School of Computer & Systems Sciences

Master of Technology (Computer Science and Technology)

Revised Course Structure and Syllabus

A student shall have to earn a minimum of 50 credits at the end of II year in order to be eligible for the award of M.Tech. Degree in Computer Science and Technology.

Semester I

S.No.	Course Name	Credits
1.	Design and Analysis of Algorithms CS-773	3
2.	Elective I	3
3.	Elective II	3
4.	Elective III	3
5.	Elective IV	3

Semester II

S.No.	Course Name	Credits
1.	Elective V	3
2.	Elective VI	3
3.	Elective VII	3
4.	Elective VIII	3
5.	Elective IX	3

Semester III

S.No.	Course Name	Credits
1	Research Reading and Laboratory CS-783	3
2	Seminar CS-784	3

Semester IV

S.No.	Course Name	Credits
1	Dissertation	14

List of Electives Courses for M.Tech. (Semester-I and Semester-II)

1.	Advance Scientific Computing CS-750	26.	Operating System CS-704
2.	Advanced Software Engineering CS-729	27.	Network Security CS-761
3.	Artificial Intelligence CS-708	28.	Object Oriented Programming CS-735
4.	Big Data Analytics CS-751	29.	Object Oriented Software Engineering CS-707
5.	Grid and Cloud Computing CS-771	30.	Parallel and Distributed Systems CS-762
6.	Computer Graphics CS-730	31.	Pattern Classification CS-763
7.	Computer Architecture CS-705	32.	Performance Modeling of Computer Communication Networks CS-764
8.	Computer Vision CS-752	33.	Randomized and Approximation Algorithms CS-779
9.	Data Communication and Computer Networks CS-703	34.	Swarm Intelligence CS-766
10.	Data Mining and Knowledge Discovery CS-715	35.	Services Oriented Architecture CS-738
11.	Data Structure CS-776	36.	Software Engineering CS-731
12.	Data Warehousing and Data Mining CS-753	37.	Software Quality Assurance CS-767
13.	Database Management Systems CS-706	38.	Theory of Computation CS-780
14.	Digital Image Processing CS-754	39.	Topics in Mathematical Sciences CS-736
15.	Embedded Systems CS-722	40.	Vehicular Communication Networks CS-768
16.	Geo Spatial Informatics CS-755	41.	VLSI Design and Testing CS-769
17.	Graph Theory CS-756	42.	Web Mining CS-737
18.	Large Scale Graph Algorithms and Application CS-777	43.	Wireless Communication and Mobile Computing CS-718
19.	Machine Learning CS-714	44.	Wireless Sensor Networks CS-770
20.	Maximum Entropy Modeling and Application CS-757	45.	MEMS Technology CS-781
21.	Micro Fabrication Technologies CS-758	46.	VLSI Technology CS-726
22.	Mobile Ad Hoc Networks CS-720	47.	**Research Methodology- CS-765**
23.	Modeling and Simulation CS-778	48.	**Academic Ethics and Technical Writing- CS-774**
24.	Multicast Communication CS-759		
25.	Natural Language Processing CS-760		

School of Computer and Systems Sciences

Master of Technology in Computer Science and Technology (M.Tech.)

Syllabus

SEMESTER I

Compulsory Course

1. Design and Analysis of Algorithms CS-773

Asymptotic Analysis, Growth of Functions and Recurrences, Divide and conquer, Dynamic programming, Greedy algorithms, Backtracking, Branch and Bound, Graph Algorithms, Computational Geometry, String Matching, Primality Testing, Probabilistic Recurrence, Basic Power and Efficiency of Randomization and Approximation, Computation Model and Complexity Classes, Reducibility, Las Vegas and Monte Carlo Algorithms, Randomized algorithms, Randomized Minimum cut algorithm, Bin-Balls Problem, Birthday-Paradox, Coupon-Collector, Stable Marriage Problem, and Basic inequalities (Markov, Chebyshev), Chernoff Bounds, Martingale Bound Algorithms for 2-SAT and 3-SAT, Randomized search algorithm, Random Graphs, Markov chains and random walks, Random graph models for real- world networks, social networks, etc, Particle Swarm optimization (PSO), Multi-swarm optimization, Ant Colony optimization, Intelligent Water Drops algorithm, Genetic algorithm, Hill-Climbing optimization algorithm.

References:

1. Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press, ISBN: 0521474655, Published: August 25, 1995
2. Mitzenmacher and Upfal, Probability and Computing: Randomized Algorithms and Probabilistic Analysis Cambridge University Press, 2005
3. T Cormen, C Leisersson, R Rivest, C Stein, Introduction to Algorithms, PHI.
4. V. Aho, J. Hopcraft, J. Ulmann, The Design and Analysis of Computer Algorithms, Addison Wesley.
5. S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani, Algorithms, McGraw-Hill Science/Engineering/Math; 1st edition, 2006
6. E Horowitz, S Sahni, S Rajasekaran, Fundamentals of Computer Algorithms, Universities Press

Elective Courses

1. Elective I (see appendix-1)
2. Elective II (see appendix-1)
3. Elective III (see appendix-1)
4. Elective IV (see appendix-1)

SEMESTER II

Elective Courses

1. Elective V (see appendix-1)
2. Elective VI (see appendix-1)
3. Elective VII (see appendix-1)
4. Elective VIII (see appendix-1)
5. Elective IX (see appendix-1)

SEMESTER III

All Compulsory Courses

1. Research Reading and Laboratory

This course should be carried out under the supervisor in the area related to dissertation work, as suggested by the supervisor. The research work related to dissertation, including the laboratory work, should be presented to the concerned supervisor. The research reading and laboratory course would be evaluated by the concerned supervisor.

2. Seminar

The Seminar course would include seminars related to the dissertation work. It would be evaluated bya seminar evaluation committee comprising three faculty members. The seminar, as part of the end- semester examination, would finalize the topic of the dissertation.

Semester: IV

1. Dissertation

Student will have to submit the dissertation for evaluation in the school. The dissertation of each student is to be evaluated through viva-voce/presentation in the school conducted by the committee comprising the supervisor and one external expert from outside the university in the related area, as recommended by the special committee of the School and approved by the University.

Appendix-1

Optional Courses for Electives I to IX in Semester I and II

1. Advance Scientific Computing CS-750

Introduction to Parallel Computing and various topologies. Spectral methods - Discrete and Fast Fourier Transforms and its parallelization. Eigen systems – JacobiTransformations, eigenvectors and convergence of the Jacobi Method, Givens Rotations, The Householder – QR/QL Algorithm – Diagonalization of thermetian matrices – Solutions of Ordinary differential equations – Euler, Mid-point and Runge Kutta methods upto order 4 and discussion of their stability, Adaptive step size control, the Bulirsch-Stoer method, introduction to stiff equations, Linear Systems of algebraic equations, Gauss-Jordan and LU Decomposition, singular Value Decomposition, Sparse Linear Systems.

References:

1. M.K. Jain, S.R.K.Iyengar, R.K.Jain, Numerical methods for Scientific and Engineering Computation, New Age International Publication.
2. C. Xavier and S.S.Iyengar, Introduction to Parallel Algorithms, Wiley Publication.

2. Advanced Software Engineering CS-729

Overview of Software Engineering, Methods of Analysis and Design of Software Systems: Structured and Object Oriented, Coding Standards and Guidelines, Theoretical Foundation of Testing: Coverage Criterions, Software Testing Techniques and Strategies, Software Debugging;Software Project Metrics and Estimation Techniques: Empirical, Heuristic and Analytical Techniques; Software Project Planning and Scheduling: PERT and CPM; Software Project Crashing; Software Reliability Metrics and Models, Software Availability, Software Risk and Configuration Management; Software Reuse and Re-engineering; CASE Tools and Support; Software Quality Assurance.

References:

1. Pressman, R., Software Engineering – A Practitioner's approach, Sixth Edition, McGraw-Hill International Edition.

2. Ghezzi, C., Jazayeri, M., Mandrioli, D., Fundamentals of Software Engineering, Second Edition, Pearson Education.
3. Peters, J.F., Pedreyz, W., Software Engineering - An Engineering Approach, John Wiley and Sons.
4. Sommerville, I., Software Engineering, Sixth Edition, Pearson Education.
5. Taha, H.A., Operations Research – An Introduction, Seventh Edition, Pearson Education.

3. Artificial Intelligence CS-708

Overview of AI: Foundations, history and sate of art; Problem Solving: Search, Game playing; Knowledge Representation and Reasoning: First Order Logic, building knowledge-bases, Logic based Reasoning Systems, Semantic Networks, Frames; Uncertainty and Reasoning: Bayesian networks, Demster-Shafer theory, Fuzzy Sets; Planning; Machine Learning: learning from observations, Artificial Neural Networks, Reinforcement learning; Intelligent Agents; Natural Language Processing; Robotics

References:

1. Knight, Kevin, Rich, Elaine, Nair, B., artificial Intelligence, Tata McGraw-Hills, 2008
2. Russell, Stuart, Artificial Intelligence: A Modern Approach, Pearson Edition 2013
3. Kaushik, Saroj, Artificial Intelligence, Cengage Laerning, 2011
4. Winston, P.H. Artificial Intelligence, Pearson, 2002

4. Big Data Analytics CS-751

Introduction to Big Data, Data Mining, Data Analytics, Predictive Analysis and Business Intelligence, Large Scale File System: Distributed File System, MapReduce, HDFS and Hadoop, Mining Big Data, Advanced Data Analytics and Machine Learning, Big Data Streams and Real Time Predictive Analysis, Tools and Visualization, Link Analysis, Web Analytics, Collaborative Filtering, Social Network Analysis, Issues, Challenges and Opportunities with Big Data and its Analytics

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

5. Grid and Cloud Computing CS-771

Roots of Cloud Computing, Layers, Types and Features of Clouds, Cloud Infrastructure Management, Cloud Services, Challenges and Opportunities. Virtualization and Resource Provisioning in Clouds, Virtual Machines (VM), VM Provisioning and Manageability, VM Migration Services. Cloud Benefits and Challenges, Market-Oriented Cloud Architecture, SLA-

oriented Resource Allocation, Global Cloud Exchange. Emerging Cloud Platforms, Programming Enterprise Clouds using Aneka, Aneka Architecture and Deployment. Parallel Programming Models, Thread Programming, Task Programming and Map Reduce using Aneka. Integration of Private and Public Clouds or Federated Clouds.

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

6. Computer Graphics CS-730

Input devices, Video display devices, 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, Fractals, Transparency, Ray tracing, 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

7. Computer Architecture CS-705

Number Representation, Addition, Subtraction, Multiplication and Division Algorithms, FloatingPoint Arithmetic Algorithms, Decimal Arithmetic Algorithms. Parallel Adder/Subtractor, Carry Lookahead Adder, Carry Save Adder. Multiprocessors and Multicomputers, PRAM, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms. Principles of Scalable Performance Metrics and Measures, Speedup Performance Laws, Scalability Analysis. CISC Scalar Processors, RISC Scalar Processors, Superscalar, VLIW and Vector Processors. Memory Hierarchy Technology, Virtual Memory Technology, Bus Cache and Shared Memory- Backplane Bus System, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models. Multiprocessor System Interconnects. Cache Coherence Issues and Synchronization Mechanisms, Message Passing Mechanisms. Linear and Nonlinear Pipeline Processors, Superscalar and Super pipeline Design.

References:

1. Kai Hwang, Naresh Jotwani, Advanced Computer Architecture: Parallelism, Scalability, Programmability, Tata McGraw-Hill, 2010

2. John L. Hennessy, David A. Computer Architecture: A Quantitative Approach, Patterson, Elsevier, 2012
3. Richsrd Y. Kain, Advanced Computer Architecture: A System Design Approach, PHI, 2011
4. Dezso Sima, Terence Fountain, Peter Kacsuk, Advanced Computer Architectures: A Design Space Approach, Pearson Education, 2003.
5. Morris Mano, Computer System Architecture, Pearson Education, 2011

8. Computer Vision CS-752

Introduction to vision; Camera models; Camera calibration; Multi-view geometry and reconstruction; Edge/ Feature extraction; Correspondence and tracking; 3D structure/ motion estimation; shape from X techniques; Recognition, scene and activity interpretation, video analysis.

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

9. Data Communication and Computer Networks CS-703

Data Communication – Analog and digital communications, Channel characteristics, modulation,encoding schemes; Error Detection and correction, Flow control, multiplexing switching, Multiple access techniques, Routing – shortest path algorithms, routing protocols, virtual path routing, Network Protocols – IP, TCP, UDP, FTP, SMTP, etc, Performance Evaluation – Queuing models, Traffic model – deterministic and stochastic

References:

1. Leon Garcia and Indra Widjaja, Communication Networks: Fundamental Concepts and Key Architecture, 2nd ed., Tata McGraw-Hill, 2004
2. Anurag Kumar, D. Manjunath and Joy Kuri, Communication Networking: An analytical approach, Elsevier, 2004.
3. Dimitri Bertsekas and Robert Gallager, Data Networks, 2nd ed., PHI, 2001.
4. Thomas G. Roberttazzi, Computer Networks and Systems, 3rd ed. Springer, 2002.

10. Data Mining and Knowledge Discovery CS-715

Concepts of data mining and knowledge discovery: Input – concepts, instances, attributes; Knowledge representation of outputs; Data mining methodologies – classification, prediction, regression, association, clustering, outlier analysis, Advanced data mining models – Machine learning: incremental learning, reinforcement learning, genetic algorithms, neural networks, intelligent agents based learning; Soft Computing: Concepts and ML models using Fuzzy set theory and Rough set theory. Applications of data mining in complex data: world-wide web, Streams, Scientific, spatial
Current topics

References:

1. Han, J. and Kamber, M., Data Mining: Concepts and Techniques, Morgan Kaufmann, 2e, 2007.
2. Witten, Ian H. and Frank Eibe, Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations. Morgan Kaufmann, 2e,2005
3. Tan, P., Kumar, V. and Steinbach, M., Introduction to Data Mining, Pearson Education Inc. 2007
4. Hand, David, Mannila Heikki and Smyth Padheaic, Principles of Data Mining, Prentice-Hall India, 2004 (Indian reprint)
5. Thuraisingham, B., Data Mining: Technologies, Techniques, Tools, and Trends, CRC Press, 1999.

11. Data Structure CS-776

Introduction to data structures; Analysis of algorithms ; Linear lists: Stacks ,Queues, Deques; Orthogonal lists; Multilinked structures ;Trees: Binary search trees, AVL trees, Red Black trees, M-way and B trees; Hash tables; Priority Queues; Sorting: Quick Sort, Heap sort, Merge sort
,External sorting, Shell sort, Bin and Radix sort; Graphs: Topological sort, Shortest path, Network flow problem, Minimum spanning tree, Algorithm design techniques: Greedy algorithms, Divide and Conquer, Dynamic Programming, Randomized algorithms, Backtracking.

References:

1. Aho, Hopcraft and Ullman. Data structures and Algorithms, Addison Welsey.
2. Horowitz and Sahni, Fundamentals of Data Structures, Computer Science Press.
3. Wirth, Algorithms + Data Structures = Programs, PHI.
4. Cormen, Leiserson, Rivest and Stein, Introduction to algorithms, Prentice Hall.

12. Data Warehousing and Data Mining CS-753

Data Warehouse Definition, Perspectives of DW, Dimensional Modelling, OLAP functions, MDX query language, Architecture, Representation, Design Process, Mapping ER to Star schema, Metadata, ETL-Extraction, Transformation and Loading, Data warehousing to Mining;Data Mining Methodologies - Association Rule Mining , Classification and Prediction, Cluster Analysis; Modern Topics. Practical: Executing MDX queries on SQL Server

References:

1. Inmon W.H., Building the Data Warehouse, Wiley, Fourth Edition, 2005
2. Ponniah P., Data Warehousing Fundamentals : A Comprehensive Guide for IT Professionals, John Wiley and Sons, Second Edition,2010
3. Anahory S. and Murray D., Data Warehousing in the Real World, Addison-Wesley, First Edition, 1997
4. Han J. and Kamber M., Data Mining : Concepts and Techniques, Morgan Kaufmann, Third Edition, 2011

13. Database Management Systems CS-706

Introduction; Database Architecture; Database Analysis: Entity Relationship Model, Database Design: Relational Model, Integrity Constraints, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF; Query Languages: Relational Algebra, Tuple Calculus, Domain Calculus, SQL; Query Processing: Query Decomposition, Query Optimization; Object Relational Databases, XML Databases, Transactions, Concurrency Control and Recovery System, Parallel and Distributed Databases, Advances in Database Systems and Technologies

References:

1. Silberschatz, A., Korth, H.F., Sudarshan, S., Database System Concepts, McGraw-Hill International Edition, 2006 (5th Edition)
2. Elmasri, R., Navathe, S.B., Fundamentals of Database Systems, Fourth Edition, Pearson Education,
3. Desai, B.C., An Introduction to Database Systems, Galgotia Publications,
4. Date, C.J., An Introduction to Database Systems, Pearson Education, 7th Edition
5. Garcia-Molina, H., Ullman, J.D., Widom, J., Database Systems: The Complete Book, Pearson Education, 2002

14. Digital Image Processing CS-754

Elements of visual perception, Arithmetic, Logical, Geometric operations, Convolution, Correlation, Spatial Domain Filtering, Image Transforms and Filtering in the Frequency domain, Image Restoration, Image Compression, Wavelet based Image Compression, Morphological Image Processing, Image Segmentation, Color Models and Relationship Between Different Models, Digital Image Watermarking, Steganography, Medical Imaging

References:

1. R C Gonzalez , R E Woods, Digital Image Processing, 3rd Edition, Pearson Education.
2. A K Jain, Fundamentals of Digital image Processing, Prentice Hall of India.
3. K R Castleman, Digital Image Processing, Pearson Education.
4. Schalkoff, Digital Image Processing and Computer Vision, John Wiley and Sons.

15. Embedded Systems CS-722

Introduction: Embedded system, software embedded in system, embedded system on chip in VLSI circuit, Categories and requirements of embedded systems, Challenges and issues relatedto embedded software developments, Embedded system Design: Concepts of concurrency, processes, threads, mutual exclusion and inter-process communication, Models and languages for embedded software, Synchronous approach to embedded system design, Scheduling paradigms, Scheduling, Algorithms, Hardware/Software Co-design, Introduction to RTOS: Basic Design using RTOS, Interfacing, RISC Processor: Architecture, Memory, Reset and Interrupt, Functions, Parallel I/O ports, Timers/Counters, Serial Communication, Analog Interfaces
Case Studies and Applications of embedded systems

References:

1. Raj Kamal, Embedded Systems, TMH

2. Franc Vahid, Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley.

16. Geo Spatial Informatics CS-755

Introduction to Geo informatics – Remote Sensing and Geospatial data, GIS; Physics of Remote Sensing, Sensors (Passive, active) and Satellites, Photogrammetry; Geospatial Data models (data structures), Digital Image Processing techniques in Remote Sensing; Geospatial data Processing, Spatial statistics, Spatial/temporal analysis and data mining: feature extraction, Supervised- Semisupervised-unsupervised classification; Applications of Geospatial informatics.

References:

1. J.R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 3rd Edition, Pearson Prentice Hall, 2005
2. George Joseph, Fundamentals of Remote Sensing, University Press, 2003
3. I. Heywood, S. Cornelius and S. Carver, An Introduction to Geographical Information Systems, Dorling Kinderseley India, 2006
4. H.J. Miller and Jiawei Han, Geographic Data Mining and Knowledge Discovery, 2nd Edition, CRC Press, 2009
5. R.A. Schowengerdt, Remote Sensing: Models and Methods for Image Processing, 2nd Edition, Academic Press, (imprint of Elsevier), 2007

17. Graph Theory CS-756

Introduction to Graph Theory, Euler Graphs, Operation On Graphs, Hamiltonian Paths And Circuits, Trees And Its Properties, Spanning Trees, Fundamental Circuits and Cut Sets, Connectivity And Separability, Planar Graphs, Kurtowaski's Graphs, Geometric Dual, Directed Graphs, Euler Diagraphs, Graph Representation, Matrix and Vector Spaces, Coloring, Covering and Partitioning

References:

1. Narsingh Deo, Graph Theory and its application to Science and Engineering, PHI
2. Chartrand G., Zhang Ping, Introduction to Graph Theory, Tata McGraw-Hill
3. Douglas B. West, Introduction to Graph Theory 2nd Ed., Pearson Education
4. Graph Theory, Schaum's Series

18. Large Scale Graph Algorithms and Application CS-777

Introduction and Application of Large-scale Graph, Characteristics, Complex Data Sources - Social Networks, Simulations, Bioinformatics; Categories- Social, Endorsement, Location, Co- occurrence graphs; Basic and Advanced Large-scale Graph Analysis- List Ranking, Link Analysis, Page Ranking Algorithms; Distributed Computation for Massive Data Sets- Spectral, Modularity-based Clustering, Random Walks; Large Graph Representation and Implementation- V-Graph Representation, MapReduce, Surfer, GraphLab; Advanced Topics- Power Law Distribution, Game-Theoretic Approach, Rank Aggregation and Voting Theory, Recommendation Systems, Social network analysis: case study - Facebook, LinkedIn, Google+, and Twitter

References:

1. Social and Economic Networks by Matthew O. Jackson (Nov 21, 2010)
2. Stanley Wasserman, Katherine Faust "Social Network Analysis Methods and Applications" (Structural Analysis in the Social Sciences) 1995
3. Tanja Falkowski "Community Analysis in Dynamic Social Networks" 2009
4. Ladislav Novak, Alan Gibbons, "Hybrid Graph Theory and Network Analysis" Cambridge Tracts in Theoretical Computer Science 2009
5. Eric D. Kolaczyk, "Statistical Analysis of Network Data Methods and Models" Springer Series in Statistics 2009
6. Akihito Hora, Nobuaki Obata Quantum Probability and Spectral Analysis of Graphs" 2007

19. Machine Learning CS-714

Overview of machine learning; Concept learning and the general-to-specific ordering; Decision tree learning; Neural networks; Support vector machines(SVM); Evaluating hypothesis; Bayesian learning; Computational learning theory; Instance based learning; Genetic Based Machine Learning (GBML); Learning Classifier System (LCS); Genetic Programming; Learning set of rules; Analytical learning; Combining inductive and Analytical learning; Reinforcement learning; Unsupervised learning.

References:

1. Mitchell, Machine Learning, McGraw Hill.
2. Marsland, Machine learning: an algorithmic perspective, CRC Press,Taylor and Francis Group.
3. Alpaydin, Introduction to Machine Learning, MIT Press.
4. Hastie, Tibshirani and Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction. Springer.

20. Maximum Entropy Modeling and Application CS-757

Uncertainty or Entropy, Mutual Information, Kullback-Leibler Measure, Entropy Maximization Principle, Diversity of Optimization Principles, Jaynes' Maximization Entropy Principle: MaxEnt, Maximum Entropy Probability Distributions, Entropy Concentration Theorem, Non- negativity of Maximizing Probabilities, Maximum Entropy for Continuous–variate Distributions, Applications to Statistical Mechanics and Statistics, Maximum entropy spectral analysis, Image Reconstruction and Pattern Recognition, Maximum Tsallis Entropy Principle, Power Law behavior, Kullback's Minimum Cross-entropy Principle, The Relationship of Kullback's MinxEnt to Jaynes' MaxEnt, Renyi's Entropy, Renyi's Measure of Directed Divergence, Maximization of Renyi's Entropy.

References:

1. J. N. Kapur and H. K. Kesavan, Entropy Optimization Principles with Applications, Academic Press 1992.

2. Tsallis C., Introduction to Nonextensive Statistical Mechanics: Approaching a Complex World; Springer 2003.
3. Jose C, Information Theoretic Learning: Renyi's Entropy and Kernel Perspectives,. Principe, Springer, 2010.
4. Cover T.M. and Thomas J.A., Elements of Information Theory; 2nd ed. Wiley 2006.

21. Micro Fabrication Technologies CS-758

Overview: VLSI and Micro-electromechanical Technologies, semiconductor and non- semiconductor materials and properties, Micromachining: Surface micromachining, bulk micromachining, Wafer Level Processes: Substrate, wafer cleaning, oxidation, Semiconductor doping: thermal diffusion and ion implantation, thin film deposition, wafer bonding, Lithography: Mask making, optical Lithography, LIGA and UV LIGA, Etching: Wet Processing,dry etching, Plasma Etching, Case studies: VLSI and MEMS technology, Lab: Minor project

References:

1. Stephen D Santuria, Microsystem Design, Kluwer Academic, 2001
2. Marc J. Madou, Fundamentals of Microfabrication, CRC Press, 1997
3. S. M. Sze, VLSI Technology, Mcgraw –Hill,1983

22. Mobile Ad Hoc Networks CS-720

Fundamentals of Wireless Communication Technology – Radio Propagation Mechanisms, Multiple Access Techniques, Characteristics of wireless Channel. Ad Hoc Networks – Definition, Application, challenges, Traffic profile, and challenges, Media Access protocols Topology-based routing; Position-based routing, Mobility and location Management, Transport Protocols, Energy Conservation Issues QoS, Security issue, Simulation of protocols.

References:

1. C. Siva Ram Murthy and B.S. Manoj, Ad Hoc Wireless Networks – Architecture and Protocols, Pearson Education, 2004 (Low price edition)
2. C.K. Toh, Ad hoc Mobile Wireless Networks – Protocols and Systems, Prentice Hall, 2002
3. Ivan Stojmenovic (ed), Handbook of Wireless Networks and Mobile Computing, John Wiley, 2002

23. Modeling and Simulation CS-778

Introduction to Simulation, Types of Systems/Model, Distributed Lag Model, Random Numbers,Pseudo Random Number Generation, Random Quadrature, Antithetic variates, Important Sampling , Generating Non-Uniform Random Numbers, Inverse Transform Method, Acceptance-Rejection Techniques, Generating Discrete Random Variables, Poisson-Binomial Variates, Normal Variates-Polar Method, Monte-Carlo Methods, Markov Chain Monte Carlo, Metropolis Hastings Algorithm, Rare Event Simulation, Discrete Event Simulation, Queuing Models- M/M/1, M/M/1/N, M/M/m/m, M/M/m systems, Long-Run Measures of Performance,

Steady State Behaviour, Network of Queues. Analysis of Simulation data, Identifying Distribution with Data, Goodness of fit, Verification and Validation of Models.

References:

1. J Banks, J. S. Carson II, B. L. Nelson, D. M. Nicol, 2010, Discrete Events System Simulation, 5th Edition, Prentice Hall.
2. A. M. Law, W. D. Kelton, 2008, Simulation Modeling and Analysis, 4th Editions, Tata-McGraw Hill.
3. R. Y. Rubinstein, D. P. Kroese, 2008, Simulation and the Monte Carlo Method, 2nd Edition, Wiley Series in Probability and Statistics, Wiley.
4. J. R. Thompson, 2000, Simulation A Modeler's Approach, Wiley Series in Probability and Statistics, Wiley.

24. Multicast Communication CS-759

Introduction, Application, Characteristics, Multicast Backbone Architecture, Multicast Routing, Basic Routing Algorithm, Group Dynamics, Multicast routing between domains, Ip multicast, Multicast in transport protocols, address allocation, Multicast LANs, Reliable Multicast, Congestion control, Security issues.

References:

1. Morgan Kaufmann, Ralph Wittmann, Martina Zitterbart ,Multicast Communication: Protocols, Programming and Applications, Edition 2000, Academic Press, USA.
2. Kennet Miller, Multicast Networking and Application, AW publication, 2008.
3. David Makofske, Kevin Almeroth, Multicast sockets: Practical Guide for Programmers, Edition 2003, Elsevier, USA.

25. Natural Language Processing CS-760

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.

References:

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

26. Operating System CS-704

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; Protection; Security; Distributed operating systems; Real-Time operating systems; Case study of Linux.

References:

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

27. Network Security CS-761

Introduction, Security goals, attacks, services and mechanisms, cryptography and steganography, Symmetric Key cipher-substitution ciphers, Transposition ciphers, stream and block ciphers, Modern block ciphers, Modern stream ciphers, DES and AES, Elliptic curve cryptosystems, RSA, Message integrity, Digital signature, Public key distribution, IPSec, SET, ESP, PGP, SSL, Security in wireless.

References:

1. Stallings, Cryptography and Network Security: Theory and practice, JohnWiley, 2013.
2. Behrouz A. Forouzan, Cryptography and Network security, Tata Mcgraw Hill 2010.
3. Bible Eric Cole, Ronald L.Krutz, Network security, Welley 2009.
4. Stinson D., Cryptography, Theory and Practice, CRC Press, Boca Raton, FA 2005.

28. Object Oriented Programming CS-735

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, Multithreaded programming.

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 of India private limited.
4. Herbert Schildt, "The Java 2: Complete Reference", Fourth edition, TMH.

29. Object Oriented Software Engineering CS-707

Object Oriented Concepts; Modeling with UML; Analysis - Object Model, Dynamic Model; System Design - Addressing Design Goals; Object Design; Reusability - Introduction to Design Patterns; Mapping Models to Code; Testing Techniques - Unit, Integration and System Testing

References:

1. Bruegge B. and Dutoit A.H., Object-Oriented Software Engineering, Using UML, Patterns, and Java, 3rd Edition, Prentice-Hall, 2010
2. Booch G., Rumbaugh J and Jacobson I., The Unified Modeling User Guide, Addison Wesley Longmen, 2nd Edition, 2005
3. Gamma, et al., Design Patterns, Elements of Reusable Object Oriented Software", Addison Wesley, Ist Edition,1994
4. Craig Larman, Applying UML and Patterns - An Introduction to Object-Oriented Analysis and Design and Iterative Development, Prentice Hall, 3rd Edition ,2008.

30. Parallel and Distributed Systems CS-762

Parallel processing concept, Parallelism in conventional machine, Pipelining, Flynn's classification, Feng's classification, Array processor, Amdahl's law, Minsky's conjecture. Static and dynamic networks, Single stage and multistage interconnection network, Blocking and nonblocking network, Star, Ring, Mesh, Torus, Pyramid etc. topology, Elementary permutations used in Interconnection network, Crossbar, Clos, Benes network, Shuffle exchange, Hypercube, PM21 network. Simple addition on various network topologies, Recurrence computation, Matrix multiplication, Sorting networks0-1 Principle, Bitonic sorter, Merger, Sorter PRAM Model, EREW, ERCW, CREW, CRCW algorithms. Distributed computation, characteristics of distributed systems, overview of related networking, operating systems and programming language concepts. Interprocess communication, message passing communication, remote procedure call (RPC), atomic transactions. Distributed coordination, physical and logical clocks, synchronization, mutual exclusion, leader election

References:

1. Kai Hwang , Advanced Computer Architecture, TMH
2. M.R. Bhujade ,Parallel Computing, New Age International Publications
3. Tanenbaum , Distributed System, Pearson Education
4. Nancy A. bynch, Distributed Algorithms:

31. Pattern Classification CS-763

Basics of Probability and Statistics, Linear Algebra, Linear Transformations, Components of Pattern Recognition System, Supervised learning/Classification: Bayes Decision theory, Maximum Likelihood and Bayesian Parameter Estimation, Non-parametric Classification, Support Vector Machines, K-Nearest-Neighbor Classification, Decision Tree based classifiers, Random Forests, Feature Selection and Feature Extraction, Unsupervised Learning/Clustering, Probabilistic Graphical Model, Algorithm Independent Topics: No Free Lunch Theorem, Ugly Duckling Theorem, Bias-Variance Dilemma, Jacknife and Bootstrap Methods

References:

1. S Theodoridis, K Koutroumbas, Pattern Recognition, Fourth Edition, Academic Press
2. R O Duda, P E Hart, D G Stork, Pattern Classification, 2nd Edition, Wiley Interscience
3. C M Bishop, Pattern Recognition and Machine Learning, Springer
4. D Koller, N Friedman, Probabilistic Graphical Models, MIT Press

32. Performance Modeling of Computer Communication Networks CS-764

Role of Modeling and Analysis, Examples of Performance Modeling, Analytic Models, Elements of Stochastic process, Poisson Process, Basic Queuing models, M/M/1; M/M/∞; M/G/ ∞; M/M/m; M/M/m/m Queues with Product formula. Cell and Burst scale Traffic Models: Round trip time distribution, PING data, Markov modulated Poisson Process, Long Range Dependence, Heavy Tail Distribution. Traffic Control: Admission Control, Effective Bandwidth, Statistical Multiplexing gain, Access Control: Leaky bucket System. Multi access Modelling: Slotted ALOHA Markov chain, Diffusion Approximation Approach, CSMA, Congestion Control, Window Control, Modelling TCP, Window Size, TCP Window Dynamics.

References:

1. M. N. O. Sadiku, S. M. Musa, 2013, Performance Analysis of Computer Networks, Springer.
2. I. Kaj, 2002, Stochastic Modeling in Broadband Communications Systems, SIAM .
3. H. Kobayashi, B. L. Mark, 2009, System Modeling and Analysis, Foundations of System Performance Evaluation, Pearson Prentice Hall.
4. M.H. Balter, 2013, Performance Modeling and Design of Computer Systems, Cambridge Univ. Press.

33. Randomized and Approximation Algorithms CS-779

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, Randomized search algorithm Introduction to approximation, Cardinality Vertex Cover, etc. Combinatorial Algorithms, Set Cover, Steiner Tree, Steiner Forest, TSP, Multiway Cut and k-Cut, Edge Cover and Vertex Cover, Layering applied to feedback vertex set, Independent Set problem, Min-cut Max Flow, Knapsack, Pseudo-polynomial time algorithm for knapsack, FPTAS, Bin Packing, Euclidean TSP, etc. LP Duality Theorem, Set Cover with Primal-Dual, Steiner Network, Sparsest Cut, Hardness of Approximation: PCP Theorem, Hardness of Clique, Set Cover, Shortest Vector

(Euclid and Gauss Theorems), Gram–Schmidt Orthogonalization, Approximate Counting, Problems with Markov chain Monte Carlo method.

References:

1. Vijay Vazirani, Approximation Algorithms, Springer-Verlag, ISBN: 3-540-65367-8, Published: 2001
2. D. Williamson and D. Shmoys, The Design of Approximation Algorithms, Cambridge University Press, 2011
3. Mitzenmacher and Upfal Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Published Cambridge University Press, 2005.
4. Rajeev Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press, ISBN: 0521474655, Published: August 25, 1995
5. Vašek Chvátal, Linear Programming, W. H. Freeman and Company, ISBN: 0716715872, Published: January 1983.

34. Swarm Intelligence CS-766

Introduction to Models and Concept of Computational Intelligence, Social Behavior as Optimization: Discrete and Continuous Optimization Problems, Classification of Optimization Algorithms, Evolutionary Computation Theory and Paradigm, Swarm and Collective intelligence, Swarm Intelligence Techniques: Particle Swarm Optimization, Ant Colony Optimization, Artificial Bees and Firefly Algorithm etc., Hybridization and Comparisons of Swarm Techniques, Application of Swarm Techniques in Different Domains and Real World Problems.

References:

1. Engelbrecht, A.P. Computational Intelligence: An Introduction, Second Edition, John Wiley and Sons, 2007.
2. Kennedy, J. and Eberhart, R.C., Swarm Intelligence, Morgan Kaufmann Publishers, 2001
3. Bonabeau, E., Dorigo, M. and Theraulaz, G., Swarm Intelligence: From Natural to Artifical Systems, Oxford University Press, 1999
4. Dorigo, M., Stutzle, T., Ant Colony Optimization, MIT Press, 2004
5. Parsopoulos, K.E., Vrahatis, M.N., Particle Swarm Optimization and Intelligence: Advances and Applications, Information Science Reference, IGI Global, 2010
6. Clerc, M., Particle Swarm Optimization, ISTE, 2006
7. Nature Inspired Metaheuristic Algorithms, Xin-She Yang, Luniver Press, 2010

35. Service Oriented Architecture CS-738

SOA Fundamentals - definition, characteristics; Architecture; Evolution; Web Service; Web Service Composition - Orchestration and Choreography; Interoperability; WS*, Metadata; Security; XML Technology - name-spaces, schema, well-formed XML documents; WSDL - name spaces, Abstract and Concrete Models; Universal Description, Discovery and Integration (UDDI), SOAP (messaging framework); Composition Languages - BPEL and CDL

References:

1. Thomas Erl, Service Oriented Architecture (SOA) : Concepts, Technology and Design, Prentice Hall, 2008
2. Newcomer E. and Lomow G, Understanding SOA with Web Services, Addison Wesley, 2004
3. http://www.w3.org/xml
4. http://www.w3.org/TR/wsdl
5. http://docs.oasis-open.org/wsbpel/2.0/OS/wsbpel-v2.0-OS.html
6. http://www.w3.org/TR/ws-cdl-10/

36. Software Engineering CS-731

Introduction, Software life-cycle models, Software requirements analysis and specification, Function-Oriented and Object-Oriented software design, UML, Software Design Principles and Patterns: Creational, Behavioral and Structural design patterns. User Interface design, Coding and Unit Testing, Integration and Systems Testing, Debugging techniques, Software quality, SEI CMM and ISO. Software reliability and Fault-tolerance, Software Project planning, monitoring, and control, Software maintenance, Computer-Aided Software Engineering (CASE), Software Reuse, Component-Based Software Development. Emerging trends in Software Engineering.

References:

1. Pressman Roger S, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Mall Rajib, Fundamentals of Software Engineering, Prentice Hall of India.
3. Sommervile Ian, Software Engineering, Addison-Wesley.
4. Gamma Erich, Helm Richard, Johnson Ralph, Vlisside John, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley Professional.
5. Freeman Elisabeth, Freeman Eric, Bates Bert, Sierra Kathy, Robson Elisabeth, Head First Design Patterns, O'Reilly Media.

37. Software Quality Assurance CS-767

Introduction: Software Quality and Quality Assurance. Software Testing: Concepts, issues and techniques, test activities, management, and automation, coverage and usage testing based on checklists and partitions, coverage and usage testing based on finite-state machines and Markov Chains, control flow, data dependency, and interaction testing. Software Testing Techniques: various Black-box and White-box testing strategies for adaptation, specialization, and integration, defect prevention and process improvement, software inspection, formal verification,fault tolerance and failure containment. Comparing quality assurance techniques and activities, feedback loop and activities for Quantifiable Quality Improvement, Quality models and measures, goal, question, Metric Paradigm, change and defect Models Defect classification and analysis, risk identification for Quantifiable Quality Improvement, FMEA, FMECA. Software Reliability: Deterministic and probabilistic models based on error seeding, failure rate, curve fitting, reliability growth, program structure, input domain, execution path, non-homogeneous Poisson process, Markov, Bayesian and unified. Emerging trends in software quality assurance.

References:

1. Tian Jeff, Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement, Wiley.
2. Galin Daniel, Software Quality Assurance: From Theory to Implementation, Addison-Wesley.
3. Pressman Roger S., Software Engineering: A Practitioners Approach, Mc Graw Hill.

38. Theory of Computation CS-780

Automata-Computation models: Finite State Automata. Regular Expressions and Regular Grammars. Context-free Grammars and Pushdown Automata, Computability- Computation models: Turing machines (TM); Turing: decidable and Turing-recognizable languages.Enhancements of TMs: multi-tape TMs, non-deterministic TMS. Equivalence of these and the standard TM. Diagonalization. Acceptance problem is undecidable: Acceptance problem is recognizable; the complement of the Acceptance problem is unrecognizable. Reductions. Examples of other undecidable languages. Rice's theorem. Post's Correspondence Problem (PCP) is undecidable. Complexity- Running time of Turing Machines. The classes P, NP, NP- hard, and NP- complete. Cook-Levin Theorem. SAT is NP-complete. Some reductions. Space Complexity, Savitch's Theorem, PSPACE. Quantified Boolean formula Satisfiability is PSPACE-complete.

References:

1. Michael Sipser. Introduction to the Theory of Computation **(**3rd edition**)** .
2. J.E. Hopcroft and J.D. Ulman. Introduction to Automata Theory, Languages ofComputations, Addison-Wesley, 1979.
3. Raymod Greenlawand James Hoover Fundamentals of Theory of Computation, Principlesand Practice, Morgan KauFmann Publishers

39. Topics in Mathematical Sciences CS-736

Axiom of Probability Bayes' Formula, Expectations of Random Variables, Jointly Distributed Random Variables, Conditional Expectation, some applications-A list model, A random graph, Limit Theorems, Random Number Generation, Simulating continuous random variables, Monte Carlo Integration. Information Theory, Measure of Uncertainty, Shannon's Measure, Entropy, Joint and conditional entropies, Mutual Information, Kullback-Leibler Directed Divergence, coding Theory and Entropy. Stochastic processes and specifications, Stationary processes, Markov chains, Markov process, Passion process, Renewal Process, Birth and Death process, Elements of queuing –M/M/1 queue etc., Random Walk, Brownian Motion. Modeling with linear programming, Simplex Method, Dual problem, Integer Linear Programming [Branch and Bound Algorithm], Deterministic Dynamic Programming [Forward and Back Recursion], and Introduction to Nonlinear Programming.

References:

1. S.M. Ross,Introduction to Probabiltity Models,8th edd.Academic Press,2004

2. S.Karlin and H.M Taylor, Introduction to Stochastic Modeling, 3rd ed, Academic Press,1998
3. J.Medhi,Stochastic Processed,@nd ed,New Age International,1996
4. T.H cover and J.A, Elements of Information Theory, John Wilev,1991

40. Vehicular Communication Networks CS-768

Vehicular Network- Definition, Architecture, Characteristics and Evolution; MAC layer Protocols – IEEE 802.11p, DSRC; Vehicular Mobility models – Flow models Traffic models behavioral models, Trace and survey based models; Routing Protocols – Position based, geocasting, other routing protocols; Traffic Engineering – Traffic Monitoring, Traffic flow models; Vehicular Safety Applications, Localization.

References:

1. Hassnaa Muoustafa and Yan Zhang (edited), Vehicular Networks Techniques, Standards and Applications, CRC Press, 2009
2. Hannes Hartenstein and Kenneth P. Laberteaux (edited), VANET Vehicular Applications and Inter-Networking Technologies, Wiley, 2010
3. Stephan Olariu and Michele C. Weigle (edited), Vehicular Networks from Theory to Practice, CRC Press, 2009.

41. VLSI Design and Testing CS-769

Introduction to VLSI Design, Different types of VLSI design styles: Full custom, standard cell based, gate array based, programmable logic, field programmable gate arrays etc. VLSI Design flow. CMOS logic: operation of MOS transistors as a switch, MOS inverter, stick diagram, design rules and layout, delay analysis, different type of MOS circuits: Dynamic logic, pass transistors etc. Combinational logic cells, Sequential logic cells, Datapath logic cells, I/O cells. ASIC Library Design: Transistors as Resistors and parasitic Capacitance, Logical effort, gate array, standard cell and datapath cell design. Introduction to hardware description language (HDL) Verilog. Floor-planning and Placement: I/O and power planning, clock planning. Routingglobal and detailed. VLSI Testing- Fault Modeling, Test pattern generation for combinational circuits, Sequential circuits testing, Built-in self-test.

References:

1. M. Sarafzadeh and C. K. Wong, An Introduction to VLSI Physical Design, MCGraw-Hill.
2. W. Wolf, Modern VLSI Design: Systems on Silicon, Pearson Education.
3. J. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Prentice Hall of India.
4. P. H. Bardell, W. H. McAnney and J. Savir, Built-in Test for VLSI: Pseudorandom Techniques, Wiley Interscience.

42. Web Mining CS-737

Data Mining Foundations : Basic concepts in data Mining, Web mining versus Data mining, Discovering knowledge from Hypertext data; An overview of web mining : What is Web mining, Web mining taxonomy, Web mining subtasks, issues, challenges; Web Search and Information Retrieval : Information Retrieval Models, Web Search and IR, Text Mining, , Latent Semantic Indexing, Web Spamming, Clustering and Classification of Web Pages, Information Extraction , Web Content Mining; Web Structure mining: Web as social network , Graph based analysis of web structure, link based ranking of web pages : Page rank and HIT, Short comings of coarse grained models, Enhanced models and techniques; Web usage mining : An introduction to web usage mining, Steps in web usage mining, Web usage mining process, Applications of Web usage mining, Clustering of web pages based on usage; Future of Web mining : Information Extraction, Web mining and Natural Language Processing, Ontology and Semantic Web

References:

1. Bing Liu, Web Data Mining, Springer Publication
2. Somen Chakrabarti, Web mining, Elseivier Publication
3. Grossman, Information Retrieval : Algorithm and Heuristics, Springer
4. Witton Frank, Data Mining , Morgan Kauffan Publishers

43. Wireless Communication and Mobile Computing CS-718

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. Mobility: challenges, limits and connectivity, mobile TCP, mobile IP and cellular IP in mobile computing.

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.,

44. Wireless Sensor Networks CS-770

Background of sensor network technologies and its applications, Keys definitions of sensor networks, Sensor Node, sensor taxonomy, sensor networks operation environments. Deployment methods: deterministic and random sensor deployment, Localization, Coverage and connectivity.MAC Protocols: Classification of MAC Protocols, S-MAC, T-MAC, B-MAC and Zig Bee, Dissemination protocol, routing protocols: Issues in designing routing protocols, Classification of routing protocols, Hierarchical routing, position-based routing, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing, Data centric and content based routing,

Data fusion technique, Load/energy balancing and lifetime maximization algorithms and simulation. Simulation using ns-2, Qualnet and MATLAB.

References:

1. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network",Elsevier,
2. Kazem, Sohraby, Daniel Minoli, Taieb Zanti, "Wireless Sensor Network: Technology,Protocols and Application", John Wiley and Sons.
3. B. Krishnamachari, " Networking Wireless Sensors", Cambridge University Press.
4. Carlos d. M and D P Agrawal, "Ad Hoc and Sensor networks: Theory and Applications",worldscientific.

45. MEMS Technology CS-781

Overview: VLSI and Micro-electromechanical Technologies, materials for MEMS. *Actuation techniques:* Electrostatic, Electromagnetic, Thermal, Piezoelectric, *Micromachining*: Surface micromachining, bulk micromachining, LIGA, *Non-Silicon micromachining techniques: PCB, LCP, PDMS/SU8, Case studies:* MEMS/RF MEMS/BioMEMS

Reference Books:

1. Stephen D Santuria, Microsystem Design, Kluwer Academic, 2001
2. Marc J. Madou, Fundamentals of Microfabrication, CRC Press, 1997
3. Hector J. De Los Santos, "RF MEMS Circuit Design for Wireless Applications", ArtechHouse, 2002

46. VLSI Technology CS-726

Basics of VLSI Technology, *Fundamentals of materials*: crystalline versus amorphous structure, and the characteristics of semiconductors, insulators, and conductors. *Processes*: Crystal growth diffusion, Ion Implantation, Oxidation, Photo-lithographic techniques, Photoresist, Chemical Vapor Deposition Technology, metallization technique, *Etching:* Wet Processing, dry etching, Plasma Etching, *Fabrication*: pn- Junction, CMOS

Reference Books:

1. *Ben G Streetman, S Banerjee, "Solid State Electronic Devices," 5th Edition, PrenticeHall Inc.*
2. S. M. Sze, VLSI Technology, Mcgraw –Hill,1983
3. Marc J. Madou, Fundamentals of Microfabrication, CRC Press, 1997