University of Technology

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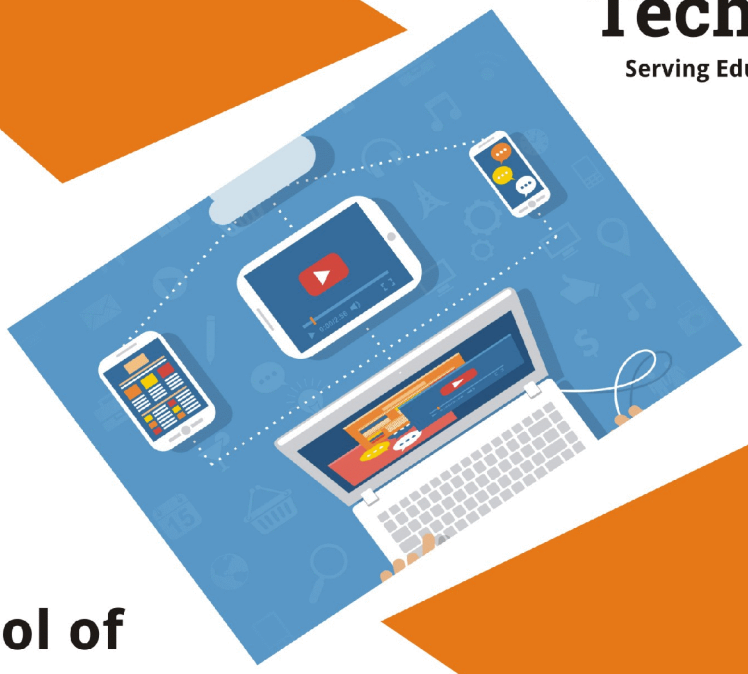

School of

Computer Applications

Syllabus of Master of Computer Applications (MCA)

A student shall have to earn a minimum of 108 credits at the end of III year in order to be eligible for the award of MCA degree

Semester I

S.No.	Course Name	Credits
1.	Digital System Design CS-101	4
2.	Discrete Mathematics CS-102	4
3.	Numerical Computing CS-103	4
4.	Programming and Problem Solving using C CS-104	4
5.	System Programming CS-138	4

Semester II

S.No.	Course Name	Credits
1.	Computer Architecture CS-106	4
2.	Data Structure CS-107	4
3.	Database Management Systems CS-111	4
4.	Object Oriented Programming CS-109	4
5.	Operating System CS-110	4

Semester III

S.No.	Course Name	Credits
1.	Formal Languages and Automata Theory CS-119	4
2.	Computer Networks CS-112	4
3.	Microprocessor Based System CS-113	4
4.	Design and Analysis of Algorithms CS-115	4
5.	Computer Graphics CS-116	4

Semester IV

S.No.	Course Name	Credits
1.	Software Engineering CS-118	4
2.	Artificial Intelligence CS-120	4
3.	Parallel and Distributed Systems CS-117	4
4.	Elective I	4
5.	Elective II	4

Semester V

S.No.	Course Name	Credits
1.	Web Based Programming CS-114	4
2.	Elective III	4
3.	Elective IV	4
4.	Elective V	4
5.	Elective VI	4

Semester VI

S.No.	Course Name	Credits
	Project Work	8

List of Optional Courses for Elective I and II

1. Algorithmic Graph Theory CS-139
2. Data Mining and Knowledge Discovery CS-133
3. Distributed Databases CS-135
4. Digital Image Processing CS-140
5. Information Security CS-141
6. Networks Programming CS-142
7. Object Oriented Analysis and Design CS-136
8. Optimization Techniques CS-128
9. VLSI Design CS-143
10. Internet and Web Technology CS-130

List of Optional Courses for Elective III to VI

1. Advanced Algorithms CS-144
2. Big Data Management CS-145
3. Cloud Computing CS-180
4. Computer Vision CS-146
5. Evolutionary Computation CS-147
6. Information Theory CS-132
7. Machine Learning CS-129
8. Modeling and Simulation CS-127
9. Multimedia Systems CS-134
10. Natural Language Processing CS-126
11. Pattern Classifications CS-122
12. Principles of Compiler Design CS-148
13. Software Testing CS-149
14. Wireless Communication and Mobile Computing CS-150

SEMESTER I (All compulsory)

1. Digital System Design CS-101

Introduction: Analog and Digital system, Active and Passive components, Number system, Binary codes, Digital Integrated Circuits: Introduction to Bipolar transistor characteristics, RTL, DTL, I^2L, TTL, ECL, MOS, CMOS, Logic Families Design: Logic gates, Boolean Algebra, K-map, Map simplification Combinational Circuit Design: Half Adder, full adder, Decoders, Encoders, 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

References:

1. Moris Mano M, Digital Logic and Computer Design, Fundamentals, PHI 2004
2. Givone D D, Digital Principles and Design, Tata McGraw- Hill , 2002

2. Discrete Mathematics CS-102

Number System: Decimal Number Systems, Binary Number Systems, Hexadecimal Number Systems, Octal Number Systems, Binary Arithmetic. Propositions and Logical Operations: Notation, Connections, Normal forms, Truth Tables, Equivalence and Implications, Theory of interference for statement calculus, Predicate calculus, Rules of Logic, Mathematical Induction and Quantifiers. Sets, Relations and Diagraphs : Review of set concepts, Relations and digraphs, Properties of relations, Equivalence relations, Computer representation of relations and digraphs, Manipulation of relations, Partially Ordered Sets (Posets). Recurrence Relations: Towers of Hanoi, Iterations, Homogeneous linear equations with constant coefficients, particular solution, difference table, finite order differences, Line in a plane in general position. Groups and Applications: Monoids, semi groups, Product and quotients of algebraic structures, Isomorphism, homomorphism, automorphism, Normal subgroups, Codes and group codes Classification of Languages: Overview of Formal Languages-Representation of regular languages and grammars, finite state machines.

References:

1. Tremblay and Manohar, Discrete Mathematical Structures, Tata McGraw Hill
2. Maggard, Thomson, Discrete Mathematics, 1st Edition
3. Semyour Lipschutz, Varsha Pati "Discrete Mathematics", IInd Edition Schaum's Series TMH
4. Kolman, Busby and Ross, "Discrete Mathematical Structures": Prentice Hall India, Edition 3
5. C.L. Liu, Elements of Discrete Structures.
6. Rosen, Discrete Mathematics and application.

3. Numerical Computing CS-103

Computing Arithmetic, Significant Digits and Numerical Instability, Root finding methods-Bisection, Newton Raphson, Secant and Regula Falsi, methods for multiple roots. System of Linear Algebraic Equations and Eigenvalue problems-Gauss Elimination, LU Decomposition-Jacobi-Gauss-Seidel and SOR methods, Interpolation and Approximation-spline approximation-Linear, quadratic and Cubic, Differentiation and Integration-Richardson's extrapolation, Gauss Quadrature methods, ordinary differential equations-Initial and Boundary Value Problems, introduction to numerical solutions of Partial Differential Equations.

References:

1. Numerical Methods for Scientific and Engineering Computation by M.K. Jain, SRK Iyengar and R.K.Jain
2. Numerical Methods for Engineers by S.C. Chopra and Raymond P. Canale
3. Introductory Methods of Numerical Analysis by Sastry
4. Numerical Analysis by E.W. Cheney and D.R.Kincaid

4. Programming and Problem Solving using C CS-104

Introduction to problem solving : Structure of C program, C data types, Storage types, String processing, C operators and expressions, Precedence of operators, Control statements, Loops , Arrays , Pointers, Array and Pointers, Static versus Dynamic Arrays, Unions, Structures, Macros, C preprocessors, Library functions, Functions : defining , accessing, function prototypes, Parameter passing, command line arguments, files handling.

References:

1. B.W. Kernighan, Dennis M. Ritchie , The C Programming Language , PHI/Pearson
2. Dromey, How to Solve it By Computer, PHI
3. E Balaguruswamy , C Programming, Tata Mc Graw Hill
4. Stephen G. Kochan ,Programming in C, Pearson Education

5. System Programming CS-138

An overview of System Programming and Operating system functions. Machine considerations for Assemblers, Assembly Language Forms, Assembly Process; System Calls, Libraries, Linking and Loading; Compilation process; Scripting language; Write small to medium size programs in assembly language and scripting languages and C in UNIX environment.

References:

1. Beck, L.L., Systems Software: An Introduction to Systems Programming, Pearson Education, 3e 1997 (2005 Reprint)
2. Hoover, A., Systems Programming with C and Unix, Kindle Edition, 2009
3. Dhamdhere, D.M., Systems Programming and Operating Systems, Tata McGraw-Hill, 2e, 1999

4. Barrett, M.L., Wagner, C.H., C and UNIX Tools for Software Design, John Wiley and Sons, 1995
5. Donovan, J.J. Systems Programming, Tata McGraw-Hill, 1972

SEMESTER II (All compulsory)

1. Computer Architecture CS-106

Data Representation, Data Types, Binary Codes and Error Detection Codes, Register Transfer language, Arithmetic, logic and Shift Microoperations. Computer Registers, Instruction Codes, Timing and Control. Computer Arithmetic- Number Representation, Addition, Subtraction, Multiplication and Division Algorithms. General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer. Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing. Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA, Serial Communication. Memory Hierarchy, Main Memory, Auxillary Memory, Associative Memory, Cache Memory, Virtual Memory. Microprogrammed Control- Control Memory, Address Sequencing, Design of Control Unit.

References:

1. Morris Mano, Computer System Architecture Pearson Education, 2012
2. David A. Patterson, John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann, 2009
3. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education, 2007
4. Behrooz Parhami Computer Architectures: From Microprocessors to Supercomputers, , Oxford, 2005.

2. Data Structure CS-107

Introduction to Data Structures, algorithms, pseudocode, time and space complexities; arrays, sparse matrix, stacks, recursion, queues, priority queues, linked lists, Introduction to trees, forest, binary tree, threaded binary tree, traversal techniques, Binary Search Trees, AVL trees, B-trees, B+ trees, Introduction to Graphs, DFS, BFS. Sorting and searching algorithms, hashing.

References:

1. Horowitz Ellis and Sahni Sartaj, “Fundamentals of Data Structures”, W H Freeman and Co.
2. Tremblay Jean-Paul and Sorenson Paul G., “An Introduction to Data Structures With Applications”, McGraw-Hill, Inc.
3. Kruse Robert L., “Data Structures and Program Design”, Prentice Hall.
4. Gilberg Richard F. and Forouzan Behrouz A., **“**Data Structures: A Pseudocode Approach with C”, Cengage Learning.
5. Cormen Thomas H., “Introduction to Algorithms”, The MIT Press.

3. Database Management Systems CS-111

Database Approach - System Concepts and Architecture, Database Users; Database Design - Entity-Relationship (E-R) Model, Relational Model, Mapping E-R to Relational Model; Languages - Relational Algebra, Tuple and Domain Relational Calculus , SQL; Normalization - Functional and Multivalued Dependency, 1NF to 5NF; Security; Transaction Management - Transaction, ACID properties, Concurrency, Recovery ; Query Optimization - Cost based and Heuristics based. Practical: Design E-R model for a real world, map to relational model, implement using available RDBMS and execute SQL queries.

References:

1. Elmasri, R., Navathe, S., Fundamentals of Database Systems, Pearson, Sixth Edition, 2006.
2. Silberschatz A., Korth H, Sudarshan S., Database System Concepts , McGraw-Hill, Sixth Edition, 2010

4. Object Oriented Programming CS-109

Concept of Object-Oriented Programming paradigm: Abstraction, Encapsulation, Inheritance, Polymorphism, Classes, Objects, member function, static member function, Data types, Arrays, Memory Allocation for Objects, Storage Management, constructors, destructor, Inheritance: single and multiple inheritances, operator overloading, function overloading, Polymorphism, abstract class, overriding, memory layout of objects; Exception Handling, Template class and function, Packages and Interfaces, Multithreaded programming, , Input/Output; Practical: using Java/C++

References:

1. Bjarne Stroustrup, The C++ Programming Language, 3rd, Pearson Education
2. Lipman, S. B. C++ Primer, 3rd ed. Pearson Education
3. H.M. Deitel, P.J.Deitel, Java : how to program, Fifth edition, Prentice Hall Publication.
4. Herbert Schildt, The Java 2: Complete Reference, Fourth edition, TMH.

5. Operating System CS-110

Introduction to Operating Systems; layered architecture, basic concepts: interrupt architecture, system calls,, Processes and Threads: synchronization and protection; CPU scheduling; Deadlocks; Main memory management including paging and segmentation schemes; Virtual memory management including page replacement algorithms; Storage management including file systems; Case studies of Unix.

References:

1. A. Silberschatz, P. Galvin and G. Gagne, Operating System Concepts, 9th Edition
2. William Stallings, Operating Systems: Internals and Design Principles, 7th Edition

SEMESTER III (All compulsory)

1. Formal Languages and Automata Theory CS-119

Regular language Models: Finite state machines (deterministic, non-deterministic), regular languages and regular grammars, properties; Context-free language models: Context-free languages, properties of CFL, Pushdown automata; Turing Machines, limits of algorithmic computation; Grammars, hierarchy of formal languages, properties of models of computation, Computational complexity, complexity class P and NP,.

Reference:

1. Linz, Peter, An introduction to Formal Languages and Automata, Narosa Publishing House, 2007
2. Lewis, H.R., and Papadimitriou, C.H., Elements of Theory of Computation, Pearson Education, 2002
3. Hofcroft, J.E., and Ullman, J.D., Introduction to Automata Theory, Languages and Computation, Narosa Publishing house 2008
4. Krithivasan, Kamala, Introduction to Automata Theory, Languages and Computation, Pearson Education, 2009
5. Martin, J.C., Introduction to Languages and Theory of Computation, Tata McGraw-Hill Publication, 3e, 2007

2. Computer Networks CS-112

Overview of Computer Network, OSI and TCP/IP Reference Models, Guided and Unguided Transmission Media, Analog and Digital communication, Encoding and Modulation, Nyquist theorem, Shannon's capacity, Switching techniques, multiplexing techniques-TDM, FDM, Framing, Error detection and Error correction – VRC, LRC, CRC, Stop and Wait Protocol, Sliding Window Protocol, Go-back-n ARQ, Selective-Reject ARQ, HDLC, Channel Allocation, ALOHA Systems, CSMA Protocols, Collision Free Protocols, Local Area Networks, Bridges, ATM, Routing: Flooding, Spanning tree, Distance Vector routing, Link state routing, Bellman-Ford and Dijkstra routing algorithms, Congestion control - Leaky Bucket and Token Bucket algorithms , IP Protocol, IP Addressing, ARP, RARP, OSFP, BGP, TCP, UDP, Application Protocols-DHCP, DNS, Telnet, SMPT, Network Security-RSA

Books:

1. Andrew S. Tanenbaum, Computer Networks, Fourth Edition, Pearson Education,
2. Behrouz A. Ferouzan, Data Communications and Networking, 2nd ed Update, TMH,
3. Alberto Leon-Garcia and Indra Widjaja, Communication Networks, 2nd Ed, Tata McGraw-Hill,
4. William Stallings, Data and computer Communications, 7th Edition, Pearson Education,

3. Microprocessor Based System CS-113

Programming the 8085: 8085 Microprocessor, Bus Structure and Timings, Demultiplexing the bus, Addressing Modes and Instruction set, 8085 Interrupts, Programming the 8086: Software Model of 8086, Memory address Space and Data Organization, Segment Registers and Memory

Segmentation, Dedicated and General Use of Memory, Addressing Modes, Instruction Set, Interrupt Processing, Minimum/ Maximum Mode, Interfacing Peripherals and Applications: Digital to Analog Converters, Analog to Digital Converters, 8255 PPI, 8279 Keyboard Display Interface, 8253 Programmable Interval Timer, 8259 Programmable Interrupt Controller, 8237 DMA Controller, Introduction to 80186, 80286, 80386 and 80486 Microprocessors, Registers, Memory Management.

References:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Wiley Eastern Limited, 2002
2. Barry B. Brey, C.R.Sharma, The Intel Microprocessors: Atrchitecture, Programming and Interfacing, Pearson Education, 2005
3. Sunil Mathur, Microprocessor 8086: Architecture, Programming and Interfacing, PHI, 2011
4. Douglas V. Hall, Microprocessor and Interfacing, McGraw Hill Company, 2005.

4. Design and Analysis of Algorithms CS-115

Growth of Functions, Summations, Recurrences, Design Techniques: Divide and conquer, Dynamic programming, Greedy algorithms, Backtracking, Branch and Bound, Graph Algorithms: Elementary graph algorithms, Single source shortest paths, All-pairs shortest paths, Maximum Flow, P and NP class problems, NP-completeness and reducibility, NP-completeness proofs, NP-complete problems, Polynomials and the Fast Fourier transform, Number-theoretic Algorithms, String matching, Algorithms for Parallel computers, Approximation algorithms etc.

References:

1. T Cormen, C Leisersson, R Rivest, C Stein, Introduction to Algorithms, PHI.
2. V. Aho, J. Hopcraft, J. Ulmann, The Design and Analysis of Computer Algorithms, Addison Wesley.
3. E Horowitz, S Sahni, S Rajasekaran, Fundamentals of Computer Algorithms, Universities Press
4. S. Basse, A. V. Gelder, Computer Algorithms: Introduction to Design and Analysis, Pearson Education Asia Pvt. Ltd.

5. Computer Graphics CS-116

Input devices, Video display devices, Area filling algorithms with irregular boundaries, Cohen-Sutherland and Cyrus-Beck line clipping algorithms, Basic 2-dimensional and 3-dimensional geometric transformations, Homogeneous coordinate system, Parallel projection, Isometric projection and its construction, Perspective projection, Hidden surface elimination algorithms, Basic illumination models, Gouraud and Phong surface rendering models, Representation of curves and surfaces.

References:

1. J.D. Foley, A. Van Dam, J.F. Hughes and S.K. Feiner, Computer Graphics: Principles and Practice, Second Edition, Addison Wesley
2. D. Hearn and P. M. Baker, Computer Graphics, Prentice Hall of India, Second Edition

3. Rogers, Procedural Elements of Computer Graphics, Second Edition, TMG
4. Rogers and Adams, Mathematical Elements of Computer Graphics, Second Edition, TMG

SEMESTER IV

Compulsory Courses

1. Software Engineering CS-118

Introduction, Software Product and Process, Software Process Models, Requirements Engineering, Requirements Analysis –Data Flow Diagram, Requirement Specification, Requirement Validation; Design- Concepts, Coupling, Cohesion, Mapping Requirements to Design, User Interface Design, Structure Charts, Coding Principles, Coding Standards and Guidelines, Software Testing Techniques and Strategies, Software Debugging, Software Project Metrics and Estimation Techniques – Empirical, Heuristic and Analytical Techniques, Software Quality Assurance, CASE Tools.

References:

1. Pressman, R., Software Engineering – A Practitioner's approach, Sixth Edition, McGraw-Hill International Edition.
2. Sommerville, I., Software Engineering, Sixth Edition, Pearson Education.
3. Ghezzi, C., Jazayeri, M., Mandrioli, D., Fundamentals of Software Engineering, Second Edition, Pearson Education.
4. Jalote, P., An Integrated Approach to Software Engineering, Second Edition, Narosa Publishing House.

2. Artificial Intelligence CS-120

Overview of AI; Problem solving; Various search strategies; Game playing; Minmax, Alpha-Beta pruning; 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.

References:

1. Rich and Knight, Artificial Intelligence, Tata McGraw-Hill.
2. Russell and Norvig, Artificial Intelligence: A Modern Approach (3rd Edition), Prentice Hall.
3. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, Inc.
4. Winston, Artificial Intelligence, Addison Wesley.

3. Parallel and Distributed Systems CS-117

Introduction to Parallel and Distributed Systems, Classification, Various Speedup Laws, Interconnection Network Architecture, Algorithms On Parallel/Distributed Machine, PRAM

Model, EREW, ERCW, CREW, CRCW Algorithms, Sorting Networks 0-1 Principle, Bitonic Sorter, Merger, Sorter, Distributed Systems, Interprocess Communication, Message Passing Communication, Distributed Coordination, Physical And Logical Clocks.

References:

1. Kai Hwang, Advanced Computer Architecture: TMH
2. M.R. Bhujade, Parallel Computing, New Age International Publications
3. M.J.Quinn, Parallel Computing, Mc-Graw Hill
4. Algorithms: Cormen, PHI
5. Tanenbaum, Distributed System, Pearson Education

Optional Courses for Elective I and II

1. Algorithmic Graph Theory CS-139

Introduction to Graph Theory, Euler Graphs, Introduction: Overview of graph, complexity, NP- completeness, Approximation and randomization of graph algorithms, Tour and Traversals, Spanning Tree and Sub-graph, Matching , Covering and Coloring, Planar graphs, Flow Problem, Extremal problems and Algebraic graph theory, Perfect graphs, Random Graph, Random graph model, , Random Walk, and Markov Chain, Erdos-Renyi random graph, Social Networking and link analysis

References:

1. Martin Charles Golumbic,Algorithmic Graph Theory and Perfect Graphs,North – Holland Publishing Company, Amsterdam, Netherlands,2004
2. Alan Gibbons, Algorithmic Graph Theory,Cambridge University Press,Cambridge,U.K.1985
3. Gary Chartrand, Ortrund R.Oellermann,Applied and Algorithmic Graph Theory,Mcgraw-hill Education,Europe,1993
4. David Easley and Jon Kleinberg Networks, Crowds, and Markets: Reasoning about a Highly Connected World , Cambridge University Press, (2010)

2. Data Mining and Knowledge Discovery CS-133

Introduction to Data Mining and knowledge discovery in databases (KDD); Data mining primitives, concepts, tasks and functionalities - concept learning, classification and prediction, association rule mining, clustering and anomaly detection; Data preparation - cleaning, transformation, reduction, discretization; Techniques, approaches and evaluation: Credibility, evaluation and comparison of data mining models; Association rule mining techniques - Apriori, Partition-based, FP-tree, Pincer-search; Supervised (inductive) learning - Decision table, rule, tree; Model tree, Baye's theorem, k-nearest neighbour, Regression, SVM; Unsupervised learning – Clustering Techniques - Partition, k-d tree, Hierarchical, Density, Grid, Advanced Databases: Text, Sequence, Image, etc.

References:

1. J. Han, M. Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2007

2. I.H. Witten, E. Frank, Data mining: Practical Tools and Techniques with Java Implementations, Morgan Kaufmann 1999
3. P-N. Tan, V. Kumar and M. Steinbach: Introduction to Data Mining, Pearson, 2007
4. D. Hand, H. Mannila, P. Smyth, Principles of Data Mining, Indian reprint, PHI 2004

3. Distributed Databases CS-135

Overview; Principles; Dimensions: Distribution, Heterogeneity, Autonomy, Distributed Database Architecture: Client-Server, Peer-to-Peer, Federated, Multidatabase; Distributed Database Design and Implementation: Data Fragmentation, Data Replication and Data Allocation Techniques; Distributed Query Processing and Optimization; Distributed Transaction Management, Concurrency Control and Reliability, Distributed Database Interoperability.

References:

1. Ceri, S., Pellagati, G., Distributed Database Principles and Systems, McGraw-Hill International.
2. Ozsu, M.T., Valduriez, P., Principles of Distributed Database Systems, Second Edition, Pearson Education.

4. Digital Image Processing CS-140

Digital Image fundamentals; Image sensing and acquisition; Image sampling and Quantization; Image Enhancement in Spatial Domain; Grey level transformation; Histogram Processing; Image Transforms; Spatial filters; Fourier Transforms and their properties; Fast Fourier Transforms; Image Enhancement in Frequency Domain; Image Segmentation: edge detection, Hough Transform, Region based segmentation; Image Compression.

References:

1. Richard E. Woods, Rafael C. Gonzalez, Digital Image Processing, 3rd Edition
2. Anil K. Jain, Fundamentals of digital image processing

5. Information Security CS-141

Introduction, Information Security hierarchy, Vulnerability, attack and threat, Security goals, end-end security, Link encryption, Privacy, authentication, Access control, Private key and public-key, Cryptographic Algorithm: DES, RSA, SHA, DH, Physical security, Personal security, Communication Security, Software security, OS security.

References:

1. John M.D.Hunter, An information security Hadbook, Publication Springer 2002.
2. Timothy J. Shinmeall and Jonathan M Spring ,Introduction of information security, Syngress Elsevier 2011.
3. Mark Merkov, Jim Breithaupty, Information security, Principal and practices, Person 2011.
4. Stinson D., Cryptography, Theory and practice , CRC Press, Boca Raton, FA 2005.

6. Networks Programming CS-142

Introduction to Network Programming: OSI reference model, TCP and UDP connection establishment and Format, Buffer sizes and limitation, standard internet services. Inter Process Communication: fork, wait and exec function. Pipes, FIFOs streams, and shared memory, semaphores and messages queues, Sockets Programming: Socket address format, TCP and UDP sockets – Socket, connect, bind, listen, and accept, concurrent servers and interactive servers. Signals handling: signal, sigaction. signal masking. signal generation: kill, alarm. Interactions of signal and wait, server process termination, I/O Multiplexing and socket options: I/O Models, select function. Threads: threaded servers – thread creation and termination, Remote Procedure calls. Practical: using C in LINUX/UNIX

References:

1. W. Richard Stevens, UNIX Network Programming – The Sockets Networking API, Vol. 1, 3rd Ed. Pearson Education, 2004
2. W. Richard Stevens, UNIX Network Programming – Interprocess Communications, Vol. 2, 2nd Ed, Pearson Education, 2004
3. Chris Brown, UNIX Distributed Programming, PHI,
4. UNIX Systems Programming using C++ T CHAN, PHI.Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

7. Object Oriented Analysis and Design CS-136

Object Oriented Paradigm and Principles; Modeling - Importance, Principles; Analysis Model; Design Model; Conceptual Model of the UML ; Structural Modeling - Classes, Relationships, Interfaces, Types, Roles, Packages, Instance; Structural Diagrams - Class, Object; Behavioral Modeling - Interactions, Use Cases, Activities, State Machines; Behavioural Diagrams - Use Case, Sequence, Collaboration, Activity, Statechart; Architectural Modeling - Component, Deployment and corresponding diagrams. Practical: Using open source UML tool.

References:

1. Booch G., Rumbaugh J. and Jacobson I., Unified Modeling Language User Guide, Pearson Education, Second Edition, 2005
2. Booch G. Object Oriented Analysis and Design with Applications, The Benjamin/Cummings Publishing Company, Third Edition, 2007

8. Optimization Techniques CS-128

Mathematical preliminary, Linear programming, Simplex method, Duality in linear programming, Convex optimization and quadratic programming, Least squares optimization, Unconstrained optimization problems, Nonlinear constrained optimization, Problems with equality constraints, Problems with inequality constraints, Application of mathematical programming in machine learning.

References:

1. D.G. Luenberger and Y. Ye, Linear and nonlinear programming, Third Edition, Springer International Edition, 2008

2. A.L. Peressini, F.E. Sullivan and J.J. Uhl, The mathematics of nonlinear programming, Springer Verlag, 1988
3. J. Nocedal and S.J. Wright, Numerical optimization, Springer Verlag, 1999
4. I. Griva, S. G. Nash and A. Sofer, Linear and nonlinear optimization, SIAM, Second Edition, 2009

9. VLSI Design CS-143

Introduction to CMOS VLSI Design; nMOS and CMOS transistor structures and process technologies, Operation of MOS transistor as a switch, Design and analysis of nMOS and CMOS inverters, common gates, latches and flip-flops, Fabrication of MOS transistors; stick diagrams, design rules and layout, Circuit characterization and performance estimation of MOS circuits. CMOS circuit and logic design. Dynamic MOS structures, Registers, counters and memory realizations using MOS logic, Design structuring; Regular structure circuits, PLAs and FSMs, system timing and clocking issues, scaling. CMOS subsystem design, Low power circuits and systems, System case studies, Design automation of VLSI Systems: basic concepts. Deep Sub-micron Technologies: Some Design Issues.

References:

1. N. H. E. Weste and K. Eshraghian, Principles of CMOS VLSI Design: A Systems Perspective, Pearson Education.
2. J. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Prentice Hall of India.
3. M. Sarafzadeh and C. K. Wong, An Introduction to VLSI Physical Design, MCGraw-Hill.

10. Internet and Web Technology CS-130

Introduction, history of internet and web technology, hardware and software requirement s, information casting , servers, web browsers, searching and web casting techniques, bookmarks, cookies, search engines, web crawlers , case study of browsers , internet chat , security issues, programming language for development.

References:

1. AchyutGodbole, Atulkahate. Web Technology, 2nd edition TMH.
2. Deitel H., Deitel P., Internet and world wide web: How to program, 5TH edition, PHI,2011.
3. Karl Barksdale, HTML, JavaScript, and Advanced Internet Technologies, Cengage Learning

SEMESTER V

Compulsory Course

11. Web Based Programming CS-114

World wide web- Introduction, Client server model, Web servers, Browsers Interface, Browser Architecture, caching in web browser, CGI Interface, Hypertext- HTML, DHTML, HTTP;Scripting language: JSP, ASP.Web Programming – Java language, Java swing, Java beans, Applets, Servlets, RMI, JAVA Utilities.

References:

1. Comer D.E, Computer Networks, Internet and applications, 3rd 2004.
2. Crouch, Web programming with ASP and COM , Pearson Education
3. Jon Duckett, Beginning Web Programming with HTML, XHTML, and CSS, Wiley Publication

Optional Courses for Elective III, IVandV

1. Advanced Algorithms CS-144

Probabilistic Recurrence, Basic Power and Efficiency of Randomization and Approximation, Computation Model and Complexity Classes, Reducibility, Classification of randomized algorithms: Las Vegas and Monte Carlo, Minimum cut algorithm, Bin-Balls Problem, Birthday-Paradox, Coupon-Collector, Stable Marriage Problem, Game Theory, Random variables and Basic inequalities (Markov, Chebyshev), Chernoff Bounds, Martingale Bound, Max-cut, Random Graphs, Markov chains and random walks, Random graph models for real-world networks, social networks, etc. Algorithms for 2-SAT and 3-SAT, Particle Swarm optimization (PSO), Multi-swarm optimization, Ant Colony optimization, Intelligent Water Drops algorithm, Genetic algorithm, Hill-Climbing optimization algorithm

References:

1. Vijay Vazirani, Approximation Algorithms, Springer-Verlag, ISBN: 3-540-65367-8, Published:
   a. 2001
2. D. Williamson and D. Shmoys, The Design of Approximation Algorithms, Cambridge
   a. University Press, 2011
3. T Cormen, C Leisersson, R Rivest, C Stein, Introduction to Algorithms, PHI.
4. Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge UniversityPress, ISBN: 0521474655, Published: August 25, 1995
5. Social and Economic Networks by Matthew O. Jackson (Nov 21, 2010)

2. Big Data Management CS-145

Introduction to Big Data; Big Data Architecture: Tradition Information Architecture, Integrated with Big Data Architecture Capabilities: Storage, Management, Database, Processing, Data Integration, Statistical Analysis; Large Scale File System: Distributed File System, MapReduce, HDFS and Hadoop; Data Management Techniques to Store Data Locally and in Cloud Infrastructures; Data Analysis using Statistical Methods and Visualization; Statistics and Computational Predictive Analysis on data; Data-Intensive Computations on Cluster and Cloud Infrastructures using MapReduce; Mining of Big Data; Issues, Challenges and Opportunities in Big Data Management

References:

1. Rajaraman, A., Ullman, J. D., Mining of Massive Datasets, Cambridge University Press, United Kingdom, 2012
2. Berman, J.J., Principles of Big Data: Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann, 2014
3. Barlow, M., Real-Time Big Data Analytics: Emerging Architecture, O Reilly, 2013
4. Schonberger, V.M. , Kenneth Cukier, K., Big Data, John Murray Publishers, 2013

3. Cloud Computing CS-180

Overview of Distributed Computing: Trends of computing, Introduction to Parallel/distributed computing, Grid Computing, Cloud computing, Introduction to Cloud Computing: What's cloud computing, Properties and Characteristics, Service models, Deployment modelsComponents of a computing cloud, Different types of clouds: public, private, hybrid, Delivering services from the cloud, Categorizing service types, Comparing vendor cloud products: Amazon, Google, Microsoft and others, Infrastructure as a Service (IaaS): Introduction to IaaS, Resource Virtualization, Server, Storage, Network, Case studies, Platform as a Service (PaaS): Introduction to PaaS, Cloud platforms and Management, Computation, Storage, Case studies, Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Case studies, Cloud Issues and Challenges: Cloud provider Lock-in, Security.

References:

1. Kai Hwang, Geoffrey Fox, Jack Dongarra, Distributed and Cloud Computing, Elsevier, 2012.
2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Mastering Cloud Computing, TMH, 2013.
3. Dan C. Marinescu, Cloud Computing: Theory and Practice, Elsevier, 2013.
4. Barrie Sosinsky, Cloud Computing Bible, Wiley, 2011.

4. Computer Vision CS-146

Introduction to vision; Camera models; Camera calibration; Multi-view geometry and reconstruction; Edge/ Feature extraction; Correspondence and tracking; 3D structure/ motion estimation; basics of object recognition.

References:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011

2. Richard Hartley and Andrew Zissermann, Multi-view Geometry in Computer Vision, 2nd Edition
3. Forsyth and Ponce, Computer Vision: A Modern Approach, Prentice Hall

5. Evolutionary Computation CS-147

Fundamentals and History of Evolutionary Computation, Common Evolutionary Computation Methods: Genetic Algorithms, Genetic Programming; Evolution Strategies, Components of Evolutionary Computation: Framework, Populations, Selection Operators, Genetic Operators; Evolutionary Computation Problem Solving: Search, Optimization, Machine Learning; Evolutionary Computation Theory: Dynamics, Selection, Reproduction, Representation, Fitness Landscapes; Multi-objective Evolutionary Computation

References:

1. De Jong, K.A., Evolutionary Computation – A Unified Approach, Prentice Hall of India, 2006
2. Eiben, A.E., Smith, J.E., Introduction to Evolutionary Computing, Springer-Verlag, 2003
3. Back, T., Fogel, D.B., Michalewicz, Z., Evolutionary Computation 1: Basic Algorithms and Operators, Institute of Physics Publishing (IPS), 2000
4. Back, T., Fogel, D.B., Michalewicz, Z., Evolutionary Computation 2: Advanced Algorithms and Operations, Institute of Physics Publishing (IPS), 2000

6. Information Theory CS-132

Review of Probability, uncertainty and information. Axioms for the Uncertainty measure, Entropy, Joint Entropy, Conditional Entropy, Mutual Information, Chain Rules, Jensen Inequality, Data Processing Inequality, Asymptotic Equipartition Property, Consequences of AEP, Data Compression: Kraft Inequality, Optimal Codes, Huffman Code, Shannon Fano-Elias Coding, Channel Capacity. Information Capacity theorem, The Shannon limit, Channel Capacity of MIMO System, Noiseless and Noisy Channel, Hamming Code, Information Measures for Continuous Random Variables, Differential Entropy, Relative Entropy and Mutual Information, Gaussian Channel, Rate Distribution Theory, Binary Source, Gaussian Source, Converse to the Rate Distortion Theory, Jaynes Maximum Entropy Principle and its Applications.

References:

1. M. Cover and Joy A. Thomas, Elements of information theory, Wiley, second edition 2012.
2. Robert B. Ash, Information Theory, Dover Publication Inc, Newyork, 1990.
3. S. M. Moser, P. N. Chen, A Student's Guide to Coding and Information Theory, 1st Edition, Cambridge Univ. Press.
4. Ranjan Bose, Information theory, coding and cryptography, Tata McGraw Hill, NewDelhi, 2008.

7. Machine Learning CS-129

An overview of Machine learning, Inductive learning: ID3, C4.5,C5; Learning Concepts and rules from Examples; Learning by analogy; Learning from observation and discovery; Learning by experimentation; Learning by training Neural Networks; Genetic Algorithm; Analysis learning; Reinforcement learning ;Applications to KDD.

References:

1. Mitchell, Machine Learning McGraw-Hill.
2. Marsland, Machine learning: an algorithmic perspective, CRC Press,Taylor and Francis Group.

8. Modeling and Simulation CS-127

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

References:

1. Raj Jain, Art of Computer Systems Performance Analysis, John Wiley and Sons, Inc, 1991.
2. Sheldon M. Ross, Simulation, 4th Ed., Elsevier 2008,
3. Averill M. Law and W. David Kelton, Simulation Modeling and Analysis, 3rd Ed. Tata McGraw-Hill, 2003
4. Geofeerey Gordon, System Simulation, 2nd Ed., PHI, 1987.

9. Multimedia Systems CS-134

Introduction to Multimedia, Fundamental Concepts of Multimedia Data types : Image, Audio, Video and Animation; Compression Technology, Multimedia Communication and delivery, Content management and retrieval, Distributed multimedia Systems.

References:

1. Ze-Nian Li and M. S. Drew, Fundamentals of Multimedia, Pearson Education, 2004.
2. K. R. Rao, Z. S. Bojkovic and Dragorad A. Milovanovi, Multimedia Communication Systems: Techniques, Standards, and Networks, Prentice Hall

10. Natural Language Processing CS-126

Introduction , Regular Expressions and Automata, Words and Transducers, N-grams, Part-of-Speech Tagging , Hidden Markov and Maximum Entropy Models, Formal Grammars of English, Syntactic Parsing, Statistical Parsing, Features and Unification, Language and

Complexity, The Representation of Meaning, Computational Semantics, Lexical Semantics, Computational Lexical Semantics, Computational Discourse, Information Extraction, Question Answering, Sentiment Analysis and Summarization, Dialog and Conversational Agents, Machine Translation. Case studies in the context of various Indian and foreign languages. Emerging trends in NLP.

References:

1. Jurafsky Daniel and Martin James H., Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Prentice Hall.
2. Manning Christopher D. and Schütze. Hinrich, Foundations of Statistical Natural Language Processing, MIT Press.
3. Allen James, Natural Language Understanding, Benjamin/Cummings.
4. Jelinek Frederick, Statistical Methods for Speech Recognition, MIT Press.
5. Pang Bo and Lee Lillian, Opinion mining and sentiment analysis, Foundations and Trends in Information Retrieval 2 (1-2), pp. 1–135, 2008.

11. Pattern Classifications CS-122

Review of Probability Theory, Conditional Probability and Bayes Rule, Bayesian Decision Theory, Maximum-Likelihood and Bayesian Parameter Estimation, Non-Parametric Techniques, Neural Networks, Optimization by Gradient Descent, Multilayer Neural Networks, Support Vector Machines, Bias and variance, Resampling for estimating statistics, Bagging, Boosting

References:

1. R O Duda, P E Hart, D G Stork, Pattern Classification, Wiley Interscience
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer
3. Fukunaga, Introduction to Statistical Pattern Recognition, Academic Press
4. S Theodoridis, K Koutroumbas, Pattern Recognition, Academic Press

12. Principles of Compiler Design CS-148

Overview of Compilation: Introduction, Structure of Compiler, Passes, Phases, Compiler Construction tools. Lexical analysis : Finite state machines, regular expression and their role for Lexical analysis, Specification and recognition of tokens , Implementation of Lexical analyzer using NFA, DFA, Lex, LEX Tool, Symbol Table, Syntax Analysis : Formal grammar and their application to Syntax Analysis, Context Free Grammar, Parse trees, Syntax tree and capabilities of CFG, Top down parsing, Bottom up parsing : Yacc automatic parser generator, Semantic Analysis : Attributes of grammar, Symbol Table, Parse tree Abstract Syntax tree, Syntax directed Translation, Syntax directed translation schemes, Overall design of a semantic analyzer Symbol Tables : Symbol table format, organization, Memory allocation, Runtime stack and heap storage allocation, Intermediate code generation : Intermediate code and data structures, Design Issues, Data structure for Intermediate code, Intermediate code generation for data types , statements and Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Object Code Generation and optimization. Practical- Practical on designing lexical analyzer using NFA, DFA , Implementing Top down predictive parser Practical on LEX and Yacc, Generating Intermediate code for simple statements

References:

1. Aho , Ulman, Sethi, Compiler: Principles, techniques and tools, Pearson education
2. Kenneth C. Louden , *Compiler Construction Principles and Practice,* , Thompson
3. *Cooper and Linda, Engineering a Compiler-, Elsevier.*
4. John R. Levine, Tony Mason, Doug Brown, lex andyacc , O'reilly

13. Software Testing CS-149

Foundation - Basic Definitions, Test Cases, Error and Fault Taxonomies, Levels of Testing; Verification and Validation; Static and Dynamic Testing; Functional Testing - Basics, Boundary Value Analysis, Equivalence Class, Decision Table-Based, Cause-Effect Graphs; Structural Testing - Coverage Metrics, Basis Path, Graph Matrix, Loop, Dataflow; Mutation testing; Regression Testing; V-Model; Levels of Testing - Unit, Integration Types, System Types, Object-Oriented Testing - Class, Integration, GUI, System, Practicals- Based on JUnit/NUnit.

References:

1. Jorgensen P.C., Software *Testing, A Craftsman's Approach*, Third Edition, Auerbach Publications, 2010
2. Chauhan N., *Software Testing: Principles and Practices*, First Edition, Oxford University Press, 2010

14. Wireless Communication and Mobile Computing CS-150

Mobile radio systems-, Paging systems, cordless telephone system, cellular telephone system, Cellular Concept: Frequency reuse, channel assignment, hand off, Interference and cell splitting, sectoring, Improving Coverage and capacity in Cellular systems. Propagation modeling: Outdoor/ Indoor Propagation models, Small scale Multipath propagation- Rayleigh fading, Ricean Fading, Nakagami fading, Shadowing, lognormal shadowing fading model, outage probability, coverage estimation under shadowing, and multipath fading. Wireless Networks 802.11, frequency-hopping, encoding and modulation, MAC Layer Protocol Architecture Multiple access with collision avoidance protocol, Virtual Carrier-Sensing, DCF Protocol, PCF Operation.

References:

1. Rappaport, Wireless communications: principal and practice , Pearson ed.
2. Matthew s. Gast, 802.11 wireless networks, o'reilly
3. Andrea Goldsmith ,Wireless communication , cambridge university press ed .
4. Jochen Schiller , Mobile communications, phi/person edu., 2nd ed.,

SEMESTER VI

1. Project Work