

MCA COURSES WITH CONTENTS

Annexure I

Revised MCA Courses with Contents

Semester I (All Compulsory)

1. Digital System Design *CS-101*

Data representation – number system, two's complement, Arithmetic operations using 2's and 1's complements, floating-point representation and arithmetic operations;
Logic gates, Boolean algebra, K-map, Map simplification, **Combinational circuit Design** – Half adder, full adders, Decoders, Encoder, Magnitude Comparator, Multiplexer, Read-Only memory, PLAs; **Sequential Circuit Design** – Flip-Flops, Registers, shift registers, Counters, Processor Logic Design – Arithmetic circuit, logic circuit, Accumulator, Status register; **Control Logic Design** – Hard-wired control, micro-program sequencer; Digital Integrated circuits – introduction to Bipolar transistor Characteristics, RTL, DTL, I²L, TTL, ECL, MOS, CMOS.

Books:

1. Morris Mano M. and Kine C.R., *Logic and Computer Design Fundamentals*, PHI, 2001
2. Givone D.D., *Digital Principles and Design*, Tata McGraw-Hill, 2002.

Note: The italic part in the content has been shifted from the content of the course Computer Architecture in semester II, as per the decision of the Committee.

2. Discrete Mathematics *CS-102*

Sets, Relations, Functions, Logic operators, truth tables, normal forms, Propositional and predicate calculus, Boolean Algebra, Euclidean algorithms, Fibonacci numbers, Congruence and equivalence relation, Groups, Subgroups, semi-group, monoids, Error detecting & correcting codes; permutation & combination, pigeon hole principle, Principle of inclusion and exclusion, Ordinary and exponential generating functions, Recurrence relation; trees, graphs, bipartite graphs, planar & dual BFS & DFS algorithms, Flyod's and Dijkstra shortest path algorithms, Kruskal & Prim's algorithms for minimum cost spanning tree; Regular expression, Finite state machine, Grammars.

Books:

1. C.L. Liu, *Elements of Discrete Mathematics*, Tata McGraw-Hill.
2. Trembly J.P. & Manohar P., *Discrete Mathematical Structures with Applications to Computer Science*, McGraw-Hill.

3. Numerical Computing *CS 103*

Data representation – Fixed-point numbers, Floating-point numbers, Finite data representation; Propagation of error, Root finding' Newton's methods, Fixed-point iteration, Ill-behaved root finding problems, Interpolation, divided differences, Spline functions, Approximation of functions – Chebyshev polynomial; Numerical integration and differentiation – Trapezoidal and Simpson rules, Gaussian numerical integration, Solution of systems of linear equations – matrices equation, method of triangular matrices, Gaussian elimination with pivoting, Jacobson and Gauss Seidel; Ordinary Differential equations – Euler method, Runge-Kutta methods, Multi-step method, System of differential equations.

Books:

1. Akai Terrence J. *Applied Numerical Methods for Engineers*, John Wiley & Sons Inc., 1994.

Approved in special committee meeting
held on 4.10.2004

2. Schilling Robert J. and Harries Sanddra L. *Applied Numerical Methods for Engineers*, Thomson, 2000.

4. Programming and Problem Solving using C CS-104

An introduction to problem solving, Design of some important algorithms-factoring methods, array techniques, sorting, searching, pattern searching, recursive, Fundamental concepts for algorithm analysis. Implementation of the algorithms using C programming language, Topics in C language – types, operators (including bitwise operators), expressions, control structures (selection, loops), functions, scope rules and specific variables; arrays and pointers (including pointer arithmetic, pointers to function and command line arguments), strings, structures and unions, bit-fields, files, dynamic memory allocation; input-output and file access.

Books:

1. R.G. Dromey, *How to solve it by Computer*, PHI
2. B.W. Kernighan and D.M. Ritchie, *The C Programming Language*, 2nd ed., PHI, 2002

5. Probability and Statistics CS-105

Probability – Axioms, Conditional probability, Bayes Theorem, random variables, Discrete RV – Binomial, geometric Poisson; Continuous RV – Uniform, Exponential, Gamma, Normal, Expectation, Mean and Variance, Jointly distributed RVs, Co-variance, Sums of RVs, Central Limit Theorem, Moment generating functions,

Sample Distribution, Inference concerning mean, Statistical inference-Parameter estimation, Maximum likelihood estimation, Hypothesis testing.

Curve fitting, Methods of least Squares, Curvilinear Multiple regression.

Books:

1. Ross, S., *A First Course in Probability*, Sixth Edition, Pearson Education
2. Ross Sheldon, *Introduction to Probability Models*, 8th ed., Elsevier, 2003
3. Trivedi K.S., *Probability and Statistics with Reliability, Queuing and Computer Science Applications*, 2nd ed. Wiley, 2002

Semester II (All Compulsory)

1. Computer Architecture CS-106

Register Transfer and Micro-operations, instruction codes and formats, addressing modes, timing and control signal generation, instruction cycles, memory reference instructions, Input out instructions; Central Processing unit – stack organization, Data transfer and manipulation, program control; Pipeline and vector Processing-Arithmetic and Instruction Pipeline, vector operations, array processors; Input output organization –I/O verses memory bus, Isolated verses memory mapped I/O, Priority interrupts, DMA, I/O processors; Memory Organization –RAM, ROM, Associative memory, Cache memory, memory management hardware.

Books:

1. Morris Mano M., *Computer System Architecture*, 2nd ed., PHI,
2. Stallings William, *Computer Organization and Architecture*, 4th ed., PHI, 1996.
3. Hennessy J.L. and Patterson D.A., *Computer Architecture*, Morgan Kaufmann, 2003

2. Data Structures *CS-107*

Linear lists : Stack, Queue, Deque ; Linked structures; Orthogonal lists; Multilinked Structures ;
Tree : Binary tree, Tree traversals ; Binary Search trees; Tree deletion; Threaded binary tree; AVL
trees; General ordered trees ; Expression trees ; Huffman trees; B-trees; B+ trees; Forest; Graphs ;
DFS , BFS, Spanning trees, Shortest path algorithm; Sorting and searching algorithms and their
analysis; Dynamic memory management

Books:

1. Langsam Y., Augenstein M.J. and Tenenbaum A.M., *Data Structures using C and C++*, 2nd ed., PHI, 2000.
2. Kruse, R., Tonodo C.L. and Leung B., *Data Structures and Program Design in C*, 2nd ed., Pearson Education, 1997.
3. Horowitz and Sahni, *Fundamentals of Data Structure*, CBS Publication

3. Operations Research (moved from Semester III) *CS-108*

Introduction - Meaning of OR, Models in OR; Linear programming, Simplex method,
Computational problems, Computer solution of linear programs; Network analysis - Assignment
problems, Maximal flow problem, Shortest route problems, Minimal Spanning tree problems;
Queuing Models - M/M/1 Model, Limited queue capacity, Multiple Servers; Reliability Models,
Inventory Models - EOQ, nonzero lead time; Dynamic programming - developing an optimal
decision policy, multiple state variables, Curse of dimensionality.

Books:

1. Taha Hamdy A., *Operations Research: an introduction*, 6th ed., PHI, 2001.
2. Gillett Billy E., *Introduction to Operations Research*, Tata McGraw-Hill, 1979.

4. Object Oriented Programming *CS-109*

The Traditional Approach, Object Oriented Paradigm, Object Oriented Features, C++ Class,
Objects, Member Functions, Static Class Members, Pointers, Union, Class Scope, Nested Classes,
Object Arrays, Composite class, Constructor, Destructor, Copy Constructor, Friends, *this* pointer,
Operator Overloading, Class Hierarchy, Multiple inheritance, Virtual functions, Virtual classes,
Class template, Function Template, File operations, Stream classes, I/O, Exception Handling.

Books:

1. Lipman, S.B. *C++ Primer*, 3rd ed., Pearson Education, 1998.
2. Stroustrup B., *Introduction to C++*, 3rd ed., Pearson Education, 2000

5. Operating Systems *CS-110*

Overview, Computer System Structures, Operating System Structures, Process and Process
Scheduling, CPU scheduling, Process Synchronization, Semaphores, Monitors, Deadlock and
methods of deadlock handling, Address Space, Paging, Segmentation, Virtual Memory, Page
Replacement Algorithms, File and Directory Concepts, Access Methods, File System Allocation
methods, Secondary Storage Scheduling and Management, Protection, Security.

Books:

1. Silberschatz and Galvin, *Operating System Concepts*, 6th ed., Wiley, 2004
2. Stallings William, *Operating Systems*, 3rd ed., PHI.

Semester III (All Compulsory)

1. Database Management Systems (Moved from Semester II) CS-111

Database Approach; Database Architecture, Database Languages, Database Users, Entity-Relationship Model; Design and Mapping to Tables, Relational Model, The Relational Algebra, The Tuple and Domain Relational Calculus, SQL Querying, SQL DDL, Embedded SQL, Relational Database Design, Functional and Multivalued Dependency, Normalization, Query Optimization, Transaction Processing, Security, Concurrency Control and Recovery Techniques.

- Books:
1. Korth H. and Silberschatz A., *Database System Concepts*, 3rd ed., McGraw-Hill, 1997
 2. Elmasri R. and Navathe S., *Fundamentals of Database Systems*, 3rd ed., Pearson Education, 2000.

2. Computer Networks CS-112

Overview of Computer Network; Data Communication – Analog and digital communications, signal and data, Channel characteristics, Nyquist theorem, Shannon's formula, modulations, encoding schemes; Error Detection – VRC, LRC, CRC, Checksum; Transmission media; Multi-channel communication – multiplexing techniques, Multiple access techniques; Switching techniques – Telephone systems, ATM; Queuing Models – little's theorem, Poisson Process, Markov Chain model, M/M/1, M/M/S/K, M/G/1 queues; ALOHA systems; Local Area Networks – CSMA/CD, Token Ring, Token Bus, FDDI, Routing – spanning tree, Bellman-Ford, Dijkstra algorithms, Distance vector and link state routing; IP protocol- fragmentation, reassembly; Transport Protocol – stop-and-wait, Sliding window protocols, congestion control, TCP, UDP; Application Protocols – FTP, Email.

- Books:
1. Tenenbaum, *Computer Networks*, 4th ed., Pearson Education, 2003
 2. Bertsekas Dimitri, and Gallager Robert, *Data Networks*, 2nd ed. PHI, 1996.
 3. Stallings William, *Data and Computer Communications*, 7th ed., Pearson Education, 2003

3. Microprocessor Based System CS-113

8085 Microprocessor, Bus structure and timings, Demultiplexing the Bus (AD7-AD8), Instructions and timing, Interfacing peripherals, I/O, Memory and Applications, 8085 interrupts structure types and masking, priority interrupt structure. Software model of the 8086/8088 microprocessor, Memory address space & data organisation, Segment registers & Memory segmentation, Dedicated & general use of memory, Instruction pointer, Data registers, Status register, Generating a memory address, stack, I/O address space, Addressing modes of 8086. The 8086 instruction set Minimum/maximum mode.

- Books:
1. Microprocessor architecture, Programming & applications with the 8085/8080-A ;R. S. Gaonker, Wiley Eastern Limited ISBN 085226, 2973, 2002.
 2. Microprocessor and Interfacing, Douglas V. Hall, Mc-Graw Hill Book Company, 1987 ISBN-0-07-100462-9.

Web-Based Programming CS-114

World Wide Web - introduction, Client-Server model, Web servers, Browser Interface, Browser architecture, optional clients, caching in web browser, Search engines, optimization of search engines, CGI interface; Hypertext - HTML, DHTML, HTTP; Scripting languages - JSP, ASP; Web Programming- Java language, Java Swings, Java Beans, Applets, Servlets, RMI, Java utilities.

Books:

1. Comer D.E., Computer Networks, Internets and Applications, 3rd ed., 2004
2. Crouch, Web Programming with ASP and COM, Pearson Education

5. Design and Analysis of Algorithms CS-115

Review of algorithm analysis: time, space, lower, upper bounds, asymptotic complexity, summation, recurrences; Design techniques; greedy methods, divide-and-conquer, backtracking, branch-and-bound, dynamic programming, basic graph algorithms, simulation; Selection of prototype algorithms; Choice of data structures and representation; NP-completeness: basic terminology, polynomial reductions, NP-complete problems. Some additional topics such as string searching, network-flow, geometric algorithms, parallel computing, etc.

Books:

1. T. Cormen, C. Leiserson, R. Rivest. *Introduction to Algorithms*, Indian Reprint, PHI, 2000.
2. V. Aho, J. Hopcraft, J. Ulmann. *The Design and Analysis of Computer Algorithms*. Addison Wesley, 1974.
3. S. Basse, A.V. Gelder, *Computer Algorithms: Introduction to design and Analysis*, 3rd ed., Pearson Education Asia Pvt. Ltd, 2000

Semester IV (All Compulsory)

1. Computer Graphics CS-116

Graphics devices - random scan and Raster-scan; Bresenahm's circle drawing algorithm, generation of ellipses, Curve drawing, Bezier and B-spline curves, 2-D graphics: polar coordinates, parametric functions, vectors, matrices operations; Transformation - homogeneous coordinate systems, translation, scaling, rotation, mirror reflection, parametric representation of a line segment; 3-D graphics: transformation- right handed coordinate system with vertical y-axis, matrices for translation, scaling rotation around axis, Parallel Projection - front and side views, Oblique view

Books:

1. D. Hearn and P.M. Baker, *Computer Graphics*, Second Edition, 1995, Prentice Hall of India
2. S. Harrington, *Computer Graphics - A Programming Approach*, McGraw-Hill International

2. Parallel and Distributed Systems (including Linux/Unix) CS-117

Parallel systems - Hardware, SIMD, MISD, MIMD, Multiprocessor systems, Parallel algorithms, Shared memory, message-passing, and data parallel programming, Shared memory multiprocessors, cache coherence, and memory consistency, Scalable multiprocessors, interconnection network design, and directory-based cache coherence protocols, Performance issues, simulation, and benchmarks, Multiprocessor real-time scheduling, Latency tolerance, techniques, Single chip multiprocessors,

distributed systems – hardware and software concepts, Client-server model; Communication – Lower-level protocols, transport protocols, higher level protocols, RMI Remote Object Invocation, Message oriented communication, Stream oriented communication; Synchronization – Clock synchronization, logical Clock, Election Algorithms, Mutual exclusion, distributed transactions; Consistency and Replication – Data centric and client centric consistency, distribution protocols, consistency protocols; Fault tolerance, Security, Distributed object-based systems, Distributed file systems.

Books:

1. Tenenbaum, Distributed Systems : Principles and Paradigms, Pearson Education
2. Coulourist, Distributed Systems: Concepts and design, 3rd ed., Pearson Education
3. Culler, D.E. and Singh J.P., Parallel Computer Architecture, Morgan Kaufmann, 2002

3. Software Engineering CS-118

Requirements Engineering, Requirements Analysis, Analysis Specification, Structured Analysis, Data Modeling, Data Flow Diagrams, Structured charts, Design Concepts, Coupling, Cohesion, Mapping Requirements to Design, user Interface Design, Software Testing Techniques and Strategies, Process models, Software Metrics, Estimation Models, Software Quality Assurance

Books:

1. Pressman, R.S.: *Software Engineering – A Practitioner's Approach*, McGRAW-HILL International Edition
2. Sommerville, I.: *Software Engineering* – Pearson Education Asia

4. Formal Languages and Automata Theory CS-119

Models of Computation – classification, properties and equivalences.

Regular languages models: finite state machine (deterministic and non-deterministic), regular grammars, regular expressions, equivalence of deterministic and non-deterministic machine and of the three models; Properties: closure, decidability, minimality of automata.

Context-free languages models: grammars (including different normal forms), pushdown automata and their equivalence; Properties: closure, iteration theorem, parsing.

Recursive and recursively enumerable sets model: Turing machines, grammars, recursive functions and their equivalence; Church's thesis; Properties: closure, decidability, undecidability, non computability, notion of reductions, computational complexity, NP-completeness

Books:

1. Lewis H.R. and Papadimitriou C.H., *Elements of the Theory of Computation*, Pearson Education Asia, 2001.
2. Martin J.C., *Introduction to Languages and the Theory of Computation*, 2e, Tata McGraw-Hill, 2000.
3. Hofcroft J.E., Ullman J.D., *Introduction to Automata Theory, Languages and Computation*, Narosa Publishing House.

5. Artificial Intelligence CS-120

Overview of AI; Problem solving; various search strategies, Game playing: Minmax, Alpha-Beta pruning; introduction to logic programming, inference mechanisms; Knowledge representation: logic, rules, semantics, frames, Conceptual dependency, Uncertain knowledge and reasoning; expert systems; NLP; Learning; Process planning and robotics; Intelligent agents.

Books:

1. E. Rich and K. Knight, *Artificial Intelligence*, Tata McGraw-Hill

- Russel and Norrig, Artificial Intelligence – A Modern Approach, PHI
3. Winston, Artificial Intelligence, Addison Wesley

Semester V

Compulsory Course

1. Compiler Construction *CS-121*

Overview of a Compiler; Lexical Analyzer; Syntax Analysis: PDA, NPDA, Construction of Top-down and Bottom-up parsers from CFG, Recursive descent parser, LL(1) parser, Operator precedence parser, LR parsers; Semantic Analysis : SDTS, Intermediate Code generation ;Code Optimization : The principle sources of optimization, Optimization of basic blocks, Loops in flow graphs, Introduction to global data-flow analysis.

Books:

1. Aho A.V., Sethi R., and Ullman J.D. *Compilers: Principles, Techniques and Tools*, Perason Education, 2004.
2. Holub A.I., *Compiler Design in C*, Prentice Hall of India, 2001.

2. Course in Social Science (contents to be developed)

Optional Course

1. Pattern Classification *CS-122*

Pattern recognition task; Statistical decision theory – Bayes rules, parametric models, logistic discrimination, predictive classification, computational learning approaches; classical linear discrimination, linear separation, Nonparametric methods – estimation of class densities, nearest neighbour methods, learning vector quantization, mixture representations; Tree structured classifiers – Finding Good Pattern Features – Bounds for the Bayes error Branch-and-bound techniques. Feature extraction.

Books:

1. Duda R.O., Hart P.E. and Stork D.G. *Pattern Classification*, 2nd ed., Wiley Interscience, 2000
2. Ahuja N. and Schachter B.J. *Pattern Models*, John Wiley & Sons, 1983

2. Image Processing and Computer Vision *CS-123*

Digital image definitions, Video parameters, Image model, Sampling, Quantization, Histogram equalization, DFT, FFT, QALSH transport, Smoothing Filters- mean median, mode filters, edge enhancement filters, edge enhancement, Run length coding, contour coding, Huffman coding, Image compression standards, Image segmentation, Thresholding, Application of morphology in IP.

Books:

1. Gonzalez and Woods, *Digital Image Processing*, Pearson Education, 2002
2. Schalkoff, *Digital Image Processing and Computer Vision*, John Wiley & Sons, 1989
3. Prat W.K., *Digital Image Processing*, Wiley Interscience, 2001

3. Computer Oriented Statistical Methods *CS-124*

Multivariate analysis – Organization of data, Expected Values of sample mean and covariance matrix, Multivariate normal distribution, Inferences about a mean vector, Time dependence in

multivariate observations, comparisons of several multivariate means, Multivariate linear regression models, principal components and graphing, factor analysis and inference, canonical correlation analysis. Discrimination and Classification; Clustering, Distance Methods - Similarity measures, Hierarchical and non-hierarchical clustering methods; K-means method, Multidimensional scaling, Structural Equation modeling, Emerging techniques in multivariate analysis - data ware housing and data mining, Neural networks, resampling

- Books:
1. Johnson, R.A. and Wichern D.W., Applied Multivariate Statistical Analysis, 5th ed., Pearson Education, 2002
 2. Martinez W.L. and Martinez A.R. Computational Statistics Handbook with MATLAB, Chapman & Hall/CRC

4. Decision Support Systems *CS-125*

Decision Support System Overview, DSS characteristics and capabilities, DSS taxonomies and frameworks; decision modeling using multi-criteria decision making, model management for decision support, DSS development approaches, DSS analysis DSS design methods, DSS development and documentation tools, Knowledge-based decision support systems, Intelligent DSS systems, Active decision support system and symbiotic systems, integrated intelligent systems.

- Books:
1. Mallack, E.G. Decision Support and Data Warehouse Systems, Tata McGraw Hill, 2000
 2. Turban, Decision Support Systems & Intelligent Systems, 6th ed., Pearson Education

5. Natural Language Processing *CS-126*

General Characteristics of Natural language - ambiguity, incompleteness, imprecision, Linguistic Essentials - Part of speech, Lexicography, morphology, Phrase structure grammar, theory, Semantics and pragmatics; Grammatical frameworks - Chomsky hierarchy, X-bar theory, LFG, Unification grammar; Efficient parsing for Natural languages; Knowledge Representations - Frames, Scripts, Conceptual graphs; Statistical Techniques - Elementary Probability theory, Essential information theory; Applications of Statistical Techniques - Word Sense Disambiguation, Lexical Acquisition, Markov Model for Part-of-speech tagging, Probabilistic CFG, Probabilistic parsing, Statistical Alignment and machine translation, Clustering.

- Books:
1. Manning D. *Statistical Foundation of Natural language Processing*, MIT Press, 1999.
 2. James A. *Introduction to Natural Language Understanding*, Addison Wesley, 1991.
 3. Harris M.D. *Natural Language Processing*, Benjamin/Cumming, 1991

6. Modeling and Simulation *CS-127*

Advantages and disadvantages of simulation systems, Components of system, Discrete and continuous systems, Examples - Simulation of queuing and inventory systems, concepts in discrete-event simulation; Simulation software - GPSS, CSIM, Simulation Packages; Statistical models in simulation; Queuing models - long run measures of performance, steady-state behaviour, M/M/1, M/M/C/∞/∞, M/M/C/N/∞, M/M/C/K/K; Pseudo random numbers, random variate generation, Inverse transform technique, Acceptance - rejection technique, Analysis of simulation data, Verification and validation of simulation models, Output analysis for single model, Simulation of computer systems.

Danks J., Carson II, J.S., Nelson, B.L. and Nicol, D.M., Discrete Event System Simulation, 3rd ed., Pearson Education
Law, A.M. and Kelton W.D., Simulation Modelling and Analysis, 3rd ed., McGraw Hill International, 2000

7. Optimization Techniques *CS-128*

Introduction and construction of LP model, Computer solution, Simplex Algorithm, Duality and sensitivity - Optimal primal and dual computations, Efficient computational algorithms- revised simplex method, bounded and decomposition algorithms, Karmarkar interior point algorithm, Deterministic dynamic programming- recursive nature of computations in DP, forward and backward recursion, Probabilistic dynamic programming- a game of chance, investment problem, Nonlinear programming algorithm- Direct search method, Gradient method, Quadratic, Geometric programming, SUMT algorithm.

Books:

1. Hillier and Lieberman, Introduction to Operations research, 7th ed., Tata McGraw Hill
2. Rardin, Optimization in Operations Research, Pearson Education

8. Machine Learning *CS-129*

An overview of Machine learning; Inductive learning, ID3, C4.5; Learning Concepts and rules from Examples; Learning by analogy; Learning from observation and discovery; Learning by experimentation. Learning by training Neural Networks; Genetic Based Machine Learning (GBML) Learning Classifier Systems (LCS), Genetic Programming; Analytical learning; Reinforcement learning. Applications to KDD.

Books:

1. Mitchell, Machine Learning, McGraw-Hill
2. Winston, Artificial Intelligence, Addison Wesley

9. Internet and Web Technology *CS-130*

Review of Network Concepts, Internetworking Technology - concepts, architecture, and protocol (TCP/IP), Internet protocol (IP), Binding Protocols, ICMP, UDP, TCP, Ipv6; Internet Applications - Client-Server programming, the Socket Interface, email, FTP, HTTP; Internet management and Security, Web Technologies - Introduction, Web pages and Browsing, Dynamic web document technologies - CGI, JSP, ASP, Coldfusion, XML; Wireless Application Protocol.

Books:

1. Godbole, Web Technologies, Tata McGraw Hill, 2002
2. Crouch, Web Programming with ASP and COM, Pearson Education

10. Applied Bioinformatics *CS-131*

Molecular Biology Basic; DNA Protein, Central Dogma - Primary Sequence analysis; Motif searching, String manipulations and Alignment methods - Machine learning strategies in Bioinformatics: Overview of Artificial neural networks, Support vector machines, Markov chain, Hidden Markov chain models - Clustering methods in Micro array data analysis: PCA, K-nearest neighbor etc - Applications of information theory in Bioinformatics: Shannon's formula, Mutual

information, Kullback-Leibler distance - DNA binding sites, Genome segmentation and Gene
firing

Books:

1. Ewens, W. and Grant G.R., *Statistical Methods in Bioinformatics: An Introduction*, Springer Verlag, 2001
2. Durbin, R., Eddy, S., Krogh, A. and Mitchison, G., *Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids*, Cambridge University Press, 1998

11. Information Theory CS-132

Information and Entropy - Shannon's measure of Information, Mutual Information; Discrete memoryless information source - Coding, Coding strategies; Discrete information source with memory - Markov process, Coding aspects; Communication Channel, Capacity of Noisy channels, Capacity with additive Gaussian white noise; Rate distribution theory - Information transmission theorems.

Books:

1. van der Lubbe Jan C. A., *Information Theory*, Cambridge University, 1997
2. Cover, Th. M. and Thomas J.A., *Elements of Information Theory*, Wiley, 1991.

12. Data Mining and Knowledge Discovery CS-133

Introduction to Data Mining and knowledge discovery in databases (KDD) & data warehouse; Data mining primitives, concepts, tasks; different machine learning, knowledge discovery and data mining approaches and techniques: Concept Learning, Decision Tree Learning, Clustering and instance based learning, Rule induction and learning, Bayesian networks and causality, Neural networks, Genetic algorithms, Reinforcement learning, Analytical learning; Credibility, evaluating data mining models.

Books:

1. Han J., Kamber M. *Data Mining: Concepts and Techniques*, Indian reprint, Morgan Kaufmann-Harcourt, India, 2001.
2. Hand D., Mannila H. and Smyth P., *Principles of Data Mining*, Indian reprint, Prentice Hall of India, 2004.
3. Witten I.H. and Frank E., *Data Mining: Practical Tools and Techniques with Java Implementations*, Morgan Kaufmann, 1999.

13. Multimedia Systems (changed from *Multimedia Communication Systems*) 134

Introduction to Multimedia, fundamental concepts of Video, Basics of digital audio, audio visual integration, multimedia authoring and tools, multimedia data compression, multimedia communication, multimedia processing in communication, multimedia communication standard, multimedia communication across network, distributed multimedia systems.

Books:

1. Li, Ze-Nian and Drew M.S., *Fundamentals of Multimedia*, Pearson Education, 2004.
2. Rao K.R., Bojkovic Z.S., and Milovanovic D.A., *Multimedia Communication System: Technique, Standard and Network*, Pearson Education, 2004

Distributed Database Systems CS-135

foundational concepts and design of Distributed Database Systems (DDBMS): Data Fragmentation, replication, and Allocation techniques for DDBMS; Methods for designing and implementing DDBMS; Architectures for DDBMS - federated, multidatabase and client server architecture; Overview of transaction management, concurrency and recovery in DDBMS; Distributed Deadlock Management and Replication Servers; Distributed Query Processing and Optimization, Distributed Object/Component-Based DBMS; Database Interoperability including CORBA and Java RMI;

- Books:
1. S. Ceri and G. Pelagatti, Distributed Databases: Principles and Systems, McGraw-Hill International
 2. Ozsu, M. Tamer and Patrick Valduriez, Principles of Distributed Database Systems, Prentice Hall, 1999

15. Object Oriented Analysis and Design (changed from Object Oriented Systems) CS-136

Object Oriented Paradigm, Principles - Abstraction, Encapsulation, Inheritance, Polymorphism, Introduction to Modeling; Needs and Type of Modeling; Unified Modeling Language - Structural Modeling: Class Diagrams, Object Diagrams; Behavioral Modeling: Use Case Diagrams, Interaction Diagrams, Statechart Diagrams, Activity Diagrams; Architectural Modeling: Component Diagrams, Deployment Diagrams; Object Oriented Analysis and Design - Overview, Use Case Model Development, Analysis model: Domain Modeling - Identification of Boundary, Controller and Entity objects, Design model: Introduction to Design Patterns, Implementation model; Code Generation: Classes, Interface, Association, Aggregation, Composition, Inheritance

- Books:
1. G. Booch, J. Rumbaugh, I. Jacobson: *The Unified Modeling Language, User Guide*, Pearson Education, Asia
 2. Jacobson, G. Booch, J. Rumbaugh: *The Unified Software Development Process*, Pearson Education, Asia
 3. E. Gamma, R. Helm, R. Johnson, J. Vlissides: *Design Patterns: Elements of Reusable Object Oriented Software*, Pearson Education, Asia

4. Object Oriented Programming CS-109

The Traditional Approach, Object Oriented Paradigm, Object Oriented Features, C++ Class, Objects, Member Functions, Static Class Members, Pointers, Union, Class Scope, Nested Classes, Object Arrays, Composite class, Constructor, Destructor, Copy Constructor; Friends, *this* pointer; Operator Overloading, Class Hierarchy, Multiple inheritance, Virtual functions, Virtual classes, Class template, Function Template, File operations, Stream classes, I/O, Exception Handling.

Books:

1. Lipman, S.B. *C++ Primer*, 3rd ed., Pearson Education, 1998.
2. Stroustrup B., *Introduction to C++*, 3rd ed., Pearson Education, 2000