# **Curriculum for**

# **Master of Computer Application**

## **M.C.A First Semester**

Course	Name of sub	Lectures	Tutorials	Practical	CR
Code					
CS-141	Discrete	3	0	0	3
	Structures				
CS-142	Accounting	3	0	0	3
	and Financial				
	Management				
CS-143	Computer	3	0	4	5
	Organization				
CS-144	Computer	3	0	4	5
	Programming				
CS-145	Foundation	2	0	4	4
	of				
	Information				
	Technology				

Total Credit : 20 Total Contact Hours : 26

## **M.C.A Second Semester**

Course	Name of sub	Lectures	Tutorials	Practical	CR
Code					
CS 246	Data	3	0	4	5
	Structures				
CS-247	Unix and	3	0	4	5
	Shell Prog				
CS-248	Formal	3	0	0	3
	Languages &				
	Automata Th				
CS 249	Combinatorics	3	0	0	3
	and Graph Th				

CS 250	Ob.Oriented	3	0	2	4
	Programming				

Total Credit : 20 Total Contact Hours : 27

## M.C.A. Third Semester

Course	Name of	Lectures	Tutorials	Practical	CR
Code	sub				
CS-351	Computer	2	0	2	3
	Based				
	Numerical				
	Methods				
Cs-352	Design &	3	0	4	5
	Analysis of				
	Algorithm				
CS-353	Information	3	0	0	3
	System				
CS-354	Operating	3	0	4	5
	System				
CS-355	Computer	4	0	2	4
	Networks				

Total Credit : 20 Total Contact Hours : 28

## M.C.A. Fourth Semester

Course	Name of	Lectures	Tutorials	Practical	CR
Code	sub				
CS -456	D.B.M.S	3	0	4	5
Cs-457	Internet &	3	0	2	4
	Java Prog				
CS-458	Computer	3	0	4	5
	Graphics				
CS -460	Elec1 Adv	3	0	0	3
	Comp				
	Networks				

CS	-464	Elec II Mobile comp	3	0	0		3	3
SI. No.	Course Code	e Subject			Р	eriod	ls	Credit
					L	Т	Р	
1.	CS-56	l Web Teo	chnology		3	0	4	05
2.	CS-562	2 Distribut	ted Systen	n	3	0	2	04
3.	CS-567	7 Software	e Engineer	ring	3	0	2	04
4.		Elective	Elective III (EL-III)			0	0	03
5.		Elective	Elective IV (EL-IV)			0	0	03
6.	CS-57	7 Colloqui	Colloquium				2	01
Tota	l Credit	: 30						

Total Credit : 20 Total Contact Hours : 27

MCA Semester – V

MCA VI Semester

## **Total Course Credit: 120**

SI.	Course	Subject	Credit
No.	Code		
1	CS-661	Semester Project	20

## **Computer Organization**

#### **CS141**

L T P Credits 3 0 4 5

**Representation of information:** Number system, Integer and floating-point representation, character codes (ASCII, EEBCDIC), and Error detection and correction codes.

**Central Processing Unit:** ALU, Arithmetic and logic operations, faster algorithm and their implementation

Control Units: Hardwired and Micro Programmed design concept, Microprogramming

**Memory:** Memory types and organization, address decoding and selecting

Peripheral Devices: I/O devices (disk and tapes), Programmed interrupt control mechanism, I/O Controllers, DMA

Bus architectures: Uni-bus and multi-bus architectures.

#### **Books and References:**

- 1. Hamacher, "Computer Organization," McGraw hill.
- 2. Tennenbaum," Structured Computer Organization," PHI
- 3. B. Ram, "Computer Fundamentals architecture and organization," New age international
- 4. Gear C. w., "Computer Organization and Programming, McGraw hill
- 5. Mano Moris, "Computer system Architecture," PHI

## **Computer Programming**

5144	LTP	Credits
	3 0 4	5

Writing a Simple Program: Learning the format of a C program, declaring variables, designing program flow and control, defining and using functions, using standard terminal I/O functions.

Fundamental Data Types and Storage Classes: Character types, integer, short, long, unsigned, single and double-precision floating point, storage classes, automatic, register, static and external.

Operators and Expressions: Using numeric and relational operators, mixed operands and type conversion, Logical operators, Bit operations, Operator precedence and associativity.

**Conditional Program Execution:** Applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch.

Program Loops and Iteration: Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue.

**Modular Programming:** Passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules.

**Arrays:** Array notation and representation, manipulating array elements, using multidimensional arrays, arrays of unknown or varying size.

**Structures:** Purpose and usage of structures, declaring structures, assigning of structures.

**Pointers to Objects:** Pointer and address arithmetic, pointer operations and declarations, using pointers as function arguments, Dynamic memory allocation, defining and using stacks and linked lists.

**Unions:** Components in overlapping memory, declaring and using unions. .h vs. private .c files, Hiding private variables and functions.

Controlling Devices: Bit access and masking, pointing to hardware structures.

**Operating System Interaction:** Reading command line arguments, creating and accessing files, file opening modes, formatted disk I/O.

**The Standard C Preprocessor:** Defining and calling macros, utilizing conditional compilation, passing values to the compiler.

**The Standard C Library:** Input/Output : fopen, fread, etc. String handling functions, Math functions : log, sin, etc, Other Standard C functions.

#### **Books and references:**

- 1. Herbert Schield, Complete Reference in C," TMH
- 2. Yashwant Kanetkar," Let us C", BPB
- 3. Balaguruswamy, "Programming in ANSI C," TMH
- 4. Yashwant Kanetkar "Pointers in C"

## Data Structures

#### CS246

#### L T P Credits 3 0 4 5

**Introduction:** Basic Terminology: Elementary Data Organization, Data Structure Operations, Algorithms Complexity, Time-Space Trade off.

**Arrays:** Array Definition and Analysis, Representation of Linear Arrays in Memory, Traversing of Linear Arrays, Insertion And Deletion, Single Dimensional Arrays, Two Dimensional Arrays, Bubble Sorting, Selection Sorting, Linear Search, Binary Search, Multidimensional Arrays, Function Associated with Arrays, Character String in C, Character String Operations, Arrays as parameters, Implementing One Dimensional Array.

**Stacks and Queues:** Introduction to Operations Associated with Stacks Push & Pop, Array representation of stacks, Operation associated with stacks: Create, Add, Delete, Application of stacks recursion polish expression and their compilation conversion of infix expression to prefix and postfix expression, Tower of Hanoi problem, Representation of Queues, Operations of queues: Create, Add, Delete, Front, Empty, Priority of Queues, Dequeues.

Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list, Polynomial Addition, More on linked list, Header nodes, Doubly linked list, Generalized list.

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, Traversing binary trees, Searching, Insertion and Deletion in binary search trees, Complexity of searching algorithm, Path length, Huffman's algorithm, General trees, AVL trees, Threaded trees, B trees.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.

Sorting: Insertion Sort, Quick sort, two-way Merge sort, Heap sort, Sorting on different keys, External sorting.

File Structure: Physical storage media, File Organization, Organization records into blocks, Sequential blocks, Indexing & Hashing, Primary Indices, Secondary Indices, B+ tree Index files, B tree index files, Static Hash functions, Indexing & hashing comparisons.

#### **Books and References:**

- 1. Horowitz and Sahani, "Fundamentals of Data structures", Galgotia publications
- 2. An introduction to data structures and application by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill)
- 3. Tannenbaum, "Data Structures", PHI
- 4. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI

## **Unix & Shell Programming**

]	L	Т	Р	Credits
-	3	0	4	5

UNIX Diversion: Unix System kernel and Utilities, File & Directions, Single & Compound Statement Command Library and Include files.

Unix System Administration: File System mounting & Unmounting, System booting, shutting down, handling user account, backup, recovery, security, terminals, printer and modem.

Different Tools & Debugger : System development tool, Lint, Make, SCCS (source code control ,system), Language Development Tool - Yacc, Lex and M4, text formatting, tools troff, nroff, tbi, pie and aqn, debuggers Dbx, Adb, Sdb, Strip and Ctrace.

UNIX Shell Programming: Bourne Shell, korn shell and C shell. Shell metacharacters, shell variable and scripts, facilities and command, environment, integer arithmetic and string manipulation, decision making, aliasing, arrays and job control.

#### **Book and References:**

- 1. Advanced UNIX Programmers by Pratta, BPB.
- 2. Kochen & Wood,"UNIX Shell Programming".
- 3. Fileder, Hunter,"UNIX System Administration".
- 4. "C Oddyssy for UNIX".
- 5. Hahn, The internet complete reference, TMH.
- 6. Unix & C Programming, Excel.
- 7. Rosen, UNIX, the complete reference, TMH.

## **Automata Theory**

**CS-248** 

#### L T P Credits 3 0 0 3

**Introduction:** Deterministic and Nondeterministic Finite Automata, Regular Expression, Two way Finite Automata, Finite Automata with output, Properties of regular sets, pumping lemma Closure properties, My-Hill-Nerode Theorem.

**Context Free Grammars:** Derivation trees, simplification forms.

**Pushdown Automata:** Definitions, Relationship between PDA and context free language, Properties of context free languages, Decision Algorithms.

**Turing Machine:** The Turing Machine Model, Complete Languages and Functions, Modification of Turing Machines, Church's Machines, Undecidability.

Properties of recursive and recursively enumerable languages, Universal turing Machines, Post correspondence problems, introduction to recursive function theory.

**Chomsky Hierarchy :** Regular grammars, unrestricted grammars, Context Sensitive Language, Relation between classes of languages.

#### **Books & References:**

- 1. Hopcroft and Ullman, "Introduction to Automata Theory, languages and computation", Addision Wesley.
- 2. Kohan, "Theory of Computer Sciences".
- 3. Korral, "Theory of Computer Sciences".
- 4. Mishra & Chandrashekharan, "Theory of Computer Sciences", PHI.

## **Object Oriented Programming**

#### CS250

L	Т	Р	Credits
3	0	2	4

**Object oriented paradigm & C++ at a glance:** Evolution of programming paradigm, structured versus object-oriented development, elements of object-oriented programming, objects, classes, multiple views of the same object, encapsulation and data abstraction, inheritance, delegation – object composition, polymorphism – virtual functions, popular oop languages, software reuse, friend functions, exception handling.

**Moving from C to C++ :** Introduction, hello world, streams based I/O, single line comment, literals – constant qualifiers, scope resolution operator (::), variable definition at the point of use, variable aliases-reference variables, strict type checking, parameters passing by reference, inline function, function overloading, default arguments, keyword typedef, functions as part of struct, type conversion, function templates, runtime memory management.

**Classes and objects:** Introduction, class specification, class objects, accessing class members, defining member functions, outside member functions as inline, accessing member functions within a class, data hiding, access boundary of objects revisited, empty classes, pointers within a class, passing objects as arguments, returning objects from functions, friend functions and friend classes, constant parameters and member functions, structures and classes, static data and member functions, class, objects and memory resource, class design steps.

**Object initialization and cleanup:** Class revisited, constructors, parameterized constructors, destructor, constructor overloading, order of construction and destruction, constructors with default arguments, nameless objects, dynamic initialization through constructors, constructors with dynamic operations, copy constructor, constructors for two-dimensional arrays, constant objects and constructor, static data members with constructors and destructors, nested classes.

**Dynamic objects:** Introduction, pointers to objects, live objects, array of objects, array of pointers to objects, pointers to object members, function set\_new\_handler(), this pointer, self-referential classes, guidelines for passing object parameters.

**Operator overloading:** Introduction, over loadable operators, unary operator overloading, operator keyword, operator return values, nameless temporary objects, limitations of increment/decrement operators, binary operator overloading, arithmetic operators, concatenation of strings, comparison operators, arithmetic assignment operators, overloading of new and delete operators, data conversion, conversion between basic data types, conversion between objects and basic types, conversion between objects of different classes, subscript operator overloading, overloading with friend functions, assignment operator overloading, tracing memory links.

**Inheritance:** Introduction, class revised, derived class declaration, forms of inheritance, inheritance and member accessibility, constructors in derived classes, destructors in derived classes, constructors invocation and data members initialization, overloaded member functions, abstract classes, multilevel inheritance, multiple inheritance, hierarchical inheritance, multipath inheritance and virtual base classes, hybrid inheritance.

**Virtual functions:** Introduction, need for virtual functions, pointer to derived class objects, definition of virtual functions, array of pointers to base class objects, pure virtual functions, abstract classes, virtual destructors.

**Generic programming with templates:** Introduction, function templates, overloaded function templates, nesting of function calls, multiple arguments function templates, user defined template arguments, class templates, inheritance of class template, class template containership, class template with overloaded operators.

**Streams computation with streams:** Predefined console streams, hierarchy of console stream classes, unformatted I/O operations, formatted console I/O operations,

manipulators, custom/user-defined manipulators, stream operator with user-defined classes.

**Stream computation with files:** Introduction, hierarchy of file stream classes, opening and closing of files, testing for errors, file modes, file pointers and their manipulators, sequential access to a file, ASCII and binary files, saving and retrieving of objects, file input/output with stream class, random access to a file, in-memory buffers and data formatting, error handling during file manipulations, filter utilities.

**Exception handling:** Introduction, error handling, exception handling model, exception handling constructs, handler throwing the same exception again, list of exceptions, catch all exceptions, exceptions in constructors and destructors, handling uncaught exceptions, exceptions in operator overloaded functions, exception in inheritance tree, exceptions in class templates, fault tolerant design techniques, case-study on software fault tolerance, memory allocation failure exception.

#### **Books & References:**

- 1. Budd,"Object Oriented Programming ", Addison Wesley.
- 2. Mastering C++ K.R Venugopal Rajkumar, TMH.
- 3. C++ Primer, "Lip man and Lajole", Addison Wesley.
- 4. Balaguruswami, "Object oriented with C++", TMH.
- 5. Maria litvin, Gary litvin, "Programming in C++", Vikas.
- 6. D Samantha, "Object oriented Programming in C++ and Java ", PHI.

#### **Computer Based Numerical & Statistical Techniques**

CS351	LTP	Credits
	2 0 2	3

**Introduction:** Errors in numerical computation, Mathematical preliminaries, Errors and their analysis, Machine Computations, Computer Software.

Algebraic and Transcendental Equations: Bisection method, Iteration method, Method of False Position, rate of convergence, Method for complex root, Muller's Method, Quotient Difference method, Newton-Raphson Method.

**Interpolation:** Introduction, Errors in Polynomial interpolation, Finite differences, Decision of errors, Newton's formula for interpolation, Gauss, Sterling, Bessel's, Everett's Formula, Interpolation by unevenly spaced points, Lagrange interpolation formula, Divided Difference, Newton's General interpolation Formula.

**Curve Fitting, Cubic Spline & Approximation:** Introduction, Method of Least Square curve fitting procedures, Fitting a straight line, Curve fitting by sum of exponential, Data fitting with cubic splines, Approximation of functions.

**Numerical Integration and Differentiation:** Introduction, Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson 1/3 rule, Simpson 3/8 rule, Booles & Weddles rule, Euler-Maclariaun formula, Gaussian Formula, Numerical evaluation of singular integrals.

**Statistical Computations:** Frequency Chart, Regression Analysis, Least Square fit, Polynomial fit, Linear and Nonlinear Regression, Multiple Regression, Statistical Quality Control Methods.

#### **Books and References:**

- 1. Balaguruswamy, "Numerical methods", TMH
- 2. Shastri, "Introductory methods of numerical analysis", PHI
- 3. V. Rajaraman, "Introduction to Numerical Methods", TMH

## **Analysis and Design of Algorithms**

#### CS352

L	Т	Р	Credits
3	0	4	5

**Introduction:** Algorithm Design paradigms- motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations.

**Divide and conquer:** Structure of divide-and-conquer algorithms: examples; Binary search, quick sort, Strassen Multiplication; Analysis of divide and conquer run time recurrence relations.

**Greedy Method:** Overview of the greedy paradigm examples of exact optimization solution (minimum cost spanning tree), Approximate solution (Knapsack problem), Single source shortest paths.

**Dynamic programming:** Overview, difference between dynamic programming and divide and conquer, Applications: Shortest path in graph, Matrix multiplication, Traveling salesman Problem, longest Common sequence.

**Graph searching and Traversal:** Overview, Traversal methods (depth first and breadth first search)

Back tracking: Overview, 8-queen problem, and Knapsack problem

**Brach and bound:** LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem

**Computational Complexity:** Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

#### **Books and references:**

- 1. E. Horowitz, S. Sahni, and S. Rajsekaran, "Funadmentals of Computer Algorithms," Galgotia Publication
- 2. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," PHI
- 3. Sara Basse, A. V. Gelder, "Computer Algorithms," Addison Wesley

## **Operating System**

CS354

L T P Credits 3 0 4 5

**Introduction:** Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection.

**Operating System Structure:** System Components, System structure, Operating System Services.

**Concurrent Processes:** Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling.

**CPU Scheduling:** Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling.

**Deadlock:** System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.

**Memory Management:** Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Organization, Impact on performance.

**I/O Management & Disk Scheduling:** I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues.

**File System:** File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.

#### **Books & References:**

- 1. Milenekovic, "Operating System Concepts", McGraw Hill
- 2. Silverschwatz, "Operating System Concepts", Willey
- 3. Dietel, "An introduction to operating system", Addision Wesley
- 4. Tannenbaum, "Operating system design and implementation", Phi

## **Computer Networks**

CS355	LTP	Credits
	4 0 2	4

**Introduction:** History & development of computer network, network topologies, ISO reference model.

**Physical layer:** Transmission media, analog transmission, digital transmission, switching multiplexing, FDM, TDM.

MAC layer: Aloha Protocols, LAN—Ethernet, token ring, FDDI, and data link layer.

**Network layer:** Routing algorithms, Congestion Control algorithms, multicast and mobile routing.

**Internetworking:** Bridges, Switches, Repeaters and Routers. **Transport Layer:** Connection Management, Flow control and buffering. **Application Layer:** DNS, SNMP, MAIL, WWW, and FTP. Use of TCP/IP Protocol Suite as running example.

**Books and references:** 

- 1. A. S. Tennanbaum, "Computer Network," 2nd Edition, PHI
- 2. D. E. Comer, "Internetworking with TCP/IP: Principles, Protocols and Architecture," Vol. I, 2<sup>nd</sup> edition, PHI
- 3. D. E Comer and D. L. Stevens, "Internetworking with TCP/IP: Design, Implementation and internals," Vol. II PHI
- 4. L. L. Peterson and B. S. Davie, "Computer Network a System approach," 2nd Edition Morgan Kaufmann, 2002
- 5. W.R Steves, "Unix Networking Programming," PHI

## **Database Management System**

CS456

L	Т	Р	Credits
3	0	4	5

**Introduction:** Data base system concepts and architecture, Data models schema and instances, Data independence and data base language and interface, Data definition languages, DML. Overall data base structure

**Data modeling using Entity Relationship Model:** E.R. model concept, notation for ER diagrams mapping constraints, Keys, Concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model, Relationships of higher degree.

**Relational Data Model and Language:** Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions triggers, foreign key relational algebra, relational calculus, domain and tuple calculus, SQL data definition queries and updates in SQL.

**Example DBMS System (Oracle 8):** Basic architecture data definition and data manipulation, ISQL,PL SQL, cursors, triggers, stored procedures etc.

**Data Base Design:** Functional dependencies, normal forms, first, second and third functional personal normal forms. BCNF, multi-valued dependencies fourth normal forms, join dependencies and fifth normal forms. Inclusion dependencies, loss less join decompositions, normalization using FD, MVD and JDs, alternatives approaches to database design.

Transaction processing concepts: Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule ,Transaction processing in distributed database fragmentation, locking, Protocols for distributed database, recovery from transaction failures, deadlock handling, Long durations transactions, SAGA.

Concurrency Control Techniques: Locking Techniques for concurrency control time stamping protocols for concurrency control, concurrency control in distributed, systems. Estimation of cost and optimization of tuple transfer for join in distributed styles, validation technique, multiple granularity, multiversion schemes.

#### **References:**

- 1. Korth, Silbertz, Sudarshan, "Data base concepts", McGraw-Hill
- 2. Elmasri, Navathe, "Fundamentals of Database systems", Addision Wisley
- 3. Date C.J., "An Introduction to Database systems"
- 4. Ramakrishna, Gehkre, "Database Management System", McGraw-Hill
- 5. Alexion leon," Fundamental of database Management Systems", Vikas

## **Computer Graphics**

S458	LTP	Credits
	3 0 4	5

Line Generation: Points ,lines ,planes, pixels and frame buffers, vector and character generation.

Graphics Primitive: Display device, Primitive devices, display file structure, Display control text.

**Polygon:** Polygon Representation, Entering polygon, filling polygons.

Segments: Segments table, creating deleting and renaming segments, visibility, image transformations.

**Transformations:** Matrices transformation, transformation routines, display procedure.

Windowing and clipping: Viewing transformation and clipping, generalize clipping, multiple windowing.

**Three Dimension:** 3 D geometry primitives, transformations, projection clipping

Interaction: Hardware input devices handling algorithms, Events handling echoing, Interactive techniques.

Hidden Line and surface: Back face removal algorithms, hidden line methods.

Rendering and illumination: Introduction to curve generation, Bezier, Hermite and B-spline algorithms and their comparison.

#### **References:**

- 1. Rogers, "Procedural elements of Computer Graphics ",McGraw hill.
- 2. Asthana, Sinha," Computer Graphics ", Addison Wesley

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- 3. Newman and Sproul, "Principle of interactive Computer Graphics", McGraw Hill.
- 4. Steven Harrington, "Computer Graphics, A programming Approach" second Edition.
- 5. Rogar and Adams,"Mathematical Elemants of Computer Graphics", Mcgraw Hill

## Web Technology

CS561

L T P Credits 3 0 4 5

This is an introductory course into the key technology utilized on the World Wide Web. It introduces the learner to HTML & Web Page design, programming in JavaScript, client vs. server side computing, VBScript/ASP, Perl, multimedia web pages, and web servers.

#### **Books And References:**

1. by Harvey M. Deitel, Paul J. Deitel and T. R. Nieto, "Internet & World Wide Web How to Program, 2nd edition," Prentice Hall, ISBN #: 0130308978 Patrick Carey, "Creating Web Pages with HTML, 3rd Edition," ISBN #: 0619101148

## **Distributed Systems**

CS562

L	Т	Р	Credits
3	0	2	4

Distributed System Concepts, Communication, Distributed Models, Invocation Semantics, Remote Procedure Calls, Naming, File System, Security, Concurrency control and recovery, local area network, distributed languages and communication primitives, case studies of distributed systems.

#### **Books and References:**

- 1. G. Couloris, "Distributed System, Concept & Design," Addison Wesley 1994.
- Tanenbaum, "Distributed Systems," PHI
  P. K. Sinha, "Distributed Operating Systems," PHI.

## Software Engineering

#### **CS567**

L T P Credits 3 0 2 4

Introduction: Introduction to software engineering, Importance of software, The Software characteristics, Software components, Software evolution, Software applications, Crisis-Problem and causes.

Software development life-cycle: Requirement analysis, software design, coding, testing and maintenance etc.

Software requirement Specification: Water fall model, prototyping interactive enhancement, spiral model role of management in software development, role of matrices and measurement, Problem analysis, requirement specification, validation, matrices, monitoring and control.

System Design: Problem partitioning, abstraction, top down and bottom up design, structured approach, functional versus object oriented approach, design specification and verification matrices, monitoring and control, Cohesiveness, coupling, 4 GL.

Coding: TOP-DOWN and BOTTOM-UP structure programming, information hiding, programming style, and internal documentation, verification, metrics, monitoring and control.

Testing: levels of testing, functional testing, structural testing, test plane, test class specification, reliability assessment, Software testing strategies, Verification and validation, Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging.

Software project Management: Cost estimation, project scheduling, staffing, software configuration management, structured Vs unstructured maintenance, quality assurance, project monitoring, risk management.

Function oriented and object oriented Software design: Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to real time systems, Object oriented design, Graphical representation of OOD, Generic OO development paradigm.

Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability growth modeling, Software quality, ISO 9000 certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM

## **Compiler Design**

L T P Credits 3 0 0 3

Introduction: Definition, functions of Compiler in Linux / Unix / TC etc environments, other associated terms e.g. Text formatter, Text Editors, Phases and Passes, FSM & RE's and their application to Lexical Analysis, Implementation of

Lexical Analyzers, Lexical- Analyzer Generator, Lex – Compiler, Formal Grammar and their application to Syntax Analysis, BNF Notation, YACC.

The Syntactic specification of Languages: CFG, Derivation and Parse Trees, Capabilities of CFG.

**Basic Parsing Techniques:** Parsers, Shift Reduce Parsing, Operator precedence parsing, top down Parsing, Predictive Parsers.

Automatic Construction of efficient Parsers: LR Parsers, the canonical collection of LR(0) items, constructing SLR Parsing Tables, Constructing canonical LR Parsing tables and LALR parsing tables, An Automatic Parser Generator, Implementation of LR parsing Tables, Constructing LALR sets of items.

**Syntax Directed Translation:** Syntax directed Translation Schemes, Implementation of Syntax directed translators, Intermediate Code, Postfix notation, Parse Trees and Syntax Trees, Three address Code, Quadruple & Triples, Translation of Assignment Statements, Boolean expressions, Control Statements, Postfix Translation, Translation with a Top Down Parser, Array references in Arithmetic expressions, Procedure Calls, Declarations and Case statements Translations.

**Symbol Tables:** Data Structure for Symbol Tables, representing scope information. Run Time Administration: Implementation of simple Stack allocation scheme, storage allocation in block structured language.

Error detection and Recovery: Lexical phase errors, syntax phase errors, semantic errors

**Code Optimization:** Loop optimization, the DAG representation of basic blocks, value numbers and Algebraic Laws, Global Data – Flow Analysis.

#### **Books and References:**

- 1. Aho,Ullman & Sethi, "Compiler Design", Addison Wesley
- 2. D.M.Dhamdhere, "Compiler Construction Principles & Practice", Macmillan India Ltd. Holub, "Compiler Design in C", PHI.

## **Multimedia Systems**

#### **CS568**

L T P Credits 3 0 0 3

Introduction to Multimedia, Multimedia Objects, Multimedia in business and work. Multimedia hardware, Memory & Storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modeling. Finite Context Modeling, Dictionary

based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.

Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.

Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file formatic animations Images standards, JPEG Compression, Zig Zag Coding.

Video representation, Colors, Video Compression, MPEG standards, MHEG Standard recent development in Multimedia.

#### **Books & References :**

- 1. Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill.
- 2. Buford "Multimedia Systems" Addison Wesley.
- 3. Agrawal & Tiwari "Multimedia Systems" Excel.
- 4. Mark Nelson "Data Compression Book" BPB.
- 5. David Hillman "Multimedia technology and Applications" Galgotia Publications.
- 6. Rosch "Multimedia Bible" Sams Publishing.
- 7. Sleinreitz "Multimedia System" Addison Wesley.
- 8. James E Skuman "Multimedia in Action" Vikas.

## **Distributed Database Systems**

#### **CS569**

#### L T P Credits 3 0 0 3

Distributed and parallel databases concepts – autonomy, distribution, and heterogeneity. Client/server, parallel and distributed architectures. Design strategies. Horizontal, vertical and hybrid fragmentation. Resource allocation. Transaction model, serialization and recovery. Concurrency control, Deadlock management and Distributed deadlock, reliability and availability, load balancing, Schema translation & Integration, multi databases and multi-dimensional indices.

Books and References

 Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan. "Database Systems Concepts, 4/e.," McGraw-Hill Publishers. Copyright 2001. ISBN 0-07-228363-7. Ozsu, M. Tamer and Patrick Valduriez' "Principles of Distributed Database Systems, 2/e," Prentice Hall Publishers. Copyright 1999. ISBN 0-13-659707-6.

## **Real Time Systems**

#### CS572

L T P Credits 3 0 0 3

**Introduction:** Concept of Real Time System, Issues in real time computing, Performance measures of Real Time System, Issues in Real Time Computing, Performance measures of Real time Systems, Real Time Application.

**Task Assignment and Scheduling:** Different task model, Scheduling hierarchy, offline vs Online Scheduling, Clock Drives.

**Model of Real Time System:** Processor, resources, temporal parameter, Periodic Task Model, Sporadic Task Model, Precedence Constraints and Data Dependencies, Scheduling hierarchy

**Scheduling of Periodic Task:** Assumptions, fixed versus dynamic priority algorithms, schedulability test for fixed priority task with arbitrary deadlines.

**Scheduling of Aperiodic and Sporadic Tasks:** Assumptions and approaches, deferrable, sporadic servers, slack stealing in deadline driven and fixed priority systems. Two level scheme for integrated scheduling, Scheduling for applications having flexible constrains.

**Resources and Resource Access Control:** Assumptions on resources and their usage, resource contention, resource access control(Priority Ceiling Protocol, Priority Inheritance protocol, Slack Based Priority Ceiling Protocol, Peremption Ceiling Protocol).

**Multi Processor Scheduling:** Model of multi processor and distributed systems, Scheduling algorithms for end to end periodic tasks in homogeneous/heterogeneous systems, Predictability and validation of dynamic multiprocessor system.

**Real time Communication:** Model of real time Communication, Priority base service For switched network, Weighted Round Robin Service, Medium access Control Protocol, Real Time Protocol.

#### **Books and References:**

- 1. Jane .W. S. Liu "Real Time Systems" Pearson Education.
- 2. Krishna .C.M "Real Time Systems" Mc-Graw Hill Publication.

## **Mobile Computing**

54	L	Т	Р	Credits
	3	0	0	3

Issues in Mobile Computing, Overview of wireless Telephony, IEEE 802.11 & Blue Tooth, Wireless Multiple access protocols, channel Allocation in cellular systems.

Data Management Issues, data replication for mobile computers, adaptive Clustering for Mobile Wireless networks.

Distributed location Management, pointer forwarding strategies, Energy Efficient Indexing on air, Energy Indexing for wireless broadcast data, Mobile IP, TCP Over wireless.

Mobile Agents Computing, Security and fault tolerance, transaction processing in Mobile computing environment.

Ad hoc network, Routing Protocol, Global State Routing (GSR), Dynamic State Routing (DSR), Fisheye State Routing (FSR), Ad hoc On-Demand Distance Vector (AODV), Destination Sequenced Distance – Vector Routing (DSDV).

#### **Data Mining and Ware Housing**

#### **CS573**

L	Т	Р	Credits
3	0	0	3

**Foundation:** Introduction to DATA Warehousing. Client/Server Computing model & Data Warehousing. Parallel processors & Cluster Systems. Distributed DBMS implementations. Client/Server RDBMS Solutions.

**Data Warehousing:** Data Warehousing Components. Building a Data Warehouse. Mapping the Data Warehousing to a Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, cleanup & Transformation Tools. Metadata.

**Business Analysis:** Reporting & Query Tools & Applications. On line Analytical Processing (OLAP). Patterns & Models. Statistics. Artificial Intelligence.

**Data Mining:** Introduction to Data Mining. Decision Trees. Neural Networks. Nearest Neighbor & Clustering. Genetic Algorithms. Rule Induction. Selecting & Using the Right Technique.

Data visualization & Overall Perspective. Data Visualization. Putting it All Together.

Appendices: A : Data Visualization. B : Big Data-Better Returns : Leveraging Your Hidden Data Assets to Improve ROI. C : Dr. E.F. Codd's 12 Guidelines for OLAP. D : Mistakes for Data warehousing Managers to Avoid.

#### **Books and References :**

- 1. Berson, "Data Warehousing, Data Mining & OLAP".
- 2. Mallach, "Data Warehousing System", (McGraw Hill).

## **Operation Research**

#### **CS465**

L T P Credits 3 0 0 3

**Introduction:** History of operations research, Nature and Scope of operations research. Allocation, assignment and Transportation models, Construction and solution of these Models.

Linear Programming: Introduction, Mathematical formulation of the problem, Graphical Solution methods, Mathematical solution of linear programming problem, Slack, and Surplus variables. Matrix formulation of general linear programming Problem.

The Simplex Method: Fundamental properties to solution corroboration of extreme points Simplex algorithm, Computational procedures, Artificial variables, two phase simplex

Method, Formulation of linear programming problems and its solution by simplex method. Unrestricted variables, problems of degeneracy, Principle of duality in simplex method, Formation of dual with mixed type of constraints. Solution of primal and dual (Solution of dual constraints, Solution of primal also) Sensitivity Analysis.

Integer Programming: Formulation and solution of Integer Programming Problem.

Game Theory: Introduction, Two persons zero sum games, The maxmini and minimax principles.

Graphical Solution: Reduction of game problem to LPP, the transportation problem, matrix form of transportation problem, Initial basic feasible solution, Selecting the entering variables, Selecting the leaving variables, Transportation algorithm, Degeneracy in transportation Problem, Inventory Control.

#### **Books and References:**

- 1. Operation Research, Theory and Application by J.K. Sharma, Macmillan India
- 2. Quantitative techniques in Management by N.D.Vohra, TMH
- 3. Linear Programming by N.P. Loomba
- 4. Operation Research: An Introduction by H.A. Taha, PHI

## **E-Commerce**

S461	L	Т	Р	Credits
	3	0	0	3

Introduction: What is E-Commerce, Forces behind E-Commerce, E-Commerce Industry Framework, and Brief History of E-Commerce.

Inter Organizational E-Commerce, Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework

#### C

Network Infrastructure for E-Commerce, Market forces behind I-way, Component of I Way, Access Equipment, Global Information Distribution Network, Broadband Telecommunication.

Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices.

Introduction to Web Security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, Firewalls & Network Security.

World Wide Web & Security, Encryption, Transaction security, Secret Key Encryption, Public Key Encryption, Virtual Private Network (VPM), Implementation Management Issues.

Overview of Electronics payment, Digital Token based Electronics Payment System, Smart Cards, Credit Card/Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.

EDI, EDI Application in Business, Legal requirement in E-Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

#### **References** :

- 1. Greenstein and Feinman "E-Commerce" TMH.
- 2. Ravi Kalakota, Andrew Whinston "Frontiers of Electronic Commerce" Addision Wesley.
- 3. Denial Amor "The E-Business Revolution" Addision Wesley.
- 4. Sokol "From EDI to E-Commerce: A Business Initiative" TMH.
- 5. Diwan, Sharma "E-Commerce" Excel.
- 6. Asset International "Net Commerce" TMH.
- 7. Bajaj and Nag "E-Commerce: The cutting edge of business" TMH.

## **Artificial Intelligence**

#### **CS466**

L	Т	Р	Credits
3	0	0	3

**Introduction :** Introduction to Artificial Intelligence, Simulation of sophisticated & Intelligent Behaviour in different area, problem solving in games, natural language, automated reasoning, visual perception, heuristic algorithm versus solution guaranteed algorithms.

Understanding Natural Languages: Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammars, Shanks Conceptual Dependency, grammar free analyzers, sentence generation, and translation.

Knowledge Representation: First order predicate calculus, Horn Clauses, Introduction to PROLOG, Semantic Nets Partitioned Nets, Minskey frames, Case Grammar Theory, Production Rules Knowledge Base, The Interface System, Forward & Backward Deduction.

Expert System: Existing Systems (DENDRAL, MYCIN), domain exploration, Meta Knowledge, Expertise Transfer, Self Explaining System.

Pattern Recognition: Introduction to Pattern Recognition, Structured Description, Symbolic Description, Machine perception, Line Finding, Interception, Semantic & Model, Object Identification, Speech Recognition.

**Programming Language:** Introduction to programming Language, LISP, PROLOG

#### **References** :

- 1. Char nick "Introduction to Artificial Intelligence", Addision Wesley.
- 2. Rich & Knight, "Artificial Intelligence".
- 3. Winston, "LISP", Addison Wesley.
- 4. Marcellous, "Expert Systems Programming", PHI.
- 5. Elamie, "Artificial Intelligence", Academic Press.
- 6. Lioyed, "Foundation of Logic Programming", Springer Verlag.

## **Simulation and Modeling**

## LTP

#### 3 0 0 3

Credits

Basic Simulation Modeling: The Nature of Simulation Systems, Models, and Simulation Discrete-Event Simulation Simulation of a Single-Server Queueing Alternative Approaches to Modeling and Coding Simulations, Parallel and Distributed Simulation ,Simulation across the Internet and Web-Based Simulation ,Steps in a Sound Simulation Study ,Other Types of Simulation : Continuous Simulation ,Combined Discrete-Continuous Simulation Monte Carlo Simulation. Advantages, Disadvantages, and Pitfalls of Simulation

Modeling Complex Systems : Introduction, List Processing in Simulation, Approaches to Storing Lists in a Computer Linked Storage Allocation, A Simple Simulation Language: simlib. Single-Server Queueing Simulation with simlib Time-Shared Computer Model Job-Shop Model Efficient Event-List Manipulation

Simulation Software : Comparison of Simulation Packages with Programming Languages Classification of Simulation Software General-Purpose Simulation Packages **Object-Oriented Simulation** 

Building Valid, Credible, and Appropriately Detailed Simulation Models Experimental Design, Sensitivity Analysis, and Optimization Simulation of Manufacturing Systems.

#### **Reference Books:**

1. Simulation Modeling and Analysis Third Edition By Law Kelton (Mc-Graw Hill)

## Cryptography & Network Security

CS467

L	Т	Р	Credits
3	0	0	3

Introduction to Security attacks, services And mechanisms, Introduction to cryptology. Conventional Encryption model, classical encryption techniques-substitution ciphers & transposition ciphers, cryptanalysis, stereography, stream & block ciphers.

**Modern Block ciphers:** Block Ciphers principles, Shandars (DES), Strength of DES, Differential & Linear Cryptanalysis of DES, Block cipher model of operation, triple DES, IDEA encryption & decryption, Strength of IDES, Confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

**Principles of Public Key Cryptography**: principle of public key cryptography, prime and relative prime numbers, modular arithmetic, PSA algorithm, security of RSA key management.

Authentication recruitments, Authentications functions, and Message Authentication codes, Digital Signatures, authentication protocols Digital signatures Standard (DES), proof of digital signatures algorithm.

**Electronics mail security:** pretty good privacy (PGP), S/MIME IP security: IP security overview, architecture, Authentication header, encapsulating security payloads, combining security association, key management.

**Web security:** security socket layer & transport layer security, secure electronic transaction (SET)

System security: intruders, viruses and related threads, firewall design principles.

#### **Books and References:**

- 1. William Stalling "Cryptography and networks security: Principles and Practice," Prentice Hall, New jersey,
- 2. Johannes A Buchmann, "Introduction to cryptography," Spiringer-verlag
- 3. Bruce Schiener, "Applied Cryptography".