based credits.
V	Introduction to IT and Cyber laws , Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property rights , Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, Cyber Crime Investigation and Cyber Security etc. , E-Mail Tracking, IP Tracking, E-Mail Recovery.

Suggested Readings:

- Electronic Commerce : Pete Ioshin, John Vacca.

Unit	BCA315: Digital Electronics
I	Number Systems and Codes: Number Systems: Decimal Number System, Binary Number System, Octal Number System, Hexa-Decimal Number System, Inter-conversion methods. Binary Arithmetic: addition and subtraction, Binary Codes: Weighted and Non-Weighted Codes, 8421 BCD Code, Excess-3 Code, Gray Code, ASCII and EBCDIC.
II	Boolean Algebra: Introduction to Logic. Logic Operations, AND, OR, NOT. Principle of Duality, AND Law, OR Law, Law of Negation, Commutative Law, Associative Law, Distributive Law, De-Morgan's Theorem. Digital Circuits: Introduction to Combinational and Sequential Circuits, Classification of Gates: Basic Gates, Universal Gates, And Exclusive Gates. Minterms and Maxterms, Sum of Products (SOP) and Products of Sum (POS). Reduction Techniques: Need of Reduction. Reduction by Boolean Algebra, Karnaugh Maps: 2,3,4 Variable.
III	Combinational Circuits: Arithmetic Circuits: Half-Adder, Half-Subtractor, Full Adder, Full Subtractor, Parallel Adder, 2's Complement Adder-Subtractor. Multiplexers, De-Multiplexers, Decoders, Encoders, Magnitude Comparator.
IV	Sequential Circuits: Flip-Flops: RS, D using NAND and NOR Gates, Introduction to Clock, & Timing Diagrams. Gated Flip-Flops (Latches). J-K Flip-Flop, T-Flip-Flop, J-K Master Slave Flip-Flop. Registers: Buffer register, shift register, SISO, SIPO, PISO, PIPO registers.
V	Sequential Circuits: Counters: Asynchronous and Synchronous; Ripple Up, Ripple Down Counters, Modulo Counters. Design of Synchronous Counters. Memories: Classification of memories, Volatile and Non-Volatile memories. Memory Technologies; Semiconductor, Magnetic and Optical Memories. RAM and ROM.

Suggested Readings:

- Fundamentals of Digital Circuits, Kumar Anand. A., PHI New Delhi
- Modern Digital Electronics, Jain R. P., Tata Mc Graw Hill , New Delhi
- Digital Design, Mano Morris, M. , PHI, New Delhi
- Digital Computer Fundamentals, Bartee Thomas, C., Mc Graw Hill.

BCA321: JAVA LAB
Practical Exercises
Exercises based on Input/output statements, loops, if, switch, array(1d-2d), constructors, Method Overloading, static and this and final keywords, String and its inbuilt functions, inbuilt mathematical functions, Method Overriding, Abstract Class, Runtime polymorphism, Exception Handling (User defined also), finally block, package, applet.
BCA322: DATABASE SYSTEM LAB
Practical Exercises
Exercises based on creating table, inserting data into tables, viewing data in the tables, sorting data in table, deleting tuples from table, updating the contents of a table, modifying the structure of table, applying primary key, foreign key and unique key constraints, computations on table data, oracle functions, grouping data from tables, subqueries, Joins
BCA323: DIGITAL ELECTRONICS LAB
Practical Exercises
Exercises based on Logic Gates:Verification of AND,OR,NOT,Universal Gates,Exclusive gates with 2 and more inputs, truth tables, NAND GATE as universal gate, Designing of logic circuits from equations. Boolean laws and postulates,demorgan's Theorem, Adder: Half adder, Full adder; Subtractor: Half , full subtractor; Encoder, Decoder, Multiplexer, Demultiplexer, 2-2 bit comparator, Sequential Circuits: RS latch,RS Flip flop,D latch,D flip Flop,J K Flip Flop, J K master slave flip flop with characteristic tables ad block, circuit diagrams;Registers:Buffer,Shift register, Counters: Asynchronous and Synchronous; Ripple Up, Ripple Down Counters, Modulo Counters.

BCA - IV Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA411	VB.NET	3	3 hrs	20	80	100
BCA412	Computer Oriented Numerical & Statistical Methods	3	3 hrs	20	80	100
BCA413	Operating System	3	3 hrs	20	80	100
BCA414	Computer Graphics	3	3 hrs	20	80	100
BCA415	Computer Architecture	3	3 hrs	20	80	100
BCA421	VB.NET Lab	4	3 hrs	20	80	100
BCA422	Computer Graphics Lab	4	3 hrs	20	80	100
BCA423	Computer Architecture Lab	4	3 hrs	20	80	100
	TOTAL					800

BCA411: VB.NET	
Unit	
I	DOT NET Framework, Overview and Base Class Library, MSIL, Common Language Run Time (CLR), Events, .NET Assemblies, Shared Assemblies, Advantages of Assemblies over Predecessors, Dynamic Link Library (DLL), Namespaces, Visual Studio IDE
II	Variables, Data types, Operators, Control Structures: if-then-else, Select Case, for-next, for Each....Next, Do loop, While...End While, Type Conversions, Functions, Subroutines, , Error Handling and Debugging
III	Array: One dimensional, two dimensional, variable size arrays, System. Array class, Array list class, Building Windows Application: button, checkbox, checkedlistbox, colordialog, combobox, datetimepicker, label, listbox, listview, picturebox, progressbar.
IV	Controls: Radiobutton, textbox, masked text box, rich text box, numeric up-down, treeview, tooltip, timer, Tab control, panel, group box, menu strip, status strip, tool strip, openfiledialog, savefiledialog, folderbrowserdialog.
V	Basic Idea of ADO.NET, OleDbConnection, OleDbCommand, OleDbDataReader, OleDbDataAdapter, Dataset, Datable, Datarow, Datacolumn. Using Data controls: Datagridview, binding source, binding navigator.

Suggested Readings

- The Visual Basic. NET Bible by Bill Evjen, Jason Beres and et al. ISBN: 0764548263
- ASP.NET Bible by mridulaParihar and et al. ISBN: 0764548166

Unit	BCA412: Computer Oriented Numerical and Statistical Method
I	Significant digits, floating point representation of numerals, arithmetic operations with normalized floating point number--addition, subtraction, multiplication and division, errors in numerical computation. Pitfalls in computing.

II	Initial approximation of roots, Descartes's rule of sign, Iterative Methods - Bisection, Regula-Falsi, Newton Raphson, method of successive approximations, Concepts of roots synthetic division, value and values of derivative of a polynomial by synthetic division.
III	Solution of ordinary differential equations - Taylor's method, Euler's method, RungeKutta second and fourth order method, Picard's method, modified Euler's method. Numerical Integration - Introduction, Trapezoidal rule, Simpson's 1/3 and 3/8 rule.
IV	Solution of simultaneous linear equation: Gauss elimination method, Pivoting, ill conditioned equations, Refinement of solution, Gauss Seidal iterative method. Curve fitting - Method of least squares, fitting of straight lines, polynomials, exponential curves.
V	The basic concepts: Variables and Attributes, Statistics, Population and sample, complete enumeration vs sample surveys, probability and purposive sampling, simple random sampling Frequency distributions: Frequency distributions, histograms, Frequency polygons, frequency curves, cumulative frequency, distributions, ogives, Measure of Central Tendency, Median, mode, arithmetic mean

Suggested Readings

- Computer Oriented Numerical Methods, R S Salaria, Khanna Publication
- Computer Oriented Numerical Methods, P Thangaraj, PHI Publication
- Computer Oriented Numerical Methods, V Rajaraman, Prentice Hall India
-

Unit	BCA413: Operating System
I	Introduction: Definition of Operating System, Types of operating systems: Batch Systems, Multi programming, Multiuser, Multitasking, Time-sharing, Spooling, Parallel, Distributed and Real-time systems, Operating System Concepts, Operating System Services, System calls.
II	Process Management: Process concept, Process States, Representation of process (PCB), Process Scheduling, CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Algorithm evaluation.
III	Memory Management: Contiguous, Non contiguous, Swapping, Fragmentation, Compaction, Paging, Segmentation, Virtual memory management, Demand paging, Page replacement and Virtual memory concepts, Introduction to Thrashing.
IV	The Deadlock problem, Characterization (Hold and wait, Circular Wait, No Pre-emption, No sharing of resources), Prevention, Avoidance: (RAG And Wait for Graph), Detection and Recovery from Deadlock: (Banking algorithm and detection algorithm), Concept of Fork and Join methods.
V	Process concurrency, Concept of concurrency, cooperating process, precedence graph, Critical section problem, Mutual exclusion, semaphores, classical process (Reader Writer problem, Consumer producer problem, Dining Philosopher problem), Inter Process Communication

Suggested Readings

- Operating System Concepts Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, John Wiley & Sons Inc.

Unit	BCA414: Computer Graphics
I	Introduction: fundamentals of Computer Graphics, point, dot, pixel, Resolution, Elements of graphics workstation. Video Display Devices-Raster Scan Systems Random Scan systems, aliasing problem and solution techniques, Input devices. Graphics Coordinate Representations, Concepts of video memory and frame buffer.
II	Algorithms: Line drawing algorithms- DDA Algorithm, Bresenham's Line Algorithm, Circle: Midpoint Circle Algorithm. Polygons, convex and convex polygons. Inside-Outside tests, Polygon fill algorithms: Boundary fill Algorithm, Flood fill Algorithm.
III	Graphics Primitives: Primitive Operations, The display file interpreter-Normalized Device Coordinates, Display- File structure. Display – file algorithm. Display control and Polygon representation. Attributes of output primitives: character generation, Line attributes - Line type. Line width, Pen and Brush options. Line Color. Color and gray scale levels. Color-tables. Gray scale. Area- Fill Attributes- Fill styles. Pattern fill. Soft fill. Character Attributes. Text attributes, curve attributes..
IV	Geometric Transformations: Matrices. Translation, Scaling, Rotation Transformations. Homogeneous Co-ordinates. Composite Transformation. Rotation and scaling about an arbitrary point. Other transformations: reflection and shearing. Inverse Transformations.
V	2-D Viewing- The viewing pipeline. Viewing co-ordinate, Reference Frame. Window to viewports co-ordinate transformation, 2-D Viewing functions. Clipping operations point clipping, Cohen- Sutherland Line Clipping algorithm, Sutherland Hodgmann polygon clipping algorithm.

Suggested Readings

- Computer Graphics Hearn & Baker
- Computer Graphics by Steven Herrington

Unit	BCA415: Computer Architecture
I	Register Transfer Language: Inter-register transfer; Parallel, Serial & Bus Transfer. Memory Transfer. Arithmetic, logic & shift micro-operations. Control Functions. Machine and Instruction cycles
II	I/O Architecture: I/O devices and their controllers: LED Display & Hex Keyboard. Peripheral Devices. I/O interface. Microprocessor Interface, Elementary concepts of Isolated IO and Memory mapped IO. Modes of Transfer: Asynchronous data transfer: strobe control, handshaking. DMA
III	CPU organization: Address, data & Control bus. Processor bus organization. ALU: Arithmetic and logic circuit. Stack organization. Instruction format and Addressing Modes.
IV	Microprogram control organization: control memory, Address sequencing: mapping of macro-operation, subroutines. Microprogram Example, microinstruction format. Microprogram sequencer.
V	Microprocessor system: Introduction to microcomputer system. Pins of 8085 microprocessor, Block diagram of 8085 microprocessor. Programming model of 8085. Assembly language structure of 8085.

Suggested Readings

- Computer System Architecture. Manno M. PHI
- Introduction to Microprocessors, Leventhal, L.A, Prentice Hall of India
- Introduction to Microprocessors, Mathur, A.P., Tata McGraw Hill

BCA421: VB.NET LAB
Practical Exercises
Exercises based on Events such as Click, Indexchangedetc, Controls like button, textbox, checkbox, etc, Control structures like for..next, while, do while etc, Arrays so as to accept the input and process the data

BCA422: COMPUTER GRAPHICS LAB
Practical Exercises
Exercises based on inbuilt graphic functions, line drawing algorithms, polygon fill algorithms, transformation(translation, scaling, rotation), simple animation

BCA423: COMPUTER ARCHITECTURE LAB
Practical Exercises
Exercises based on Data transfer group: Move, load, store, memory references, Arithmetic Group, Logical bit manipulation programs, Branch and subroutines, Stack and interrupts

BCA - V Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA511	ASP.NET	3	3 hrs	20	80	100
BCA512	Organization Behaviour	3	3 hrs	20	80	100
BCA513	LINUX Operating System	3	3 hrs	20	80	100
BCA514	Internet Programming	3	3 hrs	20	80	100
BCA515	System Analysis and Design	3	3 hrs	20	80	100
BCA521	ASP.NET Lab	4	3 hrs	20	80	100
BCA522	LINUX Lab	4	3 hrs	20	80	100
BCA523	Internet Programming Lab	4	3 hrs	20	80	100
	TOTAL					800

Unit	BCA511: ASP.NET
I	Anatomy of .NET, .NET Base Classes, Microsoft Intermediate Language, CLR, Client Server model, IIS Web Server, Namespaces, ASP.NET: How the ASP.NET works, Basics of ASP.NET, Creating and Deploying the ASP.NET applications, Concept of Code behind, Use of Web Applications using ASP.NET, Difference between Windows and Web Applications. ASP.NET directives.
II	ASP.NET: Web forms, Web Controls categories: server Controls and Web Controls: Label, TextBox, CheckBox and CheckBoxList, RadioButton and RadioButton List, ListBox and DropDownList, Table, Image, Hyperlink, HiddenField, FileUpload. RichWeb Controls: AdRotator, Calendar, TreeView, TabStrip. Concept of Master Page and Navigation Controls.

III	Validation Controls: Need of Validation Control, Various Controls like Require Field, Compare, Range, RegularExpression, Custom, Validation Summary, Dynamic controls. Debugging ASP.NET pages: Error Handling: Custom Error Page, Using Debugging Tools: Debugger and Trace Facility.
IV	ASP.NET Database Programming, Introducing ADO.NET, ADO .NET Object Models, Communicating with OLEDB Data Sources Using ADO.NET, Working with Datagrids. Data binding with different controls. Data Command, Data Reader objects.
V	Web Services: Concept of web services, Infrastructure for Web services. ASP.NET Security: IIS security: Authentication, Authorization and Impersonation using Session State.ASP.NET Application Configuration, Web.Config, Global.asax file.

Suggested Readings

- ASP.NET Bible

BCA512: Organization Behaviour	
Unit	
I	Introduction to O.B- meaning, definitions, nature and scope of O.B, objectives , importance of O.B, contributory disciplines to OB.
II	Foundation of individual behaviour - Personality-Meaning, types, Perception- definition, Meaning, Factor influencing Perception, common perceptual errors, Process, Attitudes.
III	Motivation –Meaning, Definitions, Importance, early theories of motivation, Group dynamics
IV	Leadership – Meaning and definition, characteristics, styles and Importance. Work stress, Counselling- types and importance.
V	Organizational Change- Meaning, types, Importance, Process, Resistance to change, Overcoming resistance to change.

Suggested Readings

- Management & Organization- Louis A. Allen, McGraw Hill, publications
- Management & Organization- C.B. Gupta, Sultan Chand Publications
- Management: A Global Perspective, Koontz & Weirich, McGraw Hill publications
- Management- Koontz & O' Donnel, Tata McGraw Hill publications
- Essentials of Management- Massie, Prentice Hall publications

BCA513: LINUX Operating System	
Unit	
I	Introduction to the Concept of Open Source Software, Linux Overview, History of Linux, Linux distributions, architecture, Linux file system (inode, Super block, Mounting and Unmounting) , Kernel , Introduction to Linux Processes and System calls .
II	Introduction to Shell, Various shells, shell customization, vi editor, Linux files and the file structure, listing, displaying and printing files, managing directories, File and Directory operations, Essential Linux commands, Internal and External commands, Archiving and compressing files.
III	I/O redirection and Piping, Simple filters commands – grep, head, tail, cut, paste, sort, uniq. Processes: background process, premature termination of process, process priorities, process scheduling, nohup command. Compiling C Programs in Linux Environment
IV	Shell programming: Interactive scripts. Shell variables, assigning values to variables, positional parameters, command line arguments, arithmetic in shell script, exit status of a command. sleep and wait, script termination, Taking decisions, Loop Control Structure, Shell Metacharacters, Shell Miscellany
V	File Ownerships and access permissions, changing permissions and ownerships, User and its Home directory, Booting and Shutting down, Boot Loaders, LILO, GRUB, Bootstrapping, init Process, System services, init and run levels

Suggested Readings

- Linux: The Complete Reference, Richard Petersen
- Design of the UNIX Operating System Maurice J. Bach, AT&T Bell Labs.
- Unix shell programming, Yashwant Kanetkar, BPB Publications.

BCA514: Internet Programming	
Unit	
I	JavaScript Implementation, JavaScript in HTML, Language Basics – Variables, operators, statements, functions, Data type conversions, reference types, Document object Model - browser object model - window object, location object, navigator object, screen object, history object, Events and Event handling, Button elements, Navigator object, validations with regular expressions. Introduction to Dynamic documents, Positioning elements, moving elements, elements visibility, changing colors and fonts, dynamic content, Locating mouse cursor, reacting to a mouse click, dragging and dropping of elements.

II	Introduction to Server side Programming, Introduction to PHP , PHP and HTML, essentials of PHP, Why Use PHP, Installation of Web Server, WAMP Configurations, Writing simple PHP program, embedding with HTML, comments in PHP, Variables, Naming Conventions, Strings, String Concatenation, String functions, float functions.
III	Arrays, Array – Key pair value, Array functions, is SET, UNSET, gettype(), settype(), control statements (if, switch), Loops, User Defined Functions (with argument, return values), global variable, default value, GET - POST method, URL encoding, HTML Encoding, Cookies, Sessions, Include statement. File: read and write from the file. Ethical use of features of PHP.
IV	PHP with MySQL, Creating Connection, Selecting Database, Perform Database (query), Use returned data, close connections, file handling in PHP – reading and writing from and to FILE. Using MySQL from PHP (Building a Guestbook). Self Learning: Introduction to MySQL, CRUD - Select statements, Creating Database/Tables, Inserting values, updating and Deleting.
V	Introduction to OOPS, creating classes, creating objects, setting access to properties and methods. Constructors, destructors, overloading and overriding of methods. Accessing PHP and HTTP Data. Reading POST and GET variables. Service Learning: - Teaching the Website design to school / College students - Creating a website for a School/ NGO/ College/ Department

Suggested Readings

- Web Standards Programmer's Reference: Steven M. Schafer

BCA515: System Design and Analysis	
Unit	
I	System Concept: Definition, Characteristics of a System: Organization, Interaction, Interdependence, Integration, Central Objective. Elements of a System: Outputs and Inputs, Processor(S), Control, Feedback, Environment, Boundaries and Interfaces. Types of Systems: Physical or Abstract Systems, Open and Close Systems, Man-Made Information Systems.
II	System Development Life Cycle, Considerations for Candidate System: Technical Factors, Behavioral Factors, Political Considerations, Economic Factors. Planning and Control for System Success, Prototyping, Role of System Analyst.
III	Information Gathering: Various Methods, Tools of Structured Analysis: Data-flow Diagram, Decision Tree, Structured English, Decision Tables, Data Dictionary, Feasibility Study.
IV	System Design: Definition, Types of System Design: Logical and Physical Design. Design Methodologies: Structured Design, Form-Driven Methodology-IPO Charts, Structured Walkthrough. File Organization: Sequential Organization Indexed Sequential Organization, Inverted List Organization. Logical and Physical views of Data. Input Output form Design.
V	System Implementation: Need of Testing, Test Plan, Quality Assurance, Trends in Testing, Audit Trails, Post Implementation Review. Security and Recovery in System Development: System Security, Threats to System Security, Control Measures, Disaster/Recovery Plannings: Ethics in System Development.

Suggested Readings

- System Analysis and Design, Elias M Awad

BCA521: ASP.NET LAB	
Practical Exercises	
Exercises based on Serverside web form controls: label, textbox, button, radiobutton, checkbox, dropdownlist, listbox with their events, Client side validation controls: required filed, range, compare, regular expression, custom , validation summary, Database handling with MS-Access. Insert, update, delete and select operation, Login and logout implementation using session	

BCA522: LINUX LAB	
SNo	Practical Exercises
1	Assignment based on installation of Linux Operating System.
2	Assignment based on vi editor, Linux files and the file structure, listing, displaying and printing files, managing directories, File and Directory operations, Essential Linux commands, Internal and External commands, Archiving and compressing files.
3	Assignment based on Compiling and Executing C Programs in Linux Environment.
4	Assignment based on Shell programming, shell variables, assigning values to variables, positional parameters, command line arguments, arithmetic in shell script, exit status of a command, sleep and wait, script termination, Taking decisions, Loop Control Structure, Shell Metacharacters.
5	Assignment based on File Ownerships and access permissions, changing permissions and ownerships, User and its Home directory, Booting and Shutting down, Boot Loaders, LILO, GRUB, Bootstrapping, init Process, System services, init and run levels.

BCA523: INTERNET PROGRAMMING

Practical Exercises

Exercises based on each html control like Text, Password, Checkbox, Radio, Combobox, Listbox, Textarea, Button, Submit and Reset, Exercises of JavaScript with functions, control statements in JavaScript, Implicit Objects in Java Script, different event handling of controls, CSS formatting and positioning, introductory server side PHP Script.

BCA - VI Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BCA611	Software Engineering	3	3 hrs	20	80	100
BCA612	Information System Management	3	3 hrs	20	80	100
BCA621	Colloquium Lab	4	3 hrs	20	80	100
BCA622	Major Project	4	3 hrs	40	160	200
	TOTAL					500

Unit	BCA611: Software Engineering
I	Introduction, Software Engineering, Software Process, Characteristics of Software Process, Development Process Models- waterfall, prototyping, iterative, spiral. Project Management Process, Inspection Process, Software Configuration Management process, Requirement Change Management process.
II	Software Requirement Specification (SRS)- Problem analysis, structuring information, Data flow diagram, entity relationship diagram and data dictionary, structured analysis, Characteristics and component of (SRS).
III	Planning a Software Project- Cost estimation, Single variable model, COCOMO model, software size estimation, Project scheduling and milestones, Verification & Validation. Software Architecture, Role views, Function oriented design – Top down and Bottom up strategies. Coupling, Cohesion. Concept of Object Oriented Analysis and Design
IV	Coding- Standard guideline for coding, Structured Programming, Object oriented programming, Information Hiding, Programming style, Internal Documentation. Testing- Level of testing, Unit testing, Black box & White box testing, Functional Testing, Structural Testing. Testing Process – level of testing, test plan, test case, defect logging and tracking.
V	Software Maintenance: Maintenance as part of software evaluation, reasons for maintenance, types of maintenance (Perceptive, adoptive, corrective), designing for maintainability, techniques for maintenance, case tools, Configuration Management.

Suggested Readings

- I.Sommerville, "Software Engineering", Addison Wesley,

BCA612: Information System Management

Unit	BCA612: Information System Management
I	Overview of a Management Information System. Computers and information processor, Data, Information Systems, Information Resource Management and Decision Making, MIS structure, Structure base on management activity and organizational functions.
II	Various phases in the decision making process. Behavioral model of Decision Making and organization decision making. Decision under Psychological Stress.
III	Documentation and communication decision rules. Relevance of decision making. Age of information and application of information. Type of systems. Preventing systems entropy. System stress and system change.
IV	Concepts of organizational planning, Computational support for planning. Nature of control in organization. Information system support for control. The basic model of organizational structure. Information processing model of organization structure.
V	Introduction to Decision support system (DSS) - Structure of Decision Making, Users Introduction to Expert system (ES) – Support in Decision making process, Approaches to development of DSS, Management of Knowledge – Types of Knowledge work.

Suggested Readings

- Management Information System Gordon B.Davis, Margrethe H. Olson, Tata McGraw-Hill Publishing

BCA621: Colloquium Lab

Group discussion on various topics, To provide us with an avenue to train ourselves in various interpersonal skills.

BCA622: Major Project

Software project shall be developed by the students. There shall be 3 – 4 students in one project group who will work together as a team. In extreme cases it may be 5 students with prior permission. They will work under the supervision of one of the faculty of the department. The tools which can be used to develop the project shall only be the ones which they have studied in their course.

SYLLABUS, TEACHING & EXAMINATION SCHEME
For BSc WEF FROM SESSION 2019-20

BSc - I Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS111	Computer Oriented Numerical Methods and Programming	3	3 hrs	20	80	100
BSCS112	Computer Organization	3	3 hrs	20	80	100
BSCS121	C Language Lab	4	3 hrs	20	80	100
BSc - II Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS211	Programming in C++	3	3 hrs	20	80	100
BSCS212	Data Structure	3	3 hrs	20	80	100
BSCS221	C++ and Data Structure Lab	4	3 hrs	20	80	100
BSc - III Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS311	Web Design	3	3 hrs	20	80	100
BSCS312	Operating System	3	3 hrs	20	80	100
BSCS321	Web Design Lab	4	3 hrs	20	80	100
BSc - IV Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS411	Database Management System	3	3 hrs	20	80	100
BSCS412	Computer Graphics	3	3 hrs	20	80	100
BSCS421	DBMS Lab	4	3 hrs	20	80	100
BSc - V Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS511	Java Programming	3	3 hrs	20	80	100
BSCS512	Computer networks	3	3 hrs	20	80	100
BSCS521	Java Lab	4	3 hrs	20	80	100
BSc - VI Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS611	ASP.NET	3	3 hrs	20	80	100
BSCS612	E-commerce and Cyber Law	3	3 hrs	20	80	100
BSCS621	ASP.NET Lab	4	3 hrs	20	80	100

BSc - I Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS111	Computer Oriented Numerical Methods and Programming	3	3 hrs	20	80	100
BSCS112	Computer organization	3	3 hrs	20	80	100
BSCS121	C Language Lab	4	3 hrs	20	80	100

Unit	BSCS111: Computer Oriented Numerical Methods and Programming
I	Structure of C Programme, Identifiers and keywords, Data types, Constants and variables, scope of variables, Local and Global variables, Type conversion, Arithmetic operators, Library functions, Expressions, Input/Output statements, Get char and putchar, scanf, printf, compound statements and blocks.
II	Transfer of control: Relational operators, Logical operators, Bit wise operators, Unary operators, Hierarchy of Operations, If-else statement, switch statement, Goto statements and labels, while, Do-while and for statements, Nested loops, Break statement.
III	Array and Structures: Declaration, one-dimensional and multidimensional Arrays, Pointers, Pointer declaration, operations on pointers, Functions: Defining and accessing a function, Arguments of a function, Passing arguments and array to a function, Recursion. Structures: Defining a structure, Structure variables, unions, Difference between structure and Unions, Processing a Structure.
IV	Measure of Central Tendency: Median, mode, arithmetic mean, geometric mean, harmonic mean, partition values: quartiles, deciles and percentiles. Concepts of Roots: Synthetic division, value and values of derivative of a polynomial by synthetic division, Solution of simultaneous linear equation: Gauss elimination method, Gauss Seidal iterative method, Pivoting.
V	Iterative methods: Bisection method, false position, Newton Raphson, method Ordinary differential equations: Euler's methods. Runge-Kutta methods, Predicor- Corrector method-modified Euler's method

Suggested Readings

- Let Us C, Yashwant P. Kanetkar, BPB Publications.
- Programming in ANSI C, Balaguruswamy, Mc Graw Hill
- Computer Oriented Numerical Methods, R S Salaria, Khanna Publication.
- Computer Oriented Numerical Methods, P Thangaraj, PHI Publication.
- Computer Oriented Numerical Methods, V Rajaraman, Prentice Hall India.

Unit	BSCS112: Computer Organization
I	Number Systems and Codes: Number Systems: Decimal Number System, Binary Number System, Octal Number System, Hexa-Decimal Number System, Inter-conversion methods. Binary Arithmetic: addition and subtraction, Binary Codes: Weighted and Non-Weighted Codes, 8421 BCD Code, Excess-3 Code, Gray Code, ASCII and EBCDIC.
II	Boolean Algebra: Introduction to Logic. Logic Operations, AND, OR, NOT. Principle of Duality, AND Law, OR Law, Law of Negation, Commutative Law, Associative Law, Distributive Law, De-Morgan's Theorem. Digital Circuits: Introduction to Combinational and Sequential Circuits, Classification of Gates: Basic Gates, Universal Gates, And Exclusive Gates. Minterms and Maxterms, Sum of Products (SOP) and Products of Sum (POS). Reduction Techniques: Need of Reduction. Reduction by Boolean Algebra, Karnaugh Maps: 2,3,4 Variable.
III	Combinational Circuits: Arithmetic Circuits: Half-Adder, Half-Subtractor, Full Adder, Full Subtractor, Parallel Adder, 2's Compliment Adder-Subtractor. Multiplexers, De-Multiplexers, Decoders, Encoders, Magnitude Comparator.
IV	Sequential Circuits: Flip-Flops: RS, D using NAND and NOR Gates, Introduction to Clock, & Timing Diagrams. Gated Flip-Flops (Latches). J-K Flip-Flop, T-Flip-Flop, J-K Master Slave Flip-Flop. Registers: Buffer register, shift register, SISO, SIPO, PISO, PIPO registers.
V	Sequential Circuits: Counters: Asynchronous and Synchronous; Ripple Up, Ripple Down Counters, Modulo Counters. Design of Synchronous Counters. Memories: Classification of memories, Volatile and Non-Volatile memories. Memory Technologies; Semiconductor, Magnetic and Optical Memories. RAM and ROM.

Suggested Readings

- Fundamentals of Digital Circuits, Kumar Anand. A., PHI New Delhi
- Modern Digital Electronics, Jain R. P., Tata Mc Graw Hill, New Delhi
- Digital Design, Mano Morris, M., PHI, New Delhi
- Digital Computer Fundamentals, Bartee Thomas, C., Mc Graw Hill.

BSCS121:C LANGUAGE LAB

Practical Exercises

Exercises based on Data types, Input / output statement, if statement, for loop, while loop, Nested Loops , Switch case Statement, Break statement, recursion, one dimensional, two dimensional arrays, structure, call by value function calling mechanism, call by address function calling mechanism.

BSc - II Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS211	Programming in C++	3	3 hrs	20	80	100
BSCS212	Data Structure	3	3 hrs	20	80	100
BSCS221	C++ and Data Structure Lab	4	3 hrs	20	80	100

Unit	BSCS211: Programming in C++
I	Principles of Object-Oriented Programming - Basic concepts of Object-Oriented programming, Benefits of OOPS(Object-Oriented Language), Structure of C++ program, Tokens, Keywords, Identifiers, constants, Basic data types, user-defined data types, derived data type. Declaration of Variables, Reference variable, various types of operators in C++, Scope resolution operator, type cast operator. Implicit conversion, operator precedence, control structure: If, If-else, Loops: for, while and do-while. Functions in C++:- Function prototype, call by reference, call by value, default arguments, const argument.
II	Classes and Objects:- Specifying a class, Defining member function, C++ program with class, Making an outside function inline, Nesting of member functions, access modifier, memory allocation for object, static data member, static member function. Array of objects, objects as function argument, Friend function, Friend class, returning objects.
III	Polymorphism: Types of polymorphism, Virtual functions, Function overloading, Operator Overloading:- Concepts, overloading unary operators, overloading binary operators, overloading binary operators using friend, Manipulation of string using operator, rules for overloading operators , type conversion.
IV	Constructors:- Constructors, parameterize constructor, Multiple constructor in a class, constructors with default argument, Dynamic initialization of object, copy constructor, dynamic constructor, constructing two dimensional array, const object, Destructors and its concepts.
V	Inheritance: - Concepts of inheritance, defining derived classes, types of inheritance: Single inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Multipath inheritance. Virtual base classes, Abstract classes, Constructor in derived classes, Member classes: Nesting of classes, Template: Concepts and introduction to friend and function templates.

Unit	BSCS211: Programming in C++
I	Principles of Object -Oriented Programming:-Object-Oriented Programming Paradigm, Basic concepts of Object-Oriented programming, Benefits of OOPS, Object-Oriented Language, Application of OOPS, Application of C++, Simple C++ Program, Structure of C++ program, Creating Source file. Compiling and linking, Tokens, Keywords, Identifiers, constants, Basic data types, User-defined data types, derived data type, Symbolic constants, Type compatibility, Declaration of Variables, Dynamic initialization of variable, Reference variable, Operator in C++, Scope resolution operator, Member dereferencing operator, Memory management operator, manipulator, Type cast operator.
II	Expressions and their type, Special assignment expression, implicit conversion, operator overloading, Operator precedence, control structure Function in C++:- Function prototype, call by reference, Return by reference, Inline function, Default arguments, const Argument, Function overloading, Classes and Object:- Specifying a class, Defining member function, C++ program with class, Making an outside function inline, Nesting of member functions, access modifier, array with in class, memory allocation for object, static data member, static member function, Array of objects, Objects as function argument, Friend function, Friend class, Returning objects, const member function, pointer to member.
III	Constructors:- Constructors, parameterize constructor, Multiple constructor in a class, constructors with default argument, Dynamic initialization of object, copy constructor, dynamic constructor, constructing two dimensional array, const object, Destructors, Operator Overloading:- Operator overloading, overloading unary operators, overloading binary operators, overloading binary operators using friend, Manipulation of string using operator, Rules for overloading operators , type conversion.
IV	Inheritance: - Defining derived classes, Single inheritance, Private member inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes, Constructor in derived classes, Member classes: Nesting of classes, Template, generic function, generic classes.
V	Working with file:- Classes for file stream operations, opening and closing a file, Detecting End-of file, Open(): file mode, File pointer and their manipulation, Sequential input and output operation.

Suggested Readings

- Object- Oriented Programming with C++ by E Balagurusamy, Tata Mcgraw hill

Unit	BSCS212: Data Structure
I	Elementary data structure: Data types, Arrays and their representation, records and record structures. Linked lists: Representation of linked list in memory, insertion, deletion and searching of linked list, circular linked list, doubly linked list.
II	Stacks: Definition, array and linked implementation, operations on stack, application of stack, arithmetic expressions and recursion, prefix and postfix notations, evaluation of polish notation using stack. Queues: Queue data structure, implementation, operation on queues, operations on circular queue, priority queues.
III	Trees: Concept and terminology, Binary trees, linear and linked representation of binary trees, binary search tree, insertion and deletion operations on a binary search tree, Tree traversal techniques- In order, Preorder, Post order traversal and their recursive algorithms.
IV	Graphs and their representations, adjacency matrix, path matrix, graph traversal, breadth first search and depth first search algorithms.
V	Sorting and Searching: Sequential, Binary Search, Internal and external sorting techniques, Bubble sort, Insertion sort, Selection sort, Merge sort and quick sort algorithms.

Suggested Readings

- Schaum's outline of Data Structure.

BSCS221: C++ and Data Structure Lab	
Practical Exercises	
Exercises based on Concept of Class, Data Member, Member Function, Constructor, Implicit Pointer, New Operator, Friend Function & Friend Class, Inheritance, Function Overloading, Operator Overloading, Polymorphism Using Virtual Class, File Handling	
Exercises based on Linear array and Multidimensional array, Linked list: insertion, deletion ,searching a item, Stack implementation using Array, Stack implementation using Linked list, Queue implementation, Tree traversal : pre order, In order, Post order, Searching : Linear , Binary, Sorting: Bubble, Insertion, Selection	

BSc - III Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS311	Web Design	3	3 hrs	20	80	100
BSCS312	Operating System	3	3 hrs	20	80	100
BSCS321	Web Design Lab	4	3 hrs	20	80	100

Unit	BSCS311: Web Design
I	Creating Forms, The <FORM> tag, Named Input fields, Multiple, lines text windows, Drop down and list boxes, Hidden, Text, Text Area, Password, File Upload, Button, Submit, Reset, Radio, Checkbox, Select, Option, Forms and Scripting, Action Buttons, Grouping related fields, Disabled and read-only fields, Form field event handlers, Passing form data.
II	Java Script: Introduction, Client-Side JavaScript, JavaScript Objects. Operators: Assignment Operators, Comparison Operators, Arithmetic Operators, % (Modulus), ++(Increment), -- (Decrement), -(Unary Negation), Logical Operators, Short-Circuit Evaluation, String Operators, Special Operators, ? (Conditional operator), (Comma operator), delete, new, this, void. Statements: Break, comment, continue, delete, do ... while, export, for, for...in, function, if...else, import, labelled, return, switch, var, while.
III	Properties and Methods of Each: Array, Boolean, Date, Function, Math, Number, Object, String, regExp Document and its associated objects : document, Link, Area, Anchor, Image, Applet, Layer Events and Event Handlers : General Information about Events, Defining Event, Handlers, event, onAbort, onBlur, onClick, onDbClick, onDragDrop, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onMove, onReset, onResize, onSelect, onSubmit, onUnload.
IV	VB script: Introduction ,client side vb script, Operators: : Assignment Operators, Comparison Operators, Arithmetic Operators ,Various data types,control structures : Decisional (conditional/alternative) statements If ... Then ... Else ,Case of, Looping structures like for each ,do while/until, , VBScript Procedures : Scope of Variables, VB script functions, arrays, string manipulation classes and objects.
V	Dynamic HTML: object model and collections: introduction, object referencing, collections all and children, dynamic style, dynamic positioning, using the frames collection, navigator object. event model : introduction, various events and coding, tracking the mouse with event, Various Filters and Transitions.

Suggested Readings

- HTML complete, BPB Publication(Sybex)
- Deitel and Deitel

Unit	BSCS312: Operating System
I	Introduction: Definition of Operating System, Types of operating systems: Batch Systems, Multi programming, Multiuser, Multitasking, Time-sharing, Spooling, Parallel, Distributed and Real-time systems, Operating System Concepts, Operating System Services, System calls.
II	Process Management: Process concept, Process States, Representation of process (PCB), Process Scheduling, CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Algorithm evaluation.
III	Memory Management: Contiguous, Non contiguous, Swapping, Fragmentation, Compaction, Paging, Segmentation, Virtual memory management, Demand paging, Page replacement and Virtual memory concepts, Introduction to Thrashing.
IV	The Deadlock problem, Characterization (Hold and wait, Circular Wait, No Pre-emption, No sharing of resources), Prevention, Avoidance: (RAG And Wait for Graph), Detection and Recovery from Deadlock: (Banking algorithm and detection algorithm), Concept of Fork and Join methods.
V	Process concurrency, Concept of concurrency, cooperating process, precedence graph, Critical section problem, Mutual exclusion , semaphores, classical process (Reader Writer problem, Consumer producer problem, Dining Philosopher problem), Inter Process Communication

Suggested Readings

- Operating System Concepts Abraham Silberschatz, Peter Baer Galvin, Greg Gagne John Wiley & Sons Inc.

BSCS321:Web Design Lab	
Practical Exercises	
Exercises based on Events such as Click, Indexed etc (at least 2), Controls like button, textbox, checkbox, etc (at least 6), on Javascript control structures such as while (at least 4) javascript Arrays so as to accept the input and process the data, VBscript control structures such as while (at least 2), vbscript Arrays so as to accept the input and process the data , on DHTML objects(all and children)	

BSc - IV Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS411	Database management System	3	3 hrs	20	80	100
BSCS412	Computer graphics	3	3 hrs	20	80	100
BSCS421	DBMS Lab	4	3 hrs	20	80	100

Unit	BSCS411: Database Management System
I	Introduction to Database: Need for DBMS, advantages of DBMS, views of data, instances and schema data independence, database administrator, database manager, database languages, overall structure of DBMS.
II	Entity Relationship Model: Entities, attributes, relationship, constraints, keys, E-R diagram. Concept of strong and weak entity sets, generalization, specialization and aggregation.
III	Relational Model: Structure of Relational Databases, Relational Databases, Modification of the Databases, Tuple Relational Calculus, Domain Relational Calculus.
IV	SQL – Basic structure – Clauses, data types, creating tables. Modification of the database – deletion, insertion, updates. Retrieving data from tables, ordering, set operations – union, intersect, except, concept of NULL values, nested subqueries – set membership, set comparison, exist and not exist operator, unique, not unique construct.
V	Joins, equi-joins, non-equi-joins, self joins, outer joins. Aggregate functions – group by and having clause. Math functions, string functions, group by clause. Indexes, views, granting and revoking permissions.

Suggested Readings

- Database Concepts, Korth, Silbertz, Sudarshan, McGraw Hill.
- Database Management System, Suresh Fatehpuria.
- SQL/PL-SQL The Programming Language of Oracle, IVAN BAYROSS.

Unit	BSCS412: Computer Graphics
I	Introduction: fundamentals of Computer Graphics, point, dot, pixel, Resolution, Elements of graphics workstation. Video Display Devices-Raster Scan Systems Random Scan systems. Input devices. Graphics Software Coordinate Representations, Fundamental Problems in Geometry, Concepts of video memory and frame buffer.
II	Algorithms: Line drawing algorithms- DDA Algorithm, Bresenham's Line Algorithm, Circle: Midpoint Circle Algorithm. Polygons, convex and convex polygons. Inside-Outside tests, Polygon fill algorithms: Boundary fill Algorithm, Flood fill Algorithm. Character generation. Attributes of lines, curves, characters. etc.
III	Graphics Primitives: Primitive Operations, The display file interpreter-Normalized Device Coordinates, Display-File structure. Display – file algorithm. Display control and Polygon representation. Attributes of output primitives: Line attributes - Line type. Line width. Pen and Brush options. Line Color. Color and gray scale levels. Color-tables. Gray scale. Area- Fill Attributes- Fill styles. Pattern fill. Soft fill. Character Attributes. Text attributes.
IV	Geometric Transformations: Matrices. Translation, Scaling Transformations. Sine and Cos Rotation. Homogeneous Co-ordinates . Composite Transformation. Rotation and scaling about an arbitrary point. Inverse Transformations, Transformations Routines.
V	2-D Viewing- The viewing pipeline. Viewing co-ordinate, Reference Frame. Window to viewports co-ordinate transformation, 2-D Viewing functions. Clipping operations point clipping, Cohen- Sutherland Line Clipping algorithm, Sutherland Hodgmann polygon clipping algorithm

Suggested Readings

- Computer graphics Donald,Hearn, M.Pauline Baker
- Computer graphics Steven Harrington.

BSCS421:DATABASE MANAGEMENT SYSTEM LAB
Practical Exercises
Exercises based on creating table, inserting data into tables, viewing data in the tables, sorting data in table, deleting tuples from table, updating the contents of a table, modifying the structure of table, applying primary key, foreign key and unique key constraints, computations on table data, oracle functions, grouping data from tables, subqueries, Joins

BSc - V Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS511	Java Programming	3	3 hrs	20	80	100
BSCS512	Computer Networks	3	3 hrs	20	80	100
BSCS521	Java Lab	4	3 hrs	20	80	100

Unit	BSCS511: Java Programming
I	Object Oriented Concepts in Java, Comparison of Java and C++, Java features like security, portability, byte code, java virtual machine, object oriented, robust, multithreading, architectural neutral, distributed and dynamic. Java Source File Structure, Compilation, Execution.
II	Class Fundamentals, Object & Object reference, Creating and Operating Objects, Use of Tokens, Identifiers, Keywords, Literals, Comments, Primitive Data Types, Operators-precedence and associativity, Type conversion, Command line argument,-decision making – if, if..Else, switch; loops – for, while, do...while; special statements–return, break, continue.
III	Array – single and two dimension array. Object Life time & Garbage Collection, Access Modifiers, Constructors , Object Life time & Garbage Collection, Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion, Finalize() Method, Use of this keyword
IV	Inheritance – Advantages of Inheritance in OOP, types of Inheritance, constructors in inheritance, use of super keyword, polymorphism; Abstract Class, Interfaces - defining an interface, implementing and applying interfaces, using variables in interfaces, extending interfaces; Method overriding – use, need, advantage.
V	Use of super, final and static keyword, Package - Organizing Classes and Interfaces in Packages, Package as Access Protection, defining Package, CLASSPATH Setting for Packages and Introduction to Applet programming. Introduction to Exception Handling: try..catch..throw..throws...finally, Accepting input from keyboard

Suggested Readings

- Programming with Java -E Balaguruswamy, IV Edition.

Unit	BSCS512: Computer Networks
I	Principles of Data Communication: Evolution of computer networks, General features and tasks of a communication system, Fundamentals of signals, carrier waves, modes of transfer : simplex , half duplex ,full duplex, types of networks : LAN, WAN, MAN, SAN, PAN, CAN, VPN, EPN. Introduction to serial communication.
II	Networking Architecture : ISO-OSI, IBM SNA architecture –their functions of each layer and implementation. Concepts of circuit switching, packet switching and message switching. Fundamentals of datagrams. Flow and Error Control – Stop and Wait, Sliding Window, Automatic Repeat Request
III	Data communication concepts: Connecting devices, hub, switch, bridge, routers and gateways, Signal encoding and decoding techniques - Amplitude Modulation, Frequency Modulation, Phase Modulation, signal bandwidth requirements, signal formats used in LAN, Network Protocols: LAN cabling standards : IEEE LAN standards.
IV	Error detection and correction codes: Parity bit, Checksum, Hamming codes, CRC, single error detection and correction. Introduction to Network security Model, concepts of key, Ceaser cipher, transposition cipher, DES.
V	Transmission media - twisted pair, coaxial cable, optical-fibre. LAN topologies: STAR, BUS and RING network, LAN access techniques: ALOHA, CSMA, token ring and token bus. Issues related with network reliability and fault redundant network systems.

Suggested Readings

- Stalling, Data & Computer Communication.
- Tanenbaum, Computer Network, Pearson.Ed., Pearson
- Kurose, Computer Networking, Pearson
- Peterson, Davie; Computer Networks, Elsevier

BSCS521:JAVA PROGRAMMING LAB	
Practical Exercises	
Exercises based on Input/output, loops, if,switch, array(1d-2d), Use of different types of constructors, Implement Method Overloading, Use of static and this and final keyword, Implement Single and Multilevel (using super), Use of String and its inbuilt functions, Use of inbuilt mathematical functions, Implement Method Overriding, Implement Abstract Class, Implement Exception Handling, Implement finally block, Implement package	

BSc - VI Semester						
Code	Description	Pd/w	Exam	CIA	ESE	TOTAL
BSCS611	ASP.NET	3	3 hrs	20	80	100
BSCS612	E-commerce and cyber law	3	3 hrs	20	80	100
BSCS621	ASP.NET Lab	4	3 hrs	20	80	100

Unit	BSCS611: ASP.NET
I	Anatomy of .NET, .NET Base Classes, Microsoft Intermediate Language,CLR, Client Server model, IIS Web Server, Namespaces, ASP.NET: How the ASP.NET works, Basics of ASP.NET, Creating and Deploying the ASP.NET applications, Concept of Code behind, Use of Web Applications using ASP.NET, Difference between Windows and Web Applications.ASP.NET directives.
II	ASP.NET: Web forms, Web Controls categories: server Controls and Web Controls: Label, Textbox, CheckBox and CheckBoxList, RadioButton and RadioButton List, ListBox and DropDownList, Table, Image, Hyperlink, HiddenField, FileUpload. RichWeb Controls: AdRotator, Calendar, TreeView, TabStrip. Concept of Master Page and Navigation Controls.
III	Validation Controls: Need of Validation Control, Various Controls like Require Field, Compare, Range, RegularExpression, Custom, ValidationSummary, Dynamic controls. Debugging ASP.NET pages: Error Handling: Custom Error Page, Using Debugging Tools: Debugger and Trace Facility.
IV	ASP.NET Database Programming, Introducing ADO.NET, ADO .NET Object Models, Communicating with OLEDB Data Sources Using ADO.NET, Working with Datagrids. Data binding with different controls. Data Command, Data Reader objects.
V	Web Services: Concept of web services, Infrastructure for Web services. ASP.NET Security: IIS security: Authentication, Authorization and Impersonation using Session State. ASP.NET Application Configuration, Web.Config, Global.asax file.

Suggested Readings:

- ASP.NET Bible
- Professional ASP.NET 4, Wiley Publication

BSCS612: Ecommerce and Cyber Law	
I	Electronic Commerce, Scope of the Internet and Web, Using the web to reach the customer, Benefits of E-Commerce markets, Type of E-Commerce Technology, Types of E-Business Models and Markets, Types of E-Commerce Providers and Vendors.
II	E-Commerce Website Creation, Managing E-Commerce Website Development- Website Server, Developing Commerce Site, Requirement for Site, Building the Site, Implementation of Site, Building Shopping Cart Application, Mobile E-Commerce, Enhancing a Web Server with E-Commerce Application Development.
III	Implementing and Managing E-Commerce Site- Strategies, Techniques and Tools, Implementing merchandising strategies, E-Commerce Databases, Applying and Managing E-Business Intelligence Tools for application development, Types of Security Techniques, Building E-Commerce Trust Infrastructure.
IV	E-Payments Technology- Payment Technologies Issues, E-payment through Smart Cards, E-payment system, Digital Currencies, International E-Commerce Solutions- Auction resources, Smart Cards, Digital Wallets, Person to Person payments, Micropayment System (eCash), Token value and store based credits.
V	Introduction to IT and Cyber laws , Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property rights , Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, Cyber Crime Investigation and Cyber Security etc. , E-Mail Tracking, IP Tracking, E-Mail Recovery.

Suggested Readings

- Electronic Commerce : Pete Joshin, John Vacca.

BSCS621:ASP.NET LAB	
Practical Exercises	
Exercises based on Serverside web form controls: label, textbox, button, radiobutton, checkbox, dropdownlist, listbox with their events, Client side validation controls: required filed, range, compare, regular expression, custom , validation summary, Database handling with MS-Access. Insert, update, delete and select operation, Login and logout implementation using session.	