

**ACADEMIC REGULATIONS FOR MCA  
(CBCS Session 2018-19 onwards)**

The Department offers 3 year full time post graduate program leading to MCA (Master of Computer Applications). From the academic year 2018 -19, the Department offers the same program to students under Choice Based Credit System (CBCS) with following regulations.

**Table 1: Grades and Grade Points**

S.No.	Letter Grade	Meaning	Grade Point
1	'O'	Outstanding	10
2	'A+'	Excellent	9
3	'A'	Very Good	8
4	'B+'	Good	7
5	'B'	Above Average	6
6	'C'	Average	5
7	'P'	Pass	4
8	'F'	Fail	0
9	'Ab'	Absent	0

A student obtaining Grade F in a paper shall be considered failed and will be required to reappear in the End Semester examination.

**Grade Point assignment**

= and > 95 % marks	Grade Point 10.0
90 to less than 95 % marks	Grade Point 9.5
85 to less than 90 % marks	Grade Point 9.0
80 to less than 85 % marks	Grade Point 8.5
75 to less than 80 % marks	Grade Point 8.0
70 to less than 75 % marks	Grade Point 7.5
65 to less than 70 % marks	Grade Point 7.0
60 to less than 65 % marks	Grade Point 6.5
55 to less than 60 % marks	Grade Point 6.0
50 to less than 55 % marks	Grade Point 5.5
45 to less than 50 % marks	Grade Point 5.0
≤ than 45 % marks	Grade Point 4.5
= 40 % marks	Grade Point 4.0 Passing Percentage

**Computation of SGPA and CGPA:**

- i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student,  
i.e.  $SGPA (S_i) = \frac{\sum (C_i \times G_i)}{\sum C_i}$   
Where  $C_i$  is the number of credits of the  $i$ th course and  $G_i$  is the grade point scored by the student in the  $i$ th course.
- ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program,  
i.e.  $CGPA = \frac{\sum (C_i \times S_i)}{\sum C_i}$   
where  $S_i$  is the SGPA of the  $i$ th semester and  $C_i$  is the total number of credits in that semester.
- iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

**Illustration for SGPA:**

S.No.	Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
1	Course 1	4	B	6	4 x 6 =24
2	Course 2	4	B+	7	4 X 7 =28
3	Course 3	4	B	6	4X 6 = 24
4	Course 4	4	O	10	4 X 10 =40
5	Course 5-Practical I	4	C	5	4 X 5 =20
6	Course 6 – Practical II	4	B	6	4 X 6 = 24
	Total	24			24+28+24+40+20+24 =160

Thus, **SGPA =160/24 =6.67**

**Illustration for CGPA:**

	Semester- I	Semester-II	Semester-III	Semester-IV
Credit	24	24	24	24
SGPA	6.67	7.25	7	6.25

$$\text{CGPA} = \frac{(24 \times 6.67 + 24 \times 7.25 + 24 \times 7 + 24 \times 6.25)}{96} = \frac{652.08}{96} = 6.79$$

**Course Evaluation (Evaluation of the Students):**

All courses (Core/ Elective) involve an evaluation system of students that has the following two components:-

- (i) **Continuous Internal Assessment (CIA)** accounting for 20% of the final grade that a student gets in a course; and
- (ii) **End-Semester Examination (ESE)** accounting for the remaining 80% of the final grade that the student gets in a course.

**In laboratory courses (having only practical (P) component)**, the CIA will be based on students attendance (50%); Practical records, hands on Practical etc. - as applicable (50%) .

**(ii) ESE:**

**Part A**

Ten short type questions (Definitions, illustrations, functions, short explanations, etc; 25-50 words) for two marks each.  $10 \times 2 = 20$  marks; two questions from each Unit; no choice in this part.

**Part B**

Five short answer (250 words) type questions for four marks each.  $5 \times 6 = 30$  marks; one question from each Unit with internal choice.

**Part C**

Five questions of long/explanatory answer (500 words) type, one drawn from each Unit; student need to answer any three; ten marks each;  $3 \times 10 = 30$  marks.

$$20+30+30 = 80 \text{ marks}$$

**PRACTICAL EXAMINATIONS:**

The practical examination shall consist of one Board of two examiners (one of them will be from outside the college).

Duration: Three hours.

**SYLLABUS, TEACHING & EXAMINATION SCHEME  
For MCA WEF FROM SESSION 2018-19**

<b>MCA - I Semester</b>							
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
	<b>TOTAL</b>		<b>28</b>				<b>900</b>
<b>MCA - II Semester</b>							
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
	<b>TOTAL</b>		<b>28</b>				<b>900</b>
<b>MCA - III Semester</b>							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA311	LINUX Operating System	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	LINUX 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
	<b>TOTAL</b>		<b>28</b>				<b>900</b>
<b>MCA - IV Semester</b>							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA411	Advance Java	3	4	3 hrs	20	80	100
MCA412	Artificial Intelligence	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	3	3 hrs	20	80	100
MCA415A	Theory of Computation	3	3	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	3	3 hrs	20	80	100
MCA415B	Advanced DBMS	3	3	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	3	3 hrs	20	80	100
MCA415C	Cloud Computing	3	3	3 hrs	20	80	100
MCA424C	PHP Programming Lab	4	2	3 hrs	20	80	100
	TOTAL						900
<b>MCA - V Semester</b>							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA511	Embedded System	3	3	3 hrs	20	80	100
MCA512	Information Protection & Security	3	3	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	3	3 hrs	20	80	100
MCA514A	Compiler Design	3	3	3 hrs	20	80	100
MCA515A	Analysis & Design of Algorithms	3	3	3 hrs	20	80	100
MCA524A	Compiler Design Lab	4	2	3 hrs	20	80	100
	Elective Group 2						
MCA513B	BigData Analytics	3	3	3 hrs	20	80	100
MCA514B	Bioinformatics Database	3	3	3 hrs	20	80	100
MCA515B	Geographical Information Systems	3	3	3 hrs	20	80	100
MCA524B	Bio informatics Lab	4	2	3 hrs	20	80	100
	Elective Group 3						
MCA513C	AJAX & XML	3	3	3 hrs	20	80	100
MCA514C	Programming in Android	3	3	3 hrs	20	80	100
MCA515C	Wireless Technology	3	3	3 hrs	20	80	100
MCA524C	Android Programming Lab	4	2	3 hrs	20	80	100
	TOTAL						900
<b>MCA - V Semester</b>							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA 611	Practical Training	-	25	3 hrs	-	200	200

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

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, Using External and Internal Links, Working with Colors, Images, and Multimedia.
II	Advanced Web Page Design with CSS - 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.
III	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, Using JavaScript Functions and Objects, Controlling Flow with Conditions and Loops, Responding to Events, Using Windows and Frames.
IV	Advanced JavaScript Programming - Using Unobtrusive JavaScript, Using Third Party Libraries, Greasemonkey: Enhancing the Web with JavaScript, AJAX: Remote Scripting.
V	Advanced Web Site Functionality and Management - -Creating Print-Friendly Web Pages, Working with Web-Based Forms, Organizing and Managing a Web Site, Helping People Find Your Web Pages.

*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, Descartes' 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.

<b>IV</b>	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.
<b>V</b>	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

<b>MCA121: C Programming Lab</b>	
<b>Practical Exercises</b>	
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.	

<b>MCA122:Web Designing Lab</b>	
<b>Practical Exercises</b>	
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.	
Exercises based on Using Unobtrusive JavaScript, Using Third Party Libraries, AJAX: Remote Scripting.	
Exercises based on designing of some example of websites.	

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

<b>MCA124:CONM Lab</b>	
<b>Practical Exercises</b>	
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.	

<b>MCA - II Semester</b>							
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MCA215	Discrete Structures	3	4	3 hrs	20	80	100
MCA221	.NET Lab	4	2	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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Unit	<b>MCA211: Visual Programming with .NET</b>
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

<b>MCA212: Programming in Java</b>	
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.

<b>MCA213: Microprocessor and Applications</b>	
Unit	
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. Caesar 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	
<b>Practical Exercises</b>	
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	

<b>MCA222: Programming In Java Lab</b>
<b>Practical Exercises</b>
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.

<b>MCA223: Microprocessor Lab</b>
<b>Practical Exercises</b>
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.

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

<b>MCA - III Semester</b>							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA311	LINUX Operating System	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	LINUX 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
	<b>TOTAL</b>		<b>28</b>				<b>900</b>

<b>Unit</b>	<b>MCA311: LINUX Operating System</b>
<b>I</b>	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.
<b>II</b>	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.
<b>III</b>	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.
<b>IV</b>	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.
<b>V</b>	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	<b>MCA312: ASP.NET</b>
<b>I</b>	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.
<b>II</b>	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.
<b>III</b>	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
<b>IV</b>	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.
<b>V</b>	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	<b>MCA313: Database Management System</b>
<b>I</b>	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, Entity Relationship Model: Entities, attributes, relationship, constraints, keys, E-R diagram.
<b>II</b>	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).
<b>III</b>	Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expression.
<b>IV</b>	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, ambiguous attributes, aliasing and tuple variable, tables as Sets in SQL, substring pattern matching and arithmetic operators, ordering of query results.
<b>V</b>	Complex SQL queries – comparison involving NULL and three valued logic, nested queries, tuples and set comparison, correlated nested queries, EXISTS and UNIQUE function, explicit sets and renaming of attributes, joined tables. Aggregate functions, grouping – GROUP BY and HAVING clause. Insert, delete and update statements. Assertions and views.

*Suggested Readings*

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

Unit	<b>MCA314: Computer Graphics</b>
<b>I</b>	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 viewport co-ordinate transformation
<b>II</b>	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.

<b>III</b>	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.
<b>IV</b>	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.
<b>V</b>	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	<b>MCA315: Operating System</b>
<b>I</b>	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.
<b>II</b>	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.
<b>III</b>	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.
<b>IV</b>	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.
<b>V</b>	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.

<b>MCA321:LINUX LAB</b>
<b>Practical Exercises</b>
Exercises based on installation of Linux Operating System, 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, Executing C, Java Programs in Linux Environment. Exercises 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.

<b>MCA322: ASP.NET Lab</b>
<b>Practical Exercises</b>
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

<b>MCA323: DBMS Lab</b>
<b>Practical Exercises</b>
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.

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

<b>MCA - IV Semester</b>							
Code	Description	Pd/w	Credits	Exam	CIA	ESE	TOTAL
MCA411	Advance Java	3	4	3 hrs	20	80	100
MCA412	Artificial Intelligence	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	3	3 hrs	20	80	100
MCA415A	Theory of Computation	3	3	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	3	3 hrs	20	80	100
MCA415B	Advanced DBMS	3	3	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	3	3 hrs	20	80	100
MCA415C	Cloud Computing	3	3	3 hrs	20	80	100
MCA424C	PHP Programming Lab	4	2	3 hrs	20	80	100
	TOTAL						900

Unit	<b>MCA411: Advanced Java</b>
<b>I</b>	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.
<b>II</b>	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.
<b>III</b>	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.
<b>IV</b>	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.

<b>V</b>	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.
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*Suggested Readings*

- Developing Java Servlets, by James Goodwill, SAMS.

Unit	<b>MCA412: Artificial Intelligence</b>
<b>I</b>	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.
<b>II</b>	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.
<b>III</b>	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.
<b>IV</b>	Concepts of AI:-Logic, propositional and predicate calculus, Clausal form, Resolution, Unification, Inference, mechanisms. Semantic nets, frames, conceptual dependency, Blackboard architectures, scripts.
<b>V</b>	Non-monotonic reasoning- default reasoning, minimalist reasoning, statistical reasoning - Baye's theorem, certainty factors, Concepts of Dempster Shafer theory and Fuzzy logic. Neural networks, NN Architectures. Introduction to Genetic Algorithms.

*Suggested readings*

- E. Rich and K. Knight, "Artificial Intelligence", Tata McGraw Hill.
- George F Luger, "Artificial Intelligence", Fifth Edition, Addison-Wesley Publishing Company.
- E. Charnaik and D. McDermott, "Introduction to artificial Intelligence", Addison-Wesley Publishing Company.
- Stuart Russel and Peter Norvig., Artificial Intelligence a Modern Approach, 2<sup>nd</sup> 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	<b>MCA413: Software Engineering</b>
<b>I</b>	Software Problem - Cost, Schedule and Quality, Scale and Change. Software Processes -Process and Project, Component Software Processes, Software Development Process Models, Project Management Process.
<b>II</b>	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.
<b>III</b>	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.
<b>IV</b>	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.
<b>V</b>	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	<b>MCA414A: System Programming</b>
<b>I</b>	Systems Programming: Software layered structure & bare machine. Language processor: fundamentals, specifications & language development tools. Systems software and Machine architecture.
<b>II</b>	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
<b>III</b>	Assemblers: Elements of Assembly language. A simple assembly scheme, Pass structure of Assemblers. Designs of two pass assembler.

<b>IV</b>	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.
<b>V</b>	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, Dhamdhere D M, Tata Mc Graw Hill.
- Systems Programming, Donovan John J. Tata Mc Graw Hill.

Unit	<b>MCA414B: Data Warehousing &amp; Data Mining</b>
<b>I</b>	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.
<b>II</b>	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.
<b>III</b>	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
<b>IV</b>	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.
<b>V</b>	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, 2<sup>nd</sup> 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	<b>MCA414C: Internet Programming in PHP</b>
<b>I</b>	Works with the web server, Hardware and software requirements, Benefits of PHP as a server side language. Basic PHP syntax, PHP Delimiters, Creating User Defined Variable, Assigning values to scalar variable, Data type with PHP, Displaying type information, Testing for specific data type, Operators. Use of HTML for web design purpose, HTML scripts and Form's element, Embedding PHP code into HTML pages, Retrieving form data with \$_POST, \$_GET and \$_REQUEST arrays, Validating retrieved data, Strategies for handling invalid input, Adding dynamic content.
<b>II</b>	Introduction to Arrays in PHP, Numerically and Non-Numerically Indexed arrays, Array operators, Multidimensional arrays, Array sorting, Array Functions. Creating and Deleting a file, Reading and Writing text files, Working with directories in PHP, Checking for existence of file, Determining file size, Opening a file for writing, reading or appending, Using other useful file functions. File Upload/Download,
<b>III</b>	Comparing Strings, Matching and replacing substrings, Introduction to Regular Expressions, Matching and replacing substring with Regular Expressions, Splitting string with Regular expressions. Introducing Functions, Using parameters and Returning Values, Call by value and call by reference. Function: require (), include (), header(), date(), math library, string formatting functions.
<b>IV</b>	Object Oriented Programming in PHP, Object oriented concepts, Classes, objects and operations. Constructor and Destructor, Abstract class, Inheritance, Function Overriding, Interface, Final keyword, Exception Handling, User defined exception. Introduction to Session Control, Session Functionality, Setting Cookies with PHP, Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Session Variables, Destroying the variables and Session.
<b>V</b>	MySQL Architecture, Defining a Database, Creating Tables and Fields in MySQL, Working with PHP-MySQL Environment, Using phpmyadmin. Connecting to MySQL Server, Selecting Databases, Insert Update and Delete

	records, Checking for Errors, Closing the MySQL Server Connection. MySQL Database connectivity in Object Oriented manner. PHP configuration file, Error tracking and debugging.
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*Suggested Readings*

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

Unit	<b>MCA415A: Theory of Computation</b>
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	<b>MCA415B: Advanced DBMS</b>
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	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. Cursor – basic concept, types, Procedures & Functions - advantages, creation, execution, deletion, overloading, stored procedures and functions. Packages – creation and execution. Triggers - use, types, creating, deleting and exception handling.

*Suggested readings:*

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

Unit	<b>MCA415C: Cloud Computing</b>
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.
<b>IV</b>	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.
<b>V</b>	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.

<b>MCA421: Advanced Java Lab</b>	
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.

<b>MCA422: Colloquium Lab</b>	
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.	

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

<b>MCA424A: System Programming Lab</b>	
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.

<b>MCA424B: Advanced Database Lab</b>	
Practical Exercises	
The practical exercises based on MCA415B	

<b>MCA424C:PHP Programming Lab</b>	
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.	

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

Unit	MCA511: 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, 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. RAM, Registers, Status registers, ROM, AVR I/O port structure. AVR Timers, AVR Interrupts, AVR Serial Port.
IV	Introduction to AVR programming in C. Data types and time delays in C, I/O programming in C, Timer programming in C, Interrupt programming in C, Serial Programming in C. LCD, LED, Keyboard interface in C. ADC-DAC interface in C. Introduction to PWM. Relay and motor (DC, Servo, Stepper) interface in C.
V	Introduction to Robotics: History, definition, Elements of Robot, Categories of Robots, Applications of Robots, Robotic Control, introduction to Sensors: temperature, humidity, light acceleration, GPS, flow, pressure/force, torque proximity, displacement/range. Gyroscope. Simple robot designs.

**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	<b>MCA512: Information Protection &amp; Security</b>
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”, Willey

Unit	<b>MCA513A: Advance Computer Architecture</b>
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	<b>MCA513B: BigData Analytics</b>
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	<b>MCA514A: Compiler Design</b>
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	<b>MCA514B: Bioinformatics Databases</b>
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, Expaty 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.

Unit	<b>MCA514C: Programming in Android</b>
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: 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	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
<b>Practical Exercises</b>
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
<b>Practical Exercises</b>
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
<b>Practical Exercises</b>
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
<b>Practical Exercises</b>
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
<b>Total Marks</b>	<b>80</b>

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

