Course Structures & Syllabi
for

B.Sc. (Hons.) Program in Computer Science
M.Sc. in Computer Science Program
MCA in Computer Applications Program

OLD SYLLABUS(Academic session 2011-12 to 2015-16)

Department of Computer Science
Institute of Science
Banaras Hindu University

Course Structure

for

B.Sc. (Hons.) Program in Computer Science

(A SIX SEMESTER Course)

w.e.f. July 2012

Offered By:

Department of Computer Science
Faculty of Science
Banaras Hindu University

B.Sc. (Hons.) Computer Science Syllabus

Department of Computer Science
Faculty of Science
Banaras Hindu University

Semester-wise Distribution of Courses and Credits

SEMESTER I		
Course Code	***Course Title***	***Credits***
BCS 101	Introduction to Computer Programming through C	4
BCS 102	*Lab. Exercises based on course BCS 101*	2
	Total	***6***
SEMESTER II		
BCS 201	Digital Logic and Circuits	4
BCS 202	*Basic Linux lab*	2
BCS 203A	Fundamentals of Computers	2
	Total	***8***
SEMESTER III		
BCS 301	Numerical Computing	4
BCS 302	*Lab. Exercises based on course BCS 301*	2
	Total	***6***
SEMESTER IV		
BCS 401	Computer Organization and Architecture	4
BCS 402	*Lab. Exercises based on course BCS 401*	2
BCS 403A	Fundamental of Computing	2
	Total	***8***
SEMESTER V		
BCS 501	Net Centric Computing	4
BCS 502	Operating System Concepts	4
BCS 503	Discrete Mathematical Structures	4
BCS 504(A-C)	Any one of the following Major Elective Course: A: System Analysis and Design B: Operation Research C: Graph Theory and Combinatorics	4
BCS 505	*Web Design Lab*	3
BCS 506	*Lab. Exercises based on course BCS502*	3
	Total	***22***
SEMESTER VI		
BCS 601	Database Management Systems	4
BCS 602	Data Structures	4
BCS 603	*Lab. Exercises based on course BCS601*	3
BCS 604	*Lab. Exercises based on course BCS602*	3
BCS 605	*Project*	8
	Total	***22***
	Grand Total	***72***

Detailed Curriculum

B.Sc. (Hons.) Computer Science-SEMESTER I

BCS101	Introduction to Computer Programming through C	*Credits: 4*

Basic Programming Concepts: Problem solving steps using Computer.

Introduction to Programming Language C: Overview of C language, Lexical elements of C-Data Types, managing input/output operations, Operators and Hierarchy of Operations, Expressions in C, Decision Making and Repetitive Statements, break, continue, Array, Pointers, dynamic memory allocation, String handling, Functions: User Defined Functions and Library Functions, Parameter Passing, Storage Classes, enumerated data types, Command line arguments, C Preprocessors, Union & Structures, File handling in C.

Suggested Readings:

1. B.W. Kernighan and D.M.Ritchie, the C Programming Language, PHI.
2. R.C. Hutchinson and S.B. Just, Programming using the C Language, McGraw-Hill.
3. B.S. Gottfried, Schaum's Outline of Theory and Problems of Programming with C, McGraw-Hill.
4. H. Schildt, C Made Easy, Osborne McGraw-Hill.
5. Y. Kanetkar, Let Us C, BPB Publications.

BCS102	*Lab. Exercises based on course BCS101*	*Credits: 2*

Programming exercises based on course BCS101.

B.Sc. (Hons.) Computer Science-SEMESTER II

BCS201	Digital Logic and Circuits	*Credits: 4*

Number System: Binary, Octal, and Hexadecimal numbers; Fixed and Floating Point Number Representations, number base conversion, Complements, Binary Arithmetic: Addition, Subtraction, Multiplication and Division, Binary Codes.

Boolean algebra and Logic Gates: Introduction to Boolean algebra, laws of Boolean algebra, logic gates, universal logic gates, POS and SOP notations, Canonical logic forms, Logic families.

Simplification of Boolean Functions: Laws of Boolean algebra and K-Maps, Tabulation Method.

Combinational Circuits: Design Procedure of Combinational Circuits, Adders, Subtractors, Code Converters, Magnitude Comparator, Encoder, Decoder, Multiplexer, Demultiplexer, ROM, PLAs, PALs.

Sequential Circuits: Flip-Flops: SR, D, JK, T, Master/Slave F/F, Edge-trigerred F/F, Excitation Tables; Registers, Counters: synchronous and asynchronous, Shift Registers, RAM.

Logic Families: TTL, ECL, E^2L, CMOS, Characteristics of different logic families.

Suggested Readings:

1. M. M. Mano, Digital Logic and Computer Design, PHI.
2. M.M.Mano, Computer System Architecture, PHI.
3. M.M.Mano, Digital Design, Pearson Education.
4. M. M. Mano and C. R. Kime, Logic and Computer Design Fundamentals," 3rd ed., Prentice Hall, 2004.
5. Malvino, Leach, Digital Principles and Applications, McGraw-Hill.
6. V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, PHI, 2006.

7. Thomas C. Bartee, Digital Computer Fundamentals, McGraw-Hill.
8. B. Streetman, Integrated Digital Circuits, PHI

BCS202	***Basic Linux Lab***	***Credits: 2***

Basic Linux commands, vi editor and elementary Shell programming

BCS203A	***Fundamentals of Computers***	***Credits: 2***

Introduction to Computer, Computer Generation and Classification, Computer System Hardware, Computer Memory and Storage Devices, Random Access Memory, Read Only Memory, Serial Access Memory, Input and Output Devices, Data Representation, Types of Software, Introduction to Operating System: History and Evolution and Main functions, Fundamentals of Database: Purpose and Organization of Database.

Suggested Readings:

1. V. Rajaraman, Fundamentals of Computers, PHI.
2. A. Goel, Computer Fundamentals, PHI.

B.Sc. (Hons.) Computer Science-SEMESTER III

BCS301	**Numerical Computing**	***Credits: 4***

Errors in Computer Arithmetic, Normalization.

Bisection, Falsiposition and Newton-Raphson methods for solution of nonlinear equations. Errors in the solutions, Convergence of Solutions.

Gauss, Gauss-Siedel and Iterative methods for system of linear equations. Ill conditioned system, Pivotal Condensation, Matrix Inversion, Eigen-values, Eigen-vector, Diagonalization of Real Symmetric Matrix by Jacobi's Method.

Introduction to Finite Differences.

Polynomial Interpolation using Newton's and Lagrange's formulae.

Numerical Differentiation: Numerical Integration: Trapezoidal Rule, Simpson's Rule, Weddle's Rule, Gauss Quadrature Formula. Error in numerical Integration.

Numerical Solution of differential Equations: Picards Method, Taylor's Series Method, Euler's Method, Modified Euler's Method, Runge-Kutta Method, Predictor-Corrector Method.

Note: Emphasis is on computational methods

Suggested Readings:

1. V. Rajaraman, Computer Oriented Numerical Methods, PHI.
2. F.Acton, Numerical Methods that Work, Harper and Row.
3. S.D.Conte and C.D.Boor, Elementary Numerical Analysis, McGraw Hill.
4. S S Shastri, ''Introductory Methods of Numerical Analysis'', PHI.
5. C. F. Gerald and P.O. Wheatley Applied Numerical Analysis, Addison Wesley.

BCS302	***Lab. Exercises based on course BCS301***	***Credits: 2***

Programming exercises based on course BCS-301

B.Sc. (Hons.) Computer Science-SEMESTER IV

BCS401	**Computer Organization and Architecture**	***Credits: 4***

Basic Organization: Von Neumann Machine (IAS Computer), Operational flow chart (Fetch, Execute), Instruction Cycle, Organization of Central Processing Unit, Hardwired & micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing modes.

Memory Organization: Memory Hierarchy, Main memory (RAM/ROM chips), Associative memory, Cache memory, Virtual Memory, Memory Management Hardware.

I/O Organization: Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.

Instruction Formats, Op Codes Mnemonics, Data Transfer, Arithmetic, Branch, Loop, Logical, Shift and Rotate Instructions, and String Instructions.

Stacks, Calls, Returns, Near and Far Procedures, Interrupts and their Routines, Directives, Pseudo-ops, Macros and Conditional Machine Instructions, Disk File Handling, Input and Output Instructions, Device Drivers.

Suggested Readings:

1. Y.C. Liu and G.A. Gibson : Microcomputer System – 8086/8088 Family (P.Hall)
2. P. Abel : IBM PC Assembly Language Programming (PHI)
3. M. Thorn : Programming the 8086/8088 (Benjamin)
4. J.P. Hayes, Computer Architecture and Organization, 3rd ed., McGraw Hill.
5. M. M. Mano, Computer System Architecture, PHI.
6. M. M. Mano, Digital Logic and Computer Design (PHI).
7. V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, PHI, 2006.
8. William Stallings, Computer Organization and Architecture: Designing For Performance, Prentice Hall, 2005.

BCS402	***Lab. Exercises based on course BCS401***	***Credits: 2***

Programming exercises based on course BCS401

BCS403A	***Fundamentals of Computing***	***Credits: 2***

Introduction: Characteristics of Computers, Evolution of Computing, Binary Number Systems, Types of Computer Software, Software Development Steps, Types of Programming Languages, Internet Evolution, Basic Internet Terminology, Getting Connected to Internet Applications. Problem Solving Techniques using Computers: Algorithm, Flow Charts, Pseudo code.

Suggested Readings:

1. E Balagurusamy: Computing Fundamentals & C programming, TMH.
2. A.P. Godse and D.A. Godse: Fundamental of Computing and Programming (Technical Publications).

B.Sc. (Hons.) Computer Science-SEMESTER V

BCS501	**Net Centric Computing**	**Credits: 4**

Data Communication and Networking: Background and history of networking and the Internet, Network architectures, Network standards and standardization bodies, The ISO 7-layer reference model in general and its instantiation in TCP/IP; Circuit switching and packet switching, Streams and Datagrams.

Physical layer networking concepts (theoretical basis, transmission media, standards);Data link layer concepts (framing, error control, flow control, protocols); Internetworking and routing

(routing algorithms, internetworking, congestion control); Transport layer services (connection establishment, performance issues).

Applications, Protocols at the application layer; Domain names and name services, Issues for Internet service providers (ISPs), Network Security, Overview of the issues of network management, Quality of service issues: performance, failure recovery, and World Wide Web.

Suggested Readings:

1. Comer, Douglas E. Computer Networks and Internets with Applications, 3/e Prentice Hall 2001.
2. Peterson & Davie *Computer Networks 2nd ed.* Morgan Kaufman 2000.
3. Stallings, William *Data & Computer Communications 7th ed.* Prentice-Hall 2003.
4. Tanenbaum, Andrew *Computer Networks* 4th ed. Prentice-Hall 2002.

BCS502	**Operating System Concepts**	**Credits: 4**

Introduction: Definition, Design Goals, Evolution; Batch processing, Multi-programming, Time sharing; Structure and Functions of Operating System.

Process Management: Process states, State Transitions, Process Control Structure, Context Switching, Process Scheduling, Threads.

Memory Management: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Combined Systems, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing, Working Set Model.

Concurrent Processes: Process Interaction, Shared Data and Critical Section, Mutual Exclusion, Busy form of waiting, Lock and unlock primitives, Synchronization, Classical Problems of Synchronization, Semaphores, Monitors, Conditional Critical Regions, System Deadlock, Wait for Graph, Deadlock Handling Techniques: Prevention, Avoidance, Detection and Recovery.

File and Secondary Storage Management: File Attributes, File Types, File Access Methods, Directory Structure, Allocation Methods, Free Space management; Disk Structure, Logical and Physical View, Disk Head Scheduling, Protection & Security.

Suggested Readings:

1. Silberschatz and Galvin, Operating System Concepts 6/ed, Addison Wesley.
2. William Stalling, Operating Systems: Internals and Design Principles 5/ed, PHI.
3. Tanenbaum, Modern operating Systems, PHI.
4. Peterson and Silberschatz, Operating System Concepts, Addison Wesley.
5. P. B. Hansen, Operating System Principles, PHI.
6. A. N. Haberman, Introduction to Operating System Design, Galgotia.

***B*CS503**	**Discrete Mathematical Structures**	**Credits: 4**

Sets, Relations & Functions: Property of Binary Relations, Equivalence, Compatibility, Partial Ordering Relations, Hasse Diagram, Functions, Inverse Functions, Composition of Functions, Recursive Functions.

Mathematical Logic: Logic Operators, Truth Tables, Theory of Inference and Deduction, Mathematical Calculus, Predicate Calculus, Predicates and Quantifiers.

Boolean Algebra: Truth Values and Truth Tables, The Algebra of Propositional Functions, Boolean Algebra of Truth Values.

Combinatorics & Recurrence Relations: Permutation, Combination, Principle of Inclusion and Exclusion, Recurrence Relations, Generating Functions

Graph theory: Basic Concepts of Graphs and Trees, Adjacency and Incidence Matrices, Spanning Tree, Transitive Closure, Shortest Path, Planar Graphs, Graph Coloring, Eularian and Hamiltonian graphs, Applications of Graph Theoretic Concepts to Computer Science

Suggested Readings:

1. J.P. Trembley and R.P.Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill.
2. Dornhoff and Hohn, Applied Modern Algebra, McMillan.
3. N. Deo, Graph Theory with Applications to Engineering and Computer Science, PHI.
4. R. Johnsonbaugh, Discrete Mathematics, Pearson Education, 2001.
5. R. P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, 1999.
6. C.L. Liu, Elements of Discrete Mathematics, McGraw-Hill.
7. Rosen, Discrete Mathematics, Tata McGraw Hill.

BCS504A	System Analysis and Design	Credits: 4

Introduction to System Software: Software crisis, Software Characteristics, Development life cycle, Specification, Analysis, Design, Implementation and Testing.

Modular top-down analysis, design and testing, Project Feasibility, System Requirements Analysis, Fact Finding Techniques, Data Flow Diagram, Data Dictionary, Decision Tree, Decision Tables, Structured English, Systems Proposal.

System Design, CASE tools for system analysis and design, data modeling and process modeling (data flow diagrams, entity relationship diagrams), traditional and prototyping approaches, Object-Oriented Analysis and Modeling, design and development of relational database systems. I/O design, input validation and user interface design (GUI).

Suggested Readings:

1. Elias M. Awad, Systems Analysis and Design, McGraw-Hill Professional.
2. Jeffery L. Whitten, Lonnie D. Bentley and Kevin C. Dittman, Systems Analysis and Design Methods, McGraw-Hill.
3. Kenneth E. Kendall, Systems Analysis and Design, Pearson Education.
4. Valacich Joseph S., George Joey F., Hoffer Jeffrey A, Essentials of Systems Analysis And Design, Prentice Hall of India.
5. V. Rajaraman, ''System Analysis and Design'', Prentice Hall.
6. J.A. Sern, ''Analysis & Design of Information System'', McGraw Hill.

BCS504B	Operation Research	Credits: 4

Network Analysis: Terminology of network, shortest route problem, minimal spanning tree problem and max-flow problem.

Project Scheduling by PERT, CPM: Diagram, representation, critical path calculation, construction of time chart and resource labeling, probability and cost consideration in project scheduling, project control.

Linear Programming: Simplex method, Revised simplex method, Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems.

Nonlinear Programming: The Kuhn-Tucker Conditions, Quadratic Programming, Convex Programming.

Replacement Models: Introduction, Replacement policies for items whose efficiency deteriorates with time, Replacement policies for items that fail completely.

Sequencing Model: Classification of self problems, processing of n jobs through two machines, three machines, processing of two jobs through m machines.

Suggested Readings:

1. Taha, Operations Research, Macmillan.
2. B.E. Gillet, Introduction to Operations Research, McGraw-Hill.
3. S.S.Rao, Optimization Theory and Applications, Wiley Eastern.
4. G.Hadley, Linear programming, Addison-Wesley.

BCS504C	**Graph Theory and Combinatorics**	**Credits: 4**

Graph Theory: Basic definitions, Trees, cycles, bipartite graphs and other basic concepts. Matchings in bipartite graphs; Hall's theorem and its variants. Euler circuits and Hamilton cycles. Turan's theorem. Planar graphs; the five colour theorem.

Combinatorics: Introduction to Combinatorics, The Pigeonhole Principle, Permutations and Combinations Binomial Identities, combinatorial proofs, binomial and multinomial theorems. The Principle of Inclusion and Exclusion, permutations with forbidden positions, circular permutations with forbidden relations.

Suggested Readings:

1. Richard A. Brualdi, Introductory Combinatorics, Prentice Hall, 4 Edition, 2004.
2. Behzad M. and G. Chartrand, Introduction to the Theory of Graphs. Allyn and Bacon Inc., Boston.
3. G. Chartrand and L. Lesniak, Graphs and Digraphs, Chapman & Hall/CRC, 4 edition, 2004.
4. Bondy J.A. and U.S. R. Murty, Graph Theory with Applications, The Macmillan Press Ltd.
5. Deo Narsingh, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall, India, 1994.
6. Harary F., Graph Theory, Addison-Wesley publishing Co.
7. Swamy M. N. Sand K. Thulasiraman, Graphs, Networks and Algorithms, The wiley Inter-Science publication.
8. Wilson R.J., Introduction to Graph Theory, Addison Wesley; 4th edition, 1996.
9. Peter J. Cameron, Combinatorics: Topics, Techniques, Algorithms, Cambridge University Press, 1995.

BCS505	***Web Design Lab***	**Credits: 3**

Creation of simple static and dynamic web pages using HTML, DHTML, Java Script

BCS506	***Lab. Exercises based on course BCS502***	**Credits: 3**

This practical paper would carry the exercises based on course BCS502

B.Sc. (Hons.) Computer Science- SEMESTER VI

BCS601	**Database Management Systems**	**Credits: 4**

Introduction: Database Systems, View of Data Models, Database Languages, DBMS Architecture, Database Users and Data Independence.

ER Modeling, relation types, role and Structural Constraints, Extended ER Modeling Features, Design of an ER Database Schema, Reduction of ER Schema to Tables.

Relational Model: Relational Model Concepts, Relational Algebra.

Introduction to SQL: SQL data types and literals, Types of SQL commands, SQL operators, Tables, views and indexes, Queries and sub queries, Aggregate functions.

Relational Database Design: Functional and multi-valued Dependencies, Desirable Properties of Decomposition, Normalization up to 3 NF and BCNF.

Selected Database Issues: Security, Transaction Management, Introduction to Query Processing and Query Optimization, Concurrency Control, and Recovery Techniques.

Suggested Readings:

1. C.J.Date, An Introduction to Database Systems, Vol I & II, Addison Wesley.
2. Korth Silberschatz, Data Base System Concepts, 4th ed., McGraw Hill.
3. J.D.Ullman, Principles of Database Systems, Golgotha, New Delhi.
4. Wiederhold, Database Design, McGraw Hill.
5. R. Elmasri, and S.B. Navathe, Fundamentals of Database Systems, Pearson Education Asia.
6. Raghu Ramakrishnan, Database Management Systems, McGraw-Hill Education.

BCS602	**Data Structures**	**Credits: 4**

Basic Data Structures: Arrays, Stacks, Queues, dequeue, Linked Lists, Trees, AVL tree, Priority Queues, and Heap. Basic algorithms for Creation, Manipulation and Applications of Data Structures

Hashing: Hash Functions, Hash Table, and Collision Resolution Techniques.

Algorithmic Complexity: Time-Space Trade-Off, and Asymptotic notations.

Searching Algorithms: Linear Search and Binary Search.

Sorting Algorithms: Selection, Bubble, Insertion, Quick, Merge and Heap Sort

Suggested Readings:

1. Lipshutz, Data Structure, McGraw Hill.
2. Standish, Data Structure, Addison-Wesley.
3. B. Salzberg, File Structures - An Analytic Approach, Prentice-Hall.
4. A.L. Tharp, File Organization and Processing, John Wiley and Sons.
5. A. M. Tennenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, PHI, 1996.
6. S. Lipschutz, Data Structure, Schaum Series.
7. D. E. Knuth, Fundamental Algorithms, Narosa Publication.
8. N. Wirth, Algorithms+Data Structures= Program, Prentice Hall.
9. Robert Lafore, Data Structures and Algorithms in Java, Sams.

BCS603	***Lab. Exercises based on course BCS601***	**Credits: 3**

Programming exercises based on course BCS601

BCS604	***Lab. Exercises based on course BCS602***	**Credits: 3**

Programming exercises based on course BCS602.

BCS605	***Project***	**Credits: 8**

Students will be required to undertake a project work allotted according to their preference subject to the approval of their supervisor. They will have to submit a report on the project work done by them at the end of the semester and the work is evaluated by a panel of examiners.

The End

Course Structure

for

Master of Science (M.Sc.) in Computer Science Program

(A Four Semester Course)

w.e.f. July 2012

OFFERRED BY:

Department of Computer Science
Faculty of Science
Banaras Hindu University

Master of Science (M.Sc.) Computer Science
Department of Computer Science
Faculty of Science
Banaras Hindu University

Semester-wise Distribution of Courses and Credits

SEMESTER I		
Course No.	***Course Title***	***Credits***
MCS 101	Design Methods and Analysis of Algorithms	4
MCS 102	Data Communication and Computer Networks	4
MCS 103	Theory of Computation	4
MCS 104	*Lab. Exercises based on course MCS101*	3
MCS 105	*Lab. Exercises based on course MCS102*	2
MCS 106	Technical Writing and Research Seminar	3
Total		**20**
SEMESTER II		
MCS 201	Compiler Design	4
MCS 202	Computer Graphics	4
MCS 203	Software Engineering	4
MCS 204	*Lab. Exercises based on course MCS201*	3
MCS 205	*Lab. Exercises based on course MCS202*	3
MCS 206M	Introduction to ICT	2
Total		**20**
M.Sc. SEMESTER III		
MCS 301(A-C)	**Major Elective Course I: Any one of the following** A: Parallel Computing B: Internet programming C: Introduction to Cryptography	4
MCS 302(A-C)	**Major Elective Course II: Any one of the following** A: Artificial Intelligence B: Soft Computing Techniques C: Information Retrieval and Web Mining	4
MCS 303(A-G)	**Major Elective Course III: Any one of the following** A: Advanced Computer Architecture B: Design Patterns and Frameworks C: Advanced Database Systems D: Simulation and Modeling E: Operation Research F: Quantum Computing G: Data Mining	4
MCS 304	*Lab. Exercises based on course MCS301(A-C)*	3
MCS 305	*Mini Project*	3
MCS 306M	*Human Computer Interaction*	2
Total		**20**
M.Sc. SEMESTER IV		
MCS 401	Dissertation	16
MCS 402	Comprehensive Viva	04
Total		**20**
Grand Total		**80**

Detailed Curriculum

M.Sc.- SEMESTER I

MCS101	Design Methods and Analysis of Algorithms	Credits: 4

Introduction: Simple Algorithms, Analyzing Algorithms, Asymptotic Notation, Recurrence, and Masters Theorem.

Design Methods: General Consideration, Algorithm design paradigms and representative problems: Divide and Conquer (Binary search, Merge Sort, Quick Sort), Greedy Method (Coin Changing, Minimal Spanning Tree, Shortest Paths, Knapsack), Dynamic Programming (Chained Matrix Multiplication, Shortest Paths), Backtracking (Queens problem), Branch and Bound (0/1 Knapsack problem, Travelling Salesperson), Approximation (Bin Packing), Probabilistic Algorithms (Numerical Integration, Primality Testing).

Intractable Problems: Basic Concepts, Nondeterministic Algorithms, NP Completeness, Cook's Theorem, Fundamentals of NP-Hard and NP-Complete problems.

Suggested Readings:

1. Introduction to Algorithms, Third Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, PHI
2. A.Aho, V. Alfred, J. Hopcroft and J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley.
3. E. Horowitz and S. Sahani, Fundamentals of Computer Algorithms, Galgotia, New Delhi.
4. S.E. Goodman and S.T. Hedetniemi, Introduction to the Design and Analysis of Algorithms, McGraw Hill.
5. G. Brassard and P. Bratley, Algorithmics, PHI.
6. S. K. Basu, Design Methods and Analysis of Algorithms, PHI, 2005.
7. Anany V. Levitin, Introduction to the Design & Analysis of Algorithms, Addison Wesley.

MCS102	Data Communication and Computer Networks	Credits: 4

Introduction: Networks models – OSI model, Internet model.

Physical layer: Signals - Analog, Digital, Digital transmission - Coding, Sampling, Analog Transmission - Modulation of Digital and analog signals, Multiplexing, Switching, Transmission Media.

Data link layer : Error detection and Correction, Data link control and protocol, Point to point access, Multiple access , LANS- Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN's, Connecting LANs - Connecting devices.

Network layer: Internetworking, Addressing, Routing, Networks layer protocols – ARP, RARP, IP, ICMP, Ipv6, Routing- Introduction, Routing Algorithms & Protocols.

Transport layer: UDP, TCP, and Congestion Control.

Application layer protocol: DNS, FTP, HTTP, WWW, Network Management Protocol, Internet Security.

Suggested Readings:

1. W.Stallings, Data and Computer Communication, McMillan.
2. A.S.Tanenbaum, Computer Networks, PHI.
3. J. Martin, Computer Network and Distributed Data Processing, Prentice Hall.
4. W.Stallings, Local Networks, McMillan.
5. M.Schwertz, Computer Communication Network Design and Analysis, Prentice Hall.
6. B. A. Forouzan, Data Communications and Networking, TMH, 2007.
7. Keshav, An Engineering Approach to Computer Networks, Addison-Wisley.
8. Peterson and Davie, Computer Networks, Morgan and Kaufmann, 2000.

9. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education.

MCS103	Theory of Computation	Credits: 4

Finite Automata, Regular expressions, Regular languages, Deterministic and non-deterministic computations and their equivalence. Properties: closure, decidability, minimality of automata, Pumping Lemma for Regular languages.

Recursive and recursively enumerable sets models: Turing Machines, grammars, recursive functions, their equivalence, Post machines, Minskey's theorem, Church-Turing Thesis, Properties: closure, decidability, undecidability/non-computability, notion of reductions.

Context free languages models: grammars, Pushdown automaton and their equivalences, Pumping Lemma for Context free languages, Properties: closure.

Suggested Readings:

1. J.E.Hopcraft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education
2. Cohen, "Introduction to Computer Theory", John Wiley.
3. M. Sipser, Introduction to Theory of Computation, PWS Publishing Corporation, 1997.
4. J.E. Hopcroft, J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Addison-Wisley.
5. T.C. Martin, Theory of Computation, Tata McGraw-Hill
6. H.R. Lewis, C.H. Papadimitrou, Elements of the Theory of Computation, PHI.

MCS104	*Lab. Exercises based on course MCS101*	Credits: 3

Programming exercises based on course MCS101

MCS105	*Lab. Exercises based on course MCS102*	Credits: 2

Programming exercises based on course MCS102

MCS106	Technical Writing and Research Seminar	Credits: 3

Students will be required to write a paper on a topic approved by the department and to give a presentation based on it. They are also required to undertake an independent study on how to write user manual, research article and project report.

M.Sc.- SEMESTER

MCS201	Compiler Design	Credits: 4

Translators, Various phases of compiler, tool based approach to compiler construction.

Lexical analysis: token, lexeme and patterns, difficulties in lexical analysis, error reporting, implementation, regular definition, transition diagrams, LEX.

Syntax Analysis: top down parsing (recursive descent parsing, predictive parsing), operator precedence parsing, bottom-up parsing (SLR, LALR, Canonical LR), YACC.

Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom-up and top-down evaluation of attributes, L-attributed and S-attributed Definitions.

Type checking: type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

Run time system: storage organization, activation tree, activation record, parameter passing, dynamic storage allocation, symbol table: hashing, linked list, tree structures.

Intermediate code generation: intermediate representation, translation of declarations, assignments, control flow, Boolean expressions and procedure calls, implementation issues.

Code generation: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peephole optimization.

Suggested Readings:

1. Aho, Ullman and Sethi, Principles of Compiler Design, Addison Wesley.
2. J. P. Trembley and P. G. Sorensen, The Theory and Practice of Compiler Writing, McGraw Hill.
3. Holub, Compiler Design in C, PHI.

MCS202	**Computer Graphics**	**Credits: 4**

Introduction to Computer Graphics, Display Technologies, Random and Raster Scan, frame buffer, bit plane, Input Devices, Graphics Standards, Graphics Hardware.

Line and Circle Drawing Algorithms, Scan Conversion, filling algorithms, clipping, Two Dimensional transformations, Homogeneous Coordinates, Rigid Body and Affine transformations, Parallel and perspective projections, vanishing points, viewing transformation, Hidden line removal method, Cubic Spline, Bezier curve, B-Spline Curves, Fractal Curves.

Suggested Readings:

1. Computer Graphics (Principles and Practice) by Foley, van Dam, Feiner and Hughes, Addisen Wesley (Indian Edition)
2. Computer Graphics by D Hearn and P M Baker, Printice Hall of India (Indian Edition).
3. Mathematical Elements for Computer Graphics by D F Rogers.

MCS203	**Software Engineering**	**Credits: 4**

Introduction to Software Engineering: Definition; Software development and life-cycle models, CMM, Software Quality, role of metrics and measurement.

Requirements Analysis and Specification: SRS Building Process, Specification Languages, Validation of SRS, metrics, monitoring and control, Object Oriented analysis.

Software Project Planning: Software Cost Estimation Techniques, Project Scheduling & Tracking, Project Team Standards, software configuration management, management.

Software Design and Implementation: Design Concepts and Notations, Functional & Object Oriented Design Concepts, Design Strategies, Design specification and verification, Metrics, Design Translation Process.

Testing Strategies & Techniques, Debugging, Software Maintenance,

Metrics and Models: Design Metrics, Complexity Metrics, Software Reliability and Availability Models, etc. Software Reengineering, Cleanroom Approach, Software Reuse.

Introduction to IEEE Standards, Case Studies.

Suggested Readings:

1. Pankaj Jalote, ''An Integrated Approach to Software Engineering'', IIIrd Edition, Narosa Publishing House.
2. Waman S. Jawadekar ''Software Engineering: Principles and Practices'', Tata McGraw-Hill.
3. Roger S. Pressman , ''Software Engineering: A Practitioner's approach'', ,McGraw-Hill.
4. Ian Sommerville, ''Software Engineering: Pearson Education.
5. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli ''Fundamentals of Software Engineering'', PHI.
6. S. L. Pfleeger, Software Engineering: Theory and Practice, Pearson Education.

MCS204	***Lab. Exercises based on course MCS201***	**Credits: 3**

Programming exercises based on course MCS201: Compiler Design.

MCS205	*Lab. Exercises based on course MCS202*	Credits: 3

Programming exercises based on course MCS202: Computer Graphics.

MCS206M	*Introduction to ICT*	Credits: 2

Data and Information, Simple model of a computer system – CPU, peripheral devices, Common input and output devices. Types of memory- RAM and ROM- their uses. LAN and WAN – definitions and advantages, Internet – concept, uses, requirements, search engine, WWW, Intranet, E-mail – concept, uses, requirements, advantages, Computer viruses. Application of ICT in day to day life: Education, Business, Health.

Suggested Readings:

1. V.Rajaraman, Fundamentals of Computers, PHI
2. Pannu, Y.A.tomer, ICT4D Information and Communication Technology for Development, I.K. International Publishing House Pvt Ltd.

M.Sc.- SEMESTER III

MCS301A	**Parallel Computing**	Credits: 4

Introduction to Parallel Computing: Supercomputers and grand challenge problems, Modern Parallel Computers, Data Dependence Graph, Data Parallelism, Functional Parallelism, Pipelining and Data Clustering.

Interconnection Networks: Switch Network Topologies, Direct and Indirect Network Topology, Bus, Star, Ring, Mesh, Tree, Binary Tree Network, Hyper Tree Network, Hybrid, Hypercube, Perfect Shuffle Network, Torus and Butterfly Network.

Performance Analysis: Introduction, Execution Time, Speedup, Linear and Superlinear Speedup, Efficacy and Efficiency, Amdahl's Law and Amdahl Effect, Gustafson-Barsis's Law, Minsky's Conjecture, The Karp-Flatt Metric, The Isoefficiency Metric, Isoefficiency Relation, Cost and Scalability.

Parallel Computational Models: Flynn's Taxonomy, PRAM, EREW, CREW, ERCW, CRCW, Simulating CRCW, CREW & EREW, PRAM algorithms.

Introduction to Parallel Algorithms: Parallel Programming Models, PVM, MPI Paradigms, Parallel Programming Language, Brent's Theorem, Simple parallel programs in MPI environments, Parallel algorithms on network, Addition of Matrices, Multiplication of Matrices.

Suggested Readings:

1. Hwang and Briggs, Computer Architecture and Parallel Processing, McGraw Hill.
2. Crichlow, Introduction to Distributed and Parallel Computing, PHI.
3. M.J.Quinn, Designing Efficient Algorithms for Parallel Computers, McGraw-Hill.
4. V.Rajaraman, Elements of Parallel Computing, Prentice-Hall of India.
5. Joseph JA JA, Introduction to Parallel Algorithms, Addison Wesley.
6. S.G.Akl, The Design and Analysis of Parallel Algorithms, PHI.
7. Shashi Kumar M et al. Introduction to Parallel Processing, PHI New Delhi.

MCS302B	**Internet Programming**	Credits: 4

History of the Internet and World Wide Web,

Introduction to JAVA Scripts Object Based Scripting for the web, Structures – Functions – Arrays – Objects.

DYNAMIC HTML: Introduction – Object refers, Collectors all and Children. Dynamic style, Dynamic position, frames, navigator, Event Model – On check – On load – Onenor – Mouse rel – Form process – Event Bubblers – Filters – Transport with the Filter – Creating Images – Adding shadows – Creating Gradients – Creating Motion with Blur – Data Binding – Simple Data Binding – Moving with a record set – Sorting table data – Binding of an Image and table. Client Side Scripting and Server side Scripting – Accessing Web servers – IIS – Apache web server.

SQL – ASP – Working of ASP – Objects – File System Objects – Session tracking and cookies – ADO – Access a Database from ASP – Server side Active-X Components – Web Resources – XML – Structure in Data – Name spaces – DTD – Vocabularies – DOM methods.

Introduction Servlet Overview Architecture – Handling HTTP Request – Get and post request – redirecting request – multi-tier applications – JSP – Overview – Objects – scripting – Standard Actions – Directives.

Suggested Readings:

1. Deitel, Deitel and Nieto, "Internet and World Wide Web How to program", Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2002
3. R. Krishnamoorthy & S. Prabhu, "Internet and Java Programming", New Age International Publishers, 2004.
4. Thomno A. Powell, "The Complete Reference HTML and XHTML", fourth edition, Tata McGraw Hill, 2003.
5. Naughton, "The Complete Reference – Java2", Tata McGraw-Hill, 3rd edition, 1999.

MCS301C	Introduction to Cryptography	Credits: 4

Introduction to Cryptography: Introduction To Security: Attacks, Services & Mechanisms, Security, Attacks, Security Services.

Conventional Encryption: Classical Techniques, Conventional Encryption Model, and Steganography, Classical Encryption Techniques.

Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, International Data Encryption Algorithm, Random Number Generation, Placement of Encryption Function.

Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, Key Management,

Hash Functions: Message Authentication & Hash Functions, Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Secure Hash Algorithm (SHA), Digital Signatures.

Suggested Readings:

1. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, Second E/d, John Wiley & Sons, 1996.
2. William Stallings, Cryptography and Network Security: Principles and Practice, Second Edition, Prentice Hall, 1998.
3. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag.
4. A. J. Menezes, P. C. van Oorshot and S. A. Vanstone: Handbook of Applied Cryptography, CRC Press.
5. Shafi Goldwasser, Mihir Bellare, Lecture Notes on Cryptography. www.cse.ucsd.edu/~mihir/papers/gb.html
6. O. Goldreich, Foundations of Cryptography: Basic Tools, Cambridge University Press.

MCS302A	Artificial Intelligence	Credits: 4

Introduction: Definitions and Approaches, History of AI, Concept of Intelligent Agents.

AI Problem Solving: Problem solving as state space search, production system, control strategies and problem characteristics; Search techniques: Breadth First and Depth-first, Hill-climbing, Heuristics, Best-First Search, A* algorithm, Problem reduction and AO* algorithm, Constraints satisfaction, Means Ends Analysis, Game Playing.

Knowledge Representation and Reasoning: Predicate and prepositional logic, Resolution, Unification, Deduction and theorem proving, Question answering; Forward versus backward reasoning, Matching, Indexing, Semantic Net, Frames, Conceptual Dependencies and Scripts.

Applications: Introduction to Natural Language Processing and Expert System.

Suggested Readings:

1. S. Russel, P. Norvig, Artificial Intelligence: A Modern Approach, Pearson Education.
2. E. Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill.
3. N.J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann.

MCS302B	Soft Computing Techniques	Credits: 4

Introduction to Genetic Algorithm, Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues.

Neural Model and Network Architectures, Perceptron Learning, Supervised Hebbian Learning, Backpropagation, Associative Learning, Competitive Networks, Hopfield Network, Computing with Neural Nets.

Introduction to Fuzzy Sets, Basic Operations on Fuzzy sets, Fuzzy Relations, Fuzzy Measures and Fuzzy Decision Making.

Suggested Readings:

1. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall.
2. D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley.
3. Z. Michalewicz, Genetic Algorithms+Data Structures = Evolution Programs, Springer-Verlag.
4. N.K. Sinha & M. M. Gupta(Eds), Soft Computing & Intelligent Systems: Theory & Applications, Academic Press, 2000.
5. M.T. Hagan, H. B. Demuth, And M. Beale, Neural Network Design, Thompson Learning, 1996.
6. C. Lau (Ed), Neural Networks, IEEE Press.
7. J. Freeman and D. Skapura, Neural Networks: Algorithms, Applications, and Programming Techniques, Addison-Wesley.
8. G. J. Klir and T. A. Folger, Fuzzy Sets, Uncertainty, and Information, PHI.
9. G. J. Klir, and B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice-Hall, 1995.
10. H. J. Zimmerman, Fuzzy Set Theory and Its Applications, Kluwer Academic Press.

MCS302C	Information Retrieval and Web Mining	Credits: 4

Information Retrieval Concepts and Models, Introduction to World Wide Web, Hypertext Data, Search Engines, Crawling the Web.

Indexing and Search: Boolean Queries and Inverted Index, Relevance ranking, Similarity search, Web directories, Combining Searching with Browsing, Meta-searchers, Dynamic Search and Software Agents.

Clustering and Classification, Social, Semantic Web.

Suggested Readings:

1. Baeza-Yates, R. and Ribeiro-Neto, B., Modern Information Retrieval. Pearson Education 1999.
2. Chakrabarti, S., Mining the Web, Morgan Kaufmann (An Imprint of Elsevier) 2005.
3. Grossman, D. A. and Frieder, O., Information Retrieval: Algorithms and Heuristics. Kluwer 1998.

MCS303A	Advanced Computer Architecture	Credits: 4

Architectural Abstraction, Classification schemes, Parallelism: Pipelining, Multiprocessing. Issues in Branch performance, Synchronization in Multiprocessing, High Performance Processor Design Issues: Pipeline design, Memory system design, I/O design.

Instruction level parallelism, Thread and process level parallelism, Data parallelism.

Vector machines, Dependency Analysis, Vectorization, Optimization in Vector Processing, Vector Chaining, Example systems. Associative Processors and Algorithms

Super-scalar and VLIW processors, Example systems and main issues in design.

Multiprocessors: Shared Memory, Distributed Memory Architectures; Multiprocessor Interconnections,

Memory systems for Multiprocessors, Example systems; Cache Memory, coherence issues, protocols.

Multiprocessor Simulation and Measurement.

Suggested Readings:

1. D. Sima, T. Fountain, P. Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 1997.
2. .J. Flynn, "Computer Architecture: Pipelined and Parallel Processor Design", Narosa Publishing House/ Jones
3. K. Hwang, ‘‘Advanced Computer Architecture: Parallelism, Scalability, Programmability’’, McGraw-Hill, Inc
4. Hwang and Briggs, ‘‘Computer Architecture and Parallel Processing, McGraw Hill.
5. B. Barnes, Modeling and Performance Measurement of Computer Systems, MIT Press.

MCS303B	Design Patterns and Frameworks	Credits: 4

Design patterns: basic design patterns, elemental design patterns, Pree’s meta patterns, GOF patterns classification, Creational patterns: Factory method, Behavioural patterns: Strategy, Structural patterns: Composite.

Frameworks: Hot-spots, Hollywood principle, Classification, Class libraries vs. OO Frameworks, Problems, Design issues, Documentation issues, Testing issues, Metrics.

Suggested Readings:

1. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, 1994, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley.
2. Eric Freeman, Elisabeth Freeman, Kathy Siera and Bert Bates, 2004, Head First Design Patterns, O’reilly
3. Elemental Design Pattern, Jason McC. Smith, Addison Wesley Professional
4. Building Application Frameworks: Object-Oriented FoundationsOf Framework Design, Mohamed E. Fayad, Douglas C. Schmidt, Ralph E. Johnson, Wiley, ISBN 0-471-24875-4, 1999.
5. Implementing Application Frameworks: Object-Oriented Frameworks at Work, Mohamed E. Fayad, Douglas C. Schmidt, Ralph E. Johnson, Wiley.
6. Object Oriented Application Framework, Ted G. Lewis, Kurt Schmucker, John Vlissides, Glenn Andert, Paul Calder.
7. Introduction to Developing Object Oriented Frameworks, James Carey and Brent Carlson, 2002

MCS303C	Advanced Database System	Credits: 4

Design Theory for Relational Database: Functional Dependencies, Decomposition of Relation schemes, Normal Forms for Relations. Schemes, Multivalued and other kinds of Dependencies.

Concurrent Operations on the Database: Basic Concepts, A simple Transaction Model, Model with Read and Write-Locks, Read-only, Write-only Model, Concurrency for Hierarchically Structured Items, Protection against Crashes, Optimistic Concurrency Control.

Distributed Systems, Communication in distributed systems, Principles of Distributed Data Bases, Framework for distribution. Translation of global queries into fragment queries. Query optimization and management of distributed transaction. Concurrency control and reliability in distributed databases. Administration of Distributed Data Bases.

Suggested Readings:

1. J.D.Ullman, Principles of Database Systems, Galgotia, New Delhi.
2. S.Ceri, G. Relagatti, Distributed Databases, McGraw-Hill.
3. C. Papadimitriou, The Theory of Database concurrency Control, Computer Science Press.
4. T. Ozsu, P. Valduriez, Principles of Distributed Database Systems, Prentice-Hall.

MCS303D	Simulation and Modeling	Credits: 4

Simulation and its uses, Definition of System, Types of Systems, Simulation Experiments and Field Experiments, Random Number Generators from Uniform and other Continuous and Discrete Distributions, Tests of Randomness and Goodness of Fit.

Modeling Process and Concepts of Mathematical Models, Differential, Partial Differential and Difference Equation Models, Modeling through Graphs, Stochastic Models, Monte-Carlo Integration, Simulation of Single Server System, Inventory System, Time Sharing Computer System, and Ethernet Model. Verification, Validation and Comparison of Real System and Simulation Experiments Data, Variance Reduction Techniques, Simulation Languages: SIMULA, SIMSCRIPT and GPSS.

Suggested Readings:

1. J. A. Payne, Introduction to Simulation, Programming Techniques and Methods of Analysis, Tata McGraw Hill Publishing Co. Ltd.
2. A. M. Law, W. D. Kelton, Simulation Modeling and Analysis, McGraw Hill.
3. M. H. MacDougall, Simulating Computer Systems: Techniques and Tools, The MIT Press Cambridge.
4. Z. A. Klarian, EJ Dudewicz, Modern Statistical Systems and GPSS Simulation, Computer Science Press.
5. G. Gordon, System Simulation, PHI.
6. Narsingh Deo, System Simulation with Digital Computer, PHI.
7. JN Kapoor, Mathematical Modeling, Wiley Eastern Ltd.
8. BP Zeigler, H Praehofer, TG Kim, Theory of Modeling and Simulation-Integrating Discrete Event and Continuous Complex Dynamic Systems, Academic Press 2000.

MCS303E	Operation Research	Credits: 4

Network Analysis: Terminology of network, shortest route problem, minimal spanning tree problem, max-flow problem.

Project Scheduling by PERT, CPM: Diagram, representation, critical path calculation, construction of time chart and resource labeling, probability and cost consideration in project scheduling, project control.

Linear Programming: Simplex Method, Revised simplex method, Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems.

Nonlinear Programming: The Kuhn-Tucker conditions, Quadratic programming, Convex programming.

Replacement Models: Introduction, Replacement policies for items whose efficiency deteriorates with time, Replacement policies for items that fail completely.

Sequencing Model: Classification of self problems, processing of n jobs through two machines, three machines, processing of two jobs through m machines.

Suggested Readings:

1. Taha, Operations Research, Macmillan.
2. B.E. Gillet, Introduction to Operations Research, McGraw-Hill.
3. S.S.Rao, Optimization Theory and Applications, Wiley Eastern.
4. G.Hadley, Linear programming, Addison-Wesley.

MCS303F	Quantum Computing	Credits: 4

Introduction to Quantum Computing, Moore's Law, Limits from Bits to Qubits, Powers of Quantum Computing-Some Algorithms and Applications.

Qubits, Quantum Mechanics and Computer Science Perspectives. Quantum Gates, Applications of Quantum Computing, Shor's Algorithm and Quantum Fourier Transform, Quantum Search Algorithms, Physical Realization of Quantum Computers.

Suggested Readings:

1. Colin P. Williams, Scott H. Clearwater, Explorations in Quantum Computing, Springer.
2. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.
3. Cris Calude, Gheorghe Paun, Computing with Cells and Atoms: An Introduction to Quantum, DNA and Membrane Computing, CRC.
4. Mika Hirvensalo, Quantum Computing, Springer.
5. Dirk Bouwmeester, Artur K. Ekert, Anton Zeilinger, The Physics of Quantum Information: Quantum Cryptography, Quantum Teleportation, Quantum Computation, Springer.
6. J. J. Sakurai, Modern Quantum Mechanics, Addison Wesley

MCS302G	Data Mining	Credits: 4

Data Mining and its importance, Data Mining on kind of data, Data Mining Functionalities: Association Analysis, Classification and Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Major issues in Data Mining, KDD process.

Difference between Data Mining, Data Warehouse, OLAP and DBMS

Data Preprocessing: Data cleaning, Data Integration and Transformation, Data Reduction.

Data Mining Primitives, Architectures of Data Mining Systems.

Mining Association Rules in Large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Database, Mining multilevel association rules from transaction databases, constraint based association mining.

Classification and Prediction: Issues, Classification by Decision Tree induction, Prediction.

Cluster Analysis: types of data in cluster analysis, Methods: Partitioning.

Mining complex Types of Data: Spatial Databases, Multimedia Databases, Time-series and sequence data, Text databases, WWW.

Applications and Trends in Data Mining: Application, Social Impacts.

High Performance Data Mining: PC cluster, MPICH2 cluster, homogeneous and heterogeneous cluster.

Suggested Readings:

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Academic Press, © 2001 by Academic Press.
2. Arun K Pujari, "Data Mining Techniques", Universities Press (India) Ltd., Hyderabad 2001, First Edition.

3. K.P. Soman, Shyam Diwakar and V-Ajay, ''Insight Data Mining, Theory & Practice'', EEE, PHI.
4. Hillol Kargupta, Anupam Joshi, Krishnamoorthy, Sivakumar and Yelena Yesha, ''Data Mining : Next generation challenges and future directions'', AAAI Press copublications.
5. Yike Guo and Robert Grossman, ''High Performance Data Mining, Scaling Algorithms, Applications & Systems'', Kluwer Academic, 2002.
7. Mohammed J. Zaki, Ching-Tien Ho (Eds) , ''Large scale Parallel Data Mining'', Springer, 2000.

MCS304	***Lab. Exercises based on course MCS301(A-C)***	**Credits: 3**

Programming exercises based on course MCS301 (A-C).

MCS305	***Mini Project***	**Credits: 3**

The students are required to undertake an application oriented mini project and submit a report.

MCS306M	***Human Computer Interaction***	**Credits: 2**

Introduction, History of HCI, Aspect of Human Cognition, the Computer, Models of Interaction, HCI frameworks & paradigms, Predictive Evaluation Interpretive Evaluation, Task Analysis, Empirical Evaluation, Gathering Usability Data, Usability principles.

Suggested Readings:

1. Dix, Finlay, Abowd and Beale, ''Human-Computer Interaction'', 3rd edition, by Pearson Education, 2004.
2. John carroll, ''Human-Computer Interaction in the New Millennium'', by Pearson Education, 2002.

M.Sc.- SEMESTER IV

CAM401	**Dissertation**	**Credits: 20**

Students will be required to pursue a dissertation work in industry/academic/ research institution with the departmental approval and in consultation with the internal supervisors. They will have to submit the report on dissertation work at the end of the semester and the work is evaluated by a panel of internal/external experts.

MCS402	**Comprehensive Viva**	**Credits: 4**

A Comprehensive Viva to judge students' overall academic attainments during the program.

The End

Course Structure & Syllabi

for

Master of Computer Application Program(MCA)

(A Six Semester Course)

w.e.f. July 2012

OFFERRED BY:

Department of Computer Science
Faculty of Science
Banaras Hindu University

Master of Computer Application (MCA)

Department of Computer Science,
Faculty of Science, Banaras Hindu University

Semester-wise Distribution of Courses and Credits

MCA SEMESTER I		
Course No.	***Course Title***	***Credits***
MCA 101	Introduction to Computer Programming through C	4
MCA 102	Discrete Mathematical Structures	4
MCA 103	Operating System Concepts	4
MCA 104	Lab. Exercises based on course MCA 101	3
MCA 105	Lab. Exercises based on course MCA 103	3
	Total	**18**
MCA SEMESTER II		
MCA 201	Computer Organization and Architecture	4
MCA 202	Database Management Systems	4
MCA 203	Data Structures	4
MCA 204	Lab. Exercises based on courses MCA 202	3
MCA 205	Lab. Exercises based on course MCA 203	3
MCA 206M	Fundamentals of Computing	2
	Total	**20**
MCA SEMESTER III		
MCA 301	Design Methods and Analysis of Algorithms	4
MCA 302	Data Communication and Computer Networks	4
MCA 303	Theory of Computation	4
MCA 304	Lab. Exercises based on course MCA 301	3
MCA 305	Technical Writing and Research Seminar	3
MCA 306M	Human Computer Interaction	2
	Total	**20**
MCA SEMESTER IV		
MCA 401	Compiler Design	4
MCA 402	Computer Graphics	4
MCA 403	Software Engineering	4
MCA 404	Lab. Exercises based on course MCA 401	3
MCA 405	Lab. Exercises based on course MCA 402	3
MCA 406M	Introduction to ICT	2
	Total	**20**
MCA SEMESTER V		
Course No.	Course Title	Credits
MCA 501(A-C)	Elective Course I: Any one of the following A: Parallel Computing B: Internet programming C: Introduction to Cryptography	4
MCA 502(A-D)	Elective Course II: Any one of the following A: Artificial Intelligence B: Soft Computing Techniques C: Information Retrieval and Web Mining D. Data Mining	4
MCA 503(A-F)	Elective Course III: Any one of the following A: Advanced Computer Architecture B: Design Patterns and Frameworks C: Advanced Database Systems D: Simulation and Modeling E: Operation Research F: Quantum Computing	4
MCA 504	Lab. Exercises based on course MCA501(A-C)	3

MCA 505	Comprehensive Viva	4
MCA 506	Mini Project	3
	Total	**22**
MCA SEMESTER VI		
MCA 601	Dissertation	**20**
	Total	**20**
	Grand Total	**120**

Detailed Curriculum

MCA- SEMESTER I

MCA101	Introduction to Computer Programming through C	Credits: 4

Basic Programming Concepts: Problem solving steps using Computer.

Introduction to Programming Language C: Overview of C language, Lexical elements of C-Data Types, managing input/output operations, Operators and Hierarchy of Operations, Expressions in C, Decision Making and Repetitive Statements, break, continue, Array, Pointers, dynamic memory allocation, String handling, Functions: User Defined Functions and Library Functions, Parameter Passing, Storage Classes, enumerated data types, Command line arguments, C Preprocessors, Union & Structures, File handling in C.

Suggested Readings:

1. B.W. Kernighan and D.M.Ritchie, the C Programming Language, PHI.
2. R.C. Hutchinson and S.B. Just, Programming using the C Language, McGraw-Hill.
3. B.S. Gottfried, Schaum's Outline of Theory and Problems of Programming with C, McGraw-Hill.
4. H. Schildt, C Made Easy, Osborne McGraw-Hill.
5. Y. Kanetkar, Let Us C, BPB Publications.

MCA102	Discrete Mathematical Structures	Credits: 4

Sets, Relations & Functions: Property of binary relations, equivalence, compatibility, partial ordering relations, hasse diagram, functions, inverse functions, composition of functions, recursive functions.

Mathematical Logic: Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and quantifiers.

Boolean Algebra: Truth values and truth tables, the algebra of propositional functions, Boolean algebra of truth values.

Combinatorics & Recurrence Relations: Permutation, Combination, Principle of Inclusion and Exclusion, Recurrence Relations, Generating Functions

Graph theory: Basic Concepts of Graphs and Trees, Adjacency and Incidence Matrices, Spanning Tree, Transitive Closure, Shortest Path, Planar Graphs, Graph Coloring, Eularian and Hamiltonian graphs, Applications of Graph Theoretic Concepts to Computer Science

Suggested Readings:

1. J.P. Trembley and R.P.Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill.
2. Dornhoff and Hohn, Applied Modern Algebra, McMillan.
3. N. Deo, Graph Theory with Applications to Engineering and Computer Science, PHI.
4. R. Johnsonbaugh, Discrete Mathematics, Pearson Education, 2001.
5. R. P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, 1999.
6. C.L. Liu, Elements of Discrete Mathematics, McGraw-Hill.
7. Rosen, Discrete Mathematics, Tata McGraw Hill.

MCA103	Operating System Concepts	Credits: 4

Introduction: Definition, Design Goals, Evolution; Batch processing, Multi-programming, Time sharing; Structure and Functions of Operating System.

Process Management: Process states, State Transitions, Process Control Structure, Context Switching, Process Scheduling, Threads.

Memory Management: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Combined Systems, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing, Working Set Model, Paging.

Concurrent Processes: Process Interaction, Shared Data and Critical Section, Mutual Exclusion, Busy form of waiting, Lock and unlock primitives, Synchronization, Classical Problems of Synchronization, Semaphores, Monitors, Conditional Critical Regions, System Deadlock, Wait for Graph, Deadlock Handling Techniques: Prevention, Avoidance, Detection and Recovery.

File and Secondary Storage Management: File Attributes, File Types, File Access Methods, Directory Structure, Allocation Methods, Free Space management; Disk Structure, Logical and Physical View, Disk Head Scheduling, Protection & Security.

Suggested Readings:

1. Silberschatz and Galvin, Operating System Concepts 6/ed, Addison Wesley.
2. William Stalling, Operating Systems: Internals and Design Principles 5/ed, PHI.
3. Tanenbaum, Modern operating Systems, PHI.
4. Peterson and Silberschatz, Operating System Concepts, Addison Wesley.
5. P. B. Hansen, Operating System Principles, PHI.
6. A. N. Haberman, Introduction to Operating System Design, Galgotia.

MCA104	***Lab. Exercises based on course MCA101***	**Credits: 3**

Programming exercises based on course MCA101.

MCA105	***Lab. Exercises based on course MCA103***	**Credits: 3**

Programming exercises based on course MCA103, Operating System Concepts

MCA- SEMESTER II

MCA201	**Computer Organization and Architecture**	**Credits: 4**

Basic Organization : Von Neumann Machine (IAS Computer), Operational flow chart (Fetch, Execute), Instruction Cycle, Organization of Central Processing Unit, Hardwired & micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing modes.

Memory Organization: Memory Hierarchy, Main memory (RAM/ROM chips), Auxiliary memory, Associative memory, Cache memory, Virtual Memory, Memory Management Hardware, hit/miss ratio.

I/O Organization : Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.

Instruction Formats, Op Codes Mnemonics, Data Transfer, Arithmetic, Branch, Loop, Logical, Shift and Rotate Instructions, String Instructions and Text Processing.

Stacks, Calls, Returns, Near and Far Procedures, Interrupts and Their Routines, Directives, Pseudo-ops, Macros and Conditional Machine Instructions, Disk File Handling, Input and Output Instructions, Device Drivers.

Suggested Readings:

1. Y.C. Liu and G.A. Gibson: Microcomputer System – 8086/8088 Family (P.Hall).
2. P. Abel : IBM PC Assembly Language Programming (PHI).
3. M. Thorn : Programming the 8086/8088 (Benjamin).
4. J.P. Hayes, Computer Architecture and Organization, 3rd ed., McGraw Hill.
5. M. M. Mano, Computer System Architecture, PHI.
6. M. M. Mano, Digital Logic and Computer Design (PHI).
7. V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, PHI, 2006.

8. William Stallings, Computer Organization and Architecture: Designing For Performance, Prentice Hall, 2005.

MCA202	Database Management Systems	Credits: 4

Introduction: Database Systems, View of Data Models, Database Languages, DBMS Architecture, Database Users and Data Independence.

ER Modeling, relation types, role and Structural Constraints, Extended ER Modeling Features, Design of an ER Database Schema, Reduction of ER Schema to Tables.

Relational Model: Relational Model Concepts, Relational Algebra.

Introduction to SQL: SQL data types and literals, Types of SQL commands, SQL operators, Tables, views and indexes, Queries and sub queries, Aggregate functions.

Relational Database Design: Functional and multi-valued Dependencies, Desirable Properties of Decomposition, Normalization up to 3 NF and BCNF.

Selected Database Issues: Security, Transaction Management, Introduction to Query Processing and Query Optimization, Concurrency Control, and Recovery Techniques.

Suggested Readings:

1. C.J.Date, An Introduction to Database Systems, Vol I & II, Addison Wesley.
2. Korth Silberschatz, Data Base System Concepts, 4th ed., McGraw Hill.
3. J.D.Ullman, Principles of Database Systems, Golgotha, New Delhi.
4. Wiederhold, Database Design, McGraw Hill.
5. R. Elmasri, and S.B. Navathe, Fundamentals of Database Systems, Pearson Education Asia.

MCA203	Data Structures	Credits: 4

Basic Data Structures: Arrays, Stacks, Queues, dequeue, Linked Lists, Trees, AVL tree, Priority Queues, and Heap. Basic algorithms for Creation, Manipulation and Applications of Data Structures

Hashing: Hash Functions, Hash Table, and Collision Resolution Techniques.

Algorithmic Complexity: Time-Space trade-off, and Asymptotic notations.

Searching Algorithms: Linear Search and Binary search.

Sorting Algorithms: Selection, Bubble, Insertion, Quick, Merge and Heap Sort

Suggested Readings:

1. Lipshutz, Data Structure, McGraw Hill.
2. Standish, Data Structure, Addison-Wesley.
3. A. M. Tennenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, PHI, 1996.
4. S. Lipschutz, Data Structure, Schaum Series.
5. D. E. Knuth, Fundamental Algorithms, Narosa Publication.
6. N. Wirth, Algorithms+Data Structures= Program, Prentice Hall.
7. Sahni S, data Structures, Algorithms and Applications in C++, Mc Graw- Hill, 2002.
8. Goodrich, M. and Tamassia, R. Data Structures and Algorithms in Java 3ed, John Wiley and Sons, Inc.

MCA204	*Lab. Exercises based on courses MCA202*	Credits: 3

Programming exercises based on course: MCA202.

MCA205	*Lab. Exercises based on course MCA203*	Credits: 3

Programming exercises based on paper: MCA203.

MCA206M	*Fundamentals of Computing*	Credits: 2

Introduction: Characteristics of Computers, Evolution of Computing, Binary Number Systems, Types of Computer Software, Software Development Steps, Types of Programming Languages, Internet Evolution, Basic Internet Terminology, Getting Connected to Internet Applications. Problem Solving Techniques using Computers: Algorithm, Flow Charts, Pseudocode.

Suggested Readings:

1. E Balagurusamy: Computing Fundamentals & C programming, TMH.
2. A.P. Godse and D.A. Godse: Fundamental of Computing and Programming (Technical Publications).

MCA- SEMESTER III

MCA301	Design Methods and Analysis of Algorithms	Credits: 4

Introduction: Simple Algorithms, Analyzing Algorithms, Asymptotic Notation, Recurrence, and Masters Theorem.

Design Methods: General Consideration, Algorithm design paradigms and representative problems: Divide and Conquer (Binary search, Merge Sort, Quick Sort), Greedy Method (Coin Changing, Minimal Spanning Tree, Shortest Paths, Knapsack), Dynamic Programming (Chained Matrix Multiplication, Shortest Paths), Backtracking (Queens problem), Branch and Bound (0/1 Knapsack problem, Travelling Salesperson), Approximation (Bin Packing), Probabilistic Algorithms (Numerical Integration, Primality Testing).

Intractable Problems: Basic Concepts, Nondeterministic Algorithms, NP Completeness, Cook's Theorem, Fundamentals of NP-Hard and NP-Complete problems.

Suggested Readings:

1. Introduction to Algorithms, Third Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, PHI
2. A.Aho, V. Alfred, J. Hopcroft and J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley.
3. E. Horowitz and S. Sahani, Fundamentals of Computer Algorithms, Galgotia, New Delhi.
4. S.E. Goodman and S.T. Hedetniemi, Introduction to the Design and Analysis of Algorithms, McGraw Hill.
5. G. Brassard and P. Bratley, Algorithmics, PHI.
6. S. K. Basu, Design Methods and Analysis of Algorithms, PHI, 2005.
7. Anany V. Levitin, Introduction to the Design & Analysis of Algorithms, Addison Wesley.

MCA302	Data Communication and Computer Networks	Credits: 4

Introduction: Networks models – OSI model, Internet model.

Physical layer: Signals - Analog, Digital, Digital transmission - Coding, Sampling, Analog Transmission - Modulation of Digital and analog signals, Multiplexing, Switching, Transmission Media.

Data link layer : Error detection and Correction, Data link control and protocol, Point to point access, Multiple access , LANS- Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN's, Connecting LANs - Connecting devices.

Network layer: Internetworking, Addressing, Routing, Networks layer protocols – ARP, RARP, IP, ICMP, Ipv6, Routing- Introduction, Routing Algorithms & Protocols.

Transport layer: UDP, TCP, and Congestion Control.

Application layer protocol: DNS, FTP, HTTP, WWW, Network Management Protocol, Internet Security.

Suggested Readings:

1. W.Stallings, Data and Computer Communication, McMillan.
2. A.S.Tanenbaum, Computer Networks, PHI.
3. J. Martin, Computer Network and Distributed Data Processing, Prentice Hall.
4. W.Stallings, Local Networks, McMillan.
5. M.Schwertz, Computer Communication Network Design and Analysis, Prentice Hall.
6. B. A. Forouzan, Data Communications and Networking, TMH, 2007.
7. Keshav, An Engineering Approach to Computer Networks, Addison-Wisley.
8. Peterson and Davie, Computer Networks, Morgan and Kaufmann, 2000.
9. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education.

MCA303	**Theory of Computation**	**Credits: 4**

Finite Automata, Regular expressions, Regular languages, Deterministic and non-deterministic computations and their equivalence. Properties: closure, decidability, minimality of automata, Pumping Lemma for Regular languages.

Recursive and recursively enumerable sets models: Turing Machines, grammars, recursive functions, their equivalence, Post machines, Minskey's theorem, Church-Turing Thesis, Properties: closure, decidability, undecidability/non-computability, notion of reductions.

Context free languages models: grammars, Pushdown automaton and their equivalences, Pumping Lemma for Context free languages, Properties: closure.

Suggested Readings:

1. J.E.Hopcraft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education
2. Cohen, "Introduction to Computer Theory", John Wiley.
3. M. Sipser, Introduction to Theory of Computation, PWS Publishing Corporation, 1997.
4. J.E. Hopcroft, J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Addison-Wisley.
5. T.C. Martin, Theory of Computation, Tata McGraw-Hill
6. H.R. Lewis, C.H. Papadimitrou, Elements of the Theory of Computation, PHI.

MCA304	***Lab. Exercises based on course MCA301***	**Credits: 3**

Programming exercises based on course MCA301

MCA305	**Technical Writing and Research Seminar**	**Credits: 4**

Students will be required to write a paper on a topic approved by the department and to give a presentation based on it. They are also required to undertake an independent study on how to write user manual, research article and project report.

MCA306M	***Human Computer Interaction***	**Credits: 2**

Introduction, History of HCI, Aspect of Human Cognition, the Computer, Models of Interaction, HCI frameworks & paradigms, Predictive Evaluation Interpretive Evaluation, Task Analysis, Empirical Evaluation, Gathering Usability Data, Usability principles.

Suggested Readings:

1. Dix, Finlay, Abowd and Beale, "Human-Computer Interaction", 3rd edition, by Pearson Education, 2004.
2. John carroll, "Human-Computer Interaction in the New Millennium", by Pearson Education, 2002.

MCA401	Compiler Design	Credits: 4

Translators, Various phases of compiler, tool based approach to compiler construction.

Lexical analysis: token, lexeme and patterns, difficulties in lexical analysis, error reporting, implementation, regular definition, transition diagrams, LEX.

Syntax Analysis: top down parsing (recursive descent parsing, predictive parsing), operator precedence parsing, bottom-up parsing (SLR, LALR, Canonical LR), YACC.

Syntax directed definitions: inherited and synthesized attributes, dependency graph, evaluation order, bottom-up and top-down evaluation of attributes, L-attributed and S-attributed Definitions.

Type checking: type system, type expressions, structural and name equivalence of types, type conversion, overloaded functions and operators, polymorphic functions.

Run time system: storage organization, activation tree, activation record, parameter passing, dynamic storage allocation, symbol table: hashing, linked list, tree structures.

Intermediate code generation: intermediate representation, translation of declarations, assignments, control flow, Boolean expressions and procedure calls, implementation issues.

Code generation: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peephole optimization.

Suggested Readings:

1. Aho, Ullman and Sethi, Principles of Compiler Design, Addison Wesley.
2. J. P. Trembley and P. G. Sorensen, The Theory and Practice of Compiler Writing, McGraw Hill.
3. Holub, Compiler Design in C, PHI.

MCA402	Computer Graphics	Credits: 4

Introduction to Computer Graphics, Display Technologies, Random and Raster Scan, frame buffer, bit plane, Input Devices, Graphics Standards, Graphics Hardware.

Line and Circle Drawing Algorithms, Scan Conversion, filling algorithms, clipping, Two Dimensional transformations, Homogeneous Coordinates, Rigid Body and Affine transformations, Parallel and perspective projections, vanishing points, viewing transformation, Hidden line removal method, Cubic Spline, Bezier curve, B-Spline Curves, Fractal Curves.

Suggested Readings:

1. Computer Graphics (Principles and Practice) by Foley, van Dam, Feiner and Hughes, Addisen Wesley (Indian Edition)
2. Computer Graphics by D Hearn and P M Baker, Printice Hall of India (Indian Edition).
3. Mathematical Elements for Computer Graphics by D F Rogers.

MCA403	Software Engineering	Credits: 4

Introduction to Software Engineering: Definition; Software development and life-cycle models, CMM, Software Quality, role of metrics and measurement.

Requirements Analysis and Specification: SRS Building Process, Specification Languages, Validation of SRS, metrics, monitoring and control, Object Oriented analysis.

Software Project Planning: Software Cost Estimation Techniques, Project Scheduling & Tracking, Project Team Standards, software configuration management, management.

Software Design and Implementation: Design Concepts and Notations, Functional & Object Oriented Design Concepts, Design Strategies, Design specification and verification, Metrics, Design Translation Process.

Testing Strategies & Techniques, Debugging, Software Maintenance,

Metrics and Models: Design Metrics, Complexity Metrics, Software Reliability and Availability Models, etc. Software Reengineering, Cleanroom Approach, Software Reuse.

Introduction to IEEE Standards, Case Studies.

Suggested Readings:

1. "An Integrated Approach to Software Engineering", Pankaj Jalote, IIIrd Edition, Narosa Publishing House.
2. "Software Engineering: Principles and Practices", Waman S. Jawadekar, Tata McGraw-Hill.
3. "Software Engineering: A Practitioner's approach", Roger S. Pressman, McGraw-Hill.
4. "Software Engineering:, Ian Sommerville, Pearson Education.
5. "Fundamentals of Software Engineering", Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, PHI.
6. S. L. Pfleeger, Software Engineering: Theory and Practice, Pearson Education.

MCA404	***Lab. Exercises based on course MCA401***	**Credits: 3**

Programming exercises based on course MCA401: Compiler Design.

MCA405	***Lab. Exercises based on course MCA402***	**Credits: 3**

Programming exercises based on course MCA402: Computer Graphics.

MCA406M	***Introduction to ICT***	**Credits: 2**

Data and Information, Simple model of a computer system – CPU, peripheral devices, Common input and output devices. Types of memory- RAM and ROM- their uses. LAN and WAN – definitions and advantages, Internet – concept, uses, requirements, search engine, WWW, Intranet, E-mail – concept, uses, requirements, advantages, Computer viruses. Application of ICT in day to day life: Education, Business, Health.

Suggested Readings:

1. V.Rajaraman, Fundamentals of Computers, PHI
2. Pannu, Y.A.tomer, ICT4D Information and Communication Technology for Development, I.K. International Publishing House Pvt Ltd.

MCA- SEMESTER V

MCA501A	**Parallel Computing**	**Credits: 4**

Introduction to Parallel Computing: Supercomputers and grand challenge problems, Modern Parallel Computers, Data Dependence Graph, Data Parallelism, Functional Parallelism, Pipelining and Data Clustering.

Interconnection Networks: Switch Network Topologies, Direct and Indirect Network Topology, Bus, Star, Ring, Mesh, Tree, Binary Tree Network, Hyper Tree Network, Hybrid, Hypercube, Perfect Shuffle Network, Torus and Butterfly Network.

Performance Analysis: Introduction, Execution Time, Speedup, Linear and Superlinear Speedup, Efficacy and Efficiency, Amdahl's Law and Amdahl Effect, Gustafson-Barsis's Law, Minsky's Conjecture, The Karp-Flatt Metric, The Isoefficiency Metric, Isoefficiency Relation, Cost and Scalability.

Parallel Computational Models: Flynn's Taxonomy, PRAM, EREW, CREW, ERCW, CRCW, Simulating CRCW, CREW & EREW, PRAM algorithms.

Introduction to Parallel Algorithms: Parallel Programming Models, PVM, MPI Paradigms, Parallel Programming Language, Brent's Theorem, Simple parallel programs in MPI environments, Parallel algorithms on network, Addition of Matrices, Multiplication of Matrices.

Suggested Readings:

1. Hwang and Briggs, Computer Architecture and Parallel Processing, McGraw Hill.
2. Crichlow, Introduction to Distributed and Parallel Computing, PHI.
3. M.J.Quinn, Designing Efficient Algorithms for Parallel Computers, McGraw-Hill.
4. V.Rajaraman, Elements of Parallel Computing, Prentice-Hall of India.
5. Joseph JA JA, Introduction to Parallel Algorithms, Addison Wesley.
6. S.G.Akl, The Design and Analysis of Parallel Algorithms, PHI.
7. Shashi Kumar M et al. Introduction to Parallel Processing, PHI New Delhi.

MCA502C	Internet Programming	Credits: 4

History of the Internet and World Wide Web, Introduction to JAVA Scripts – Object Based Scripting for the web. Structures – Functions – Arrays – Objects.

DYNAMIC HTML: Introduction – Object refers, Collectors all and Children. Dynamic style, Dynamic position, frames, navigator, Event Model – On check – On load – Onenor – Mouse rel – Form process – Event Bubblers – Filters – Transport with the Filter – Creating Images – Adding shadows – Creating Gradients – Creating Motion with Blur – Data Binding – Simple Data Binding – Moving with a record set – Sorting table data – Binding of an Image and table.Client Side Scripting and Server side Scripting – Accessing Web servers – IIS – Apache web server.

SQL – ASP – Working of ASP – Objects – File System Objects – Session tracking and cookies – ADO – Access a Database from ASP – Server side Active-X Components – Web Resources – XML – Structure in Data – Name spaces – DTD – Vocabularies – DOM methods.

Introduction – Servlet Overview Architecture – Handling HTTP Request – Get and post request – redirecting request – multi-tier applications – JSP – Overview – Objects – scripting – Standard Actions – Directives.

Suggested Readings:

1. Deitel, Deitel and Nieto, ''Internet and World Wide Web – How to program'', Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, ''Java Network Programming'', O'Reilly Publishers, 2002
3. R. Krishnamoorthy & S. Prabhu, ''Internet and Java Programming'', New Age International Publishers, 2004.
4. Thomno A. Powell, ''The Complete Reference HTML and XHTML'', fourth edition, Tata McGraw Hill, 2003.
5. Naughton, ''The Complete Reference – Java2'', Tata McGraw-Hill, 3rd edition, 1999.

MCA501C	Introduction to Cryptography	Credits: 4

Introduction to Cryptography: Introduction To Security: Attacks, Services & Mechanisms, Security, Attacks, and Security Services.

Conventional Encryption: Classical Techniques, Conventional Encryption Model, and Steganography, Classical Encryption Techniques.

Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, International Data Encryption Algorithm, Random Number Generation, Placement of Encryption Function.

Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, Key Management.

Hash Functions: Message Authentication & Hash Functions, Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Secure Hash Algorithm (SHA), Digital Signatures.

Suggested Readings:

1. Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, Second E/d, John Wiley & Sons, 1996.
2. William Stallings, Cryptography and Network Security: Principles and Practice, Second Edition, Prentice Hall, 1998.
3. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag.
4. A. J. Menezes, P. C. van Oorshot and S. A. Vanstone: Handbook of Applied Cryptography, CRC Press.
5. Shafi Goldwasser, Mihir Bellare, Lecture Notes on Cryptography. www.cse.ucsd.edu/~mihir/papers/gb.html
6. O. Goldreich, Foundations of Cryptography: Basic Tools, Cambridge University Press.

MCA502A	Artificial Intelligence	Credits: 4

Introduction: Definitions and Approaches, History of AI, Concept of Intelligent Agents.

AI Problem Solving: Problem solving as state space search, production system, control strategies and problem characteristics; Search techniques: Breadth First and Depth-first, Hill-climbing, Heuristics, Best-First Search, A* algorithm, Problem reduction and AO* algorithm, Constraints satisfaction, Means Ends Analysis, Game Playing.

Knowledge Representation and Reasoning: Predicate and prepositional logic, Resolution, Unification, Deduction and theorem proving, Question answering; Forward versus backward reasoning, Matching, Indexing, Semantic Net, Frames, Conceptual Dependencies and Scripts.

Applications: Introduction to Natural Language Processing and Expert System.

Suggested Readings:

1. S. Russel, P. Norvig, Artificial Intelligence: A Modern Approach, Pearson Education.
2. E. Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill.
3. N.J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann.

MCA502B	Soft Computing Techniques	Credits: 4

Introduction to Genetic Algorithm, Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues.

Neural Model and Network Architectures, Perceptron Learning, Supervised Hebbian Learning, Backpropagation, Associative Learning, Competitive Networks, Hopfield Network, Computing with Neural Nets.

Introduction to Fuzzy Sets, Basic Operations on Fuzzy sets, Fuzzy Relations, Fuzzy Measures and Fuzzy Decision Making.

Suggested Readings:

1. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall.
2. D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley.
3. Z. Michalewicz, Genetic Algorithms+ Data Structures = Evolution Programs, Springer-Verlag.

4. N.K. Sinha & M. M. Gupta(Eds), Soft Computing & Intelligent Systems: Theory & Applications, Academic Press, 2000.
5. M.T. Hagan, H. B. Demuth, And M. Beale, Neural Network Design, Thompson Learning, 1996.
6. C. Lau (Ed), Neural Networks, IEEE Press.
7. J. Freeman and D. Skapura, Neural Networks: Algorithms, Applications, and Programming Techniques, Addison-Wesley.
8. G. J. Klir and T. A. Folger, Fuzzy Sets, Uncertainty, and Information, PHI.
9. G. J. Klir, and B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice-Hall, 1995.
10. H. J. Zimmerman, Fuzzy Set Theory and Its Applications, Kluwer Academic Press.

MCA502C	Information Retrieval and Web Mining	Credits: 4

Information Retrieval Concepts and Models, Introduction to World Wide Web, Hypertext Data, Search Engines, Crawling the Web.

Indexing and Search: Boolean Queries and Inverted Index, Relevance ranking, Similarity search, Web directories, Combining Searching with Browsing, Meta-searchers, Dynamic Search and Software Agents.

Clustering and Classification, Social, Semantic Web.

Suggested Readings:

1. Baeza-Yates, R. and Ribeiro-Neto, B., Modern Information Retrieval. Pearson Education 1999.
2. Chakrabarti, S., Mining the Web, Morgan Kaufmann (An Imprint of Elsevier) 2005.
3. Grossman, D. A. and Frieder, O., Information Retrieval: Algorithms and Heuristics. Kluwer 1998.

MCA502D	Data Mining	Credits: 4

Data Mining and its importance, Data Mining on kind of data, Data Mining Functionalities: Association Analysis, Classification and Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Major issues in Data Mining, KDD process.

Difference between Data Mining, Data Warehouse, OLAP and DBMS

Data Preprocessing: Data cleaning, Data Integration and Transformation, Data Reduction.

Data Mining Primitives, Architectures of Data Mining Systems.

Mining Association Rules in Large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Database, Mining multilevel association rules from transaction databases, constraint based association mining.

Classification and Prediction: Issues, Classification by Decision Tree induction, Prediction.

Cluster Analysis: types of data in cluster analysis, Methods: Partitioning.

Mining complex Types of Data: Spatial Databases, Multimedia Databases, Time-series and sequence data, Text databases, WWW.

Applications and Trends in Data Mining: Application, Social Impacts.

High Performance Data Mining: PC cluster, MPICH2 cluster, homogeneous and heterogeneous cluster.

Suggested Readings:

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Academic Press, © 2001 by Academic Press.
2. Arun K Pujari, "Data Mining Techniques", Universities Press (India) Ltd., Hyderabad 2001, First Edition.

3. K.P. Soman, Shyam Diwakar and V-Ajay, "Insight Data Mining, Theory & Practice", EEE, PHI.
4. Hillol Kargupta, Anupam Joshi, Krishnamoorthy, Sivakumar and Yelena Yesha, "Data Mining : Next generation challenges and future directions", AAAI Press copublications.
5. Yike Guo and Robert Grossman, "High Performance Data Mining, Scaling Algorithms, Applications & Systems", Kluwer Academic, 2002.
6. Mohammed J. Zaki, Ching-Tien Ho (Eds) , "Large scale Parallel Data Mining", Springer, 2000.

MCA503A	Advanced Computer Architecture	Credits: 4

Architectural Abstraction, Classification schemes, Parallelism: Pipelining, Multiprocessing. Issues in Branch performance, Synchronization in Multiprocessing, High Performance Processor Design Issues: Pipeline design, Memory system design, I/O design.

Instruction level parallelism, Thread and process level parallelism, Data parallelism.

Vector machines, Dependency Analysis, Vectorization, Optimization in Vector Processing, Vector Chaining, Example systems. Associative Processors and Algorithms

Super-scalar and VLIW processors, Example systems and main issues in design.

Multiprocessors: Shared Memory, Distributed Memory Architectures; Multiprocessor Interconnections,

Memory systems for Multiprocessors, Example systems; Cache Memory, coherence issues, protocols.

Multiprocessor Simulation and Measurement.

Suggested Readings:

1. D. Sima, T. Fountain, P. Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 1997.
2. J. Flynn, "Computer Architecture: Pipelined and Parallel Processor Design", Narosa Publishing House/ Jones
3. K. Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw-Hill, Inc
4. Hwang and Briggs, "Computer Architecture and Parallel Processing, McGraw Hill.
5. B. Barnes, Modeling and Performance Measurement of Computer Systems, MIT Press.

MCA503B	Design Patterns and Frameworks	Credits: 4

Design patterns: basic design patterns, elemental design patterns, Pree's meta patterns, GOF patterns classification, Creational patterns: Factory method, Behavioural patterns: Strategy, Structural patterns: Composite.

Frameworks: Hot-spots, Hollywood principle, Classification, Class libraries vs. OO Frameworks, Problems, Design issues, Documentation issues, Testing issues, Metrics. ***Suggested Readings:***

1. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, 1994, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley.
2. Eric Freeman, Elisabeth Freeman, Kathy Siera and Bert Bates, 2004, Head First Design Patterns, O'reilly
3. Elemental Design Pattern, Jason McC. Smith, Addison Wesley Professional
4. Building Application Frameworks: Object-Oriented FoundationsOf Framework Design, Mohamed E. Fayad, Douglas C. Schmidt, Ralph E. Johnson, Wiley, ISBN 0-471-24875-4, 1999.
5. Implementing Application Frameworks: Object-Oriented Frameworks at Work, Mohamed E. Fayad, Douglas C. Schmidt, Ralph E. Johnson, Wiley.
6. Object Oriented Application Framework, Ted G. Lewis, Kurt Schmucker, John Vlissides, Glenn Andert, Paul Calder.

7. Introduction to Developing Object Oriented Frameworks, James Carey and Brent Carlson, 2002

MCA503C	Advanced Database System	Credits: 4

Design Theory for Relational Database: Functional Dependencies, Decomposition of Relation schemes, Normal Forms for Relations. Schemes, Multivalued and other kinds of Dependencies.

Concurrent Operations on the Database: Basic Concepts, A simple Transaction Model, Model with Read- and Write-Locks, Read-only, Write-only Model, Concurrency for Hierarchically Structured Items, Protection against Crashes, Optimistic Concurrency Control.

Distributed Systems, Communication in distributed systems, Principles of Distributed Data Bases, Framework for distribution. Translation of global queries into fragment queries. Query optimization and management of distributed transaction. Concurrency control and reliability in distributed databases. Administration of Distributed Data Bases.

Suggested Readings:

1. J.D.Ullman, Principles of Database Systems, Galgotia, New Delhi.
2. S.Ceri, G. Relagatti, Distributed Databases, McGraw-Hill.
3. C. Papadimitriou, The Theory of Database concurrency Control, Computer Science Press.
4. T. Ozsu, P. Valduriez, Principles of Distributed Database Systems, Prentice-Hall.

MCA503D	Simulation and Modeling	Credits: 4

Simulation and its uses, Definition of System, Types of Systems, Simulation Experiments and Field Experiments, Random Number Generators from Uniform and other Continuous and Discrete Distributions, Tests of Randomness and Goodness of Fit.

Modeling Process and Concepts of Mathematical Models, Differential, Partial Differential and Difference Equation Models, Modeling through Graphs, Stochastic Models, Monte-Carlo Integration, Simulation of Single Server System, Inventory System, Time Sharing Computer System, and Ethernet Model. Verification, Validation and Comparison of Real System and Simulation Experiments Data, Variance Reduction Techniques, Simulation Languages: SIMULA, SIMSCRIPT and GPSS.

Suggested Readings:

1. J. A. Payne, Introduction to Simulation, Programming Techniques and Methods of Analysis, Tata McGraw Hill Publishing Co. Ltd.
2. A. M. Law, W. D. Kelton, Simulation Modeling and Analysis, McGraw Hill.
3. M. H. MacDougall, Simulating Computer Systems: Techniques and Tools, The MIT Press Cambridge.
4. Z. A. Klarian, EJ Dudewicz, Modern Statistical Systems and GPSS Simulation, Computer Science Press.
5. G. Gordon, System Simulation, PHI.
6. Narsingh Deo, System Simulation with Digital Computer, PHI.
7. JN Kapoor, Mathematical Modeling, Wiley Eastern Ltd.
8. BP Zeigler, H Praehofer, TG Kim, Theory of Modeling and Simulation-Integrating Discrete Event and Continuous Complex Dynamic Systems, Academic Press 2000.

MCA503E	Operation Research	Credits: 4

Network Analysis: Terminology of network, shortest route problem, minimal spanning tree problem, max-flow problem.

Project Scheduling by PERT, CPM: Diagram, representation, critical path calculation, construction of time chart and resource labeling, probability and cost consideration in project scheduling, project control.

Linear Programming: Simplex Method, Revised simplex method, Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems.

Nonlinear Programming: The Kuhn-Tucker conditions, Quadratic programming, Convex programming.

Replacement Models: Introduction, Replacement policies for items whose efficiency deteriorates with time, Replacement policies for items that fail completely.

Sequencing Model: Classification of self problems, processing of n jobs through two machines, three machines, processing of two jobs through m machines.

Suggested Readings:

1. Taha, Operations Research, Macmillan.
2. B.E. Gillet, Introduction to Operations Research, McGraw-Hill.
3. S.S.Rao, Optimization Theory and Applications, Wiley Eastern.
4. G.Hadley, Linear programming, Addison-Wesley.

MCA503F	**Quantum Computing**	**Credits: 4**

Introduction to Quantum Computing, Moore's Law, Limits from Bits to Qubits, Powers of Quantum Computing-Some Algorithms and Applications.

Qubits, Quantum Mechanics and Computer Science Perspectives. Quantum Gates, Applications of Quantum Computing, Shor's Algorithm and Quantum Fourier Transform, Quantum Search Algorithms, Physical Realization of Quantum Computers.

Suggested Readings:

1. Colin P. Williams, Scott H. Clearwater, Explorations in Quantum Computing, Springer.
2. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.
3. Cris Calude, Gheorghe Paun, Computing with Cells and Atoms: An Introduction to Quantum, DNA and Membrane Computing, CRC.
4. Mika Hirvensalo, Quantum Computing, Springer.
5. Dirk Bouwmeester, Artur K. Ekert, Anton Zeilinger, The Physics of Quantum Information: Quantum Cryptography, Quantum Teleportation, Quantum Computation, Springer.
6. J. J. Sakurai, Modern Quantum Mechanics, Addison Wesley.

MCA504	***Lab. Exercises based on course MCA501(A-C)***	**Credits: 3**

Programming exercises based on course MCA501 (A-C).

MCA505	**Comprehensive Viva**	**Credits: 4**

A Comprehensive Viva to judge students' overall academic attainments during the program.

MCA506	***Mini Project***	**Credits: 3**

The students are required to undertake an application oriented mini project and submit a report.

MCA- SEMESTER VI

CAM601	**Dissertation**	**Credits: 20**

Students will be required to pursue a dissertation work in industry/academic/ research institution with the departmental approval and in consultation with the internal supervisors. They will have to submit the report on dissertation work at the end of the semester and the work is evaluated by a panel of internal/external experts.

The End