SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR - 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2019-20

M.TECH. (COMPUTER SCIENCE AND ENGINEERING)

Published by
Dr. R.S. Pande
Principal
Shri Ramdeobaba College of Engineering & Management
Ramdeo Tekdi, Gittikhadan, Katol Road, Nagpur - 440 013
Ph. : 0712-2580011 Fax : 0712 - 2583237
ISO 9001 : 2015 CERTIFIED ORGANISATION

Vision of the Department

To continually improve the education environment, in order to develop graduates with strong academic and technical background needed to achieve distinction in the discipline. The excellence is expected in various domains like workforce, higher studies or lifelong learning.

To strengthen links between industry through partnership and collaborative development works.

Mission of the Department

To develop strong foundation of theory and practices of computer science amongst the students to enable them to develop into knowledgeable, responsible professionals, lifelong learners and implement the latest computing technologies for the betterment of the society.

Programme Educational Objectives :

At the end of the programme the student will be able

1. To develop professionals with an ability to apply knowledge of Computer Science and Engineering inidentifying, analyzing and formulating problems and designing their solutions.
2. To facilitateuse of latest technologies and tools, multidisciplinary research and independent directed reflective learning.
3. To enable graduates in communicating effectively with the stakeholders, demonstrating professional ethics and engaging in lifelong learning for professional advancement.

Graduate Attributes

1. Scholarship of Knowledge
2. Critical Thinking
3. Problem Solving
4. Research Skill
5. Usage of modern tools
6. Collaborative and Multidisciplinary work
7. Project Management and Finance
8. Communication
9. Life-long Learning
10. Ethical Practices and Social Responsibility
11. Independent and Reflective Learning

Programme Outcomes

At the end of the program the student will exhibit

1. Ability to apply knowledge of Computer Science and Engineering in designing software systems.
2. Ability to understand the scope of problems through critical analysis with respect to computing domain.
3. Ability to formulate problems, propose algorithm and model efficient scalable systems.
4. Ability to augment domain knowledge by way of understanding effective methodologies and applying them to practice through experimentation.
5. Ability to apply techniques and tools in building reliable and maintainable software.
6. Ability to engage in multidisciplinary research and collaborate towards accomplishing common goal.
7. Ability to understand, design and develop software projects conforming specifications and budgetary constraints.
8. Ability to communicate effectively with leadership skills.
9. Ability to identify contemporary issues and engage in life-long learning for professional development.
10. Ability to understand professional ethics and demonstrate social ethical responsibility.
11. Ability to identify learning processes to become independent reflective learners.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Teaching Scheme for First Year (Semester I) Master of Technology

Sr. No.	Code	Course	L	P	Credits	Maximum Marks			Exam Duration	Category
						Internal Assessment	End Sem Exam	Total		
1	CST551	Advanced Computer Architecture	4	0	4	40	60	100	3 Hours	FC
2	CST552	Software Architecture	4	0	4	40	60	100	3 Hours	PC
3	CSP552	Software Architecture Lab	0	2	1	25	25	50	--	PC
4	CST553	Advancesin Algorithms	4	0	4	40	60	100	3 Hours	PC
5	CST554	Advanced Techniques in Data Management	4	0	4	40	60	100	3 Hours	PC
6	CSP554	Advanced Techniques in Data Management Lab	0	2	1	25	25	50	--	PC
7	CST555	Program Elective-I	4	0	4	40	60	100	3 Hours	PE
8	CSP555	Software Lab I	0	2	1	25	25	50	--	PC
		TOTAL	**20**	**6**	**23**	**275**	375	650		

Course code	Program Elective-I
CST555-1	Graph Mining
CST555-2	Pattern Recognition
CST555-3	Advance topics in networking

Category Details

PC	Programme Core
PE	Programme Elective
GE	Group Elective
OE	Open Elective
FC	Foundation Course

Teaching scheme for First Year (Semester II) Master of Technology

Sr. No.	Code	Course	L	P	Credits	Maximum Marks			Exam Duration	Category
						Internal Assessment	EndSem Exam	Total		
1	CST556	Compiling For High Performance Architecture	4	0	4	40	60	100	3 Hours	PC
2	CSP556	Compiling For High Performance Architecture Lab	0	2	1	25	25	50	--	PC
3	CST557	Advanced Digital Image Processing	4	0	4	40	60	100	3 Hours	PC
4	CSP557	Advanced Digital Image Processing Lab	0	2	1	25	25	50	--	PC
5	CST558	Research Methodology	3	0	3	40	60	100	3 Hours	FC
6	CST561	Group Elective I	4	0	4	40	60	100	3 Hours	GE
7	CST599	Open Elective I	3	0	3	40	60	100	3 Hours	OE
8	CSP559	Software Lab II	0	2	1	25	25	50	--	PC
9	CSP560	Seminar	0	2	1	50	50	100	--	PC
		TOTAL	**18**	**8**	**22**	**325**	425	750		

Rof Technology

Course Code	Group Elective - I
EET562	Microcontroller Applications in Power controllers
ENT560	VLSI Design Automation
CST561 - I	Optimization Techniques in Artificial Intelligence
CST561 - 2	Social Network Analysis

Course code	Open Elective - I
CST599-1	Advance Programming Techniques

Teaching scheme for Second Year (Semester III) Master Technology

Sr. No.	Course Code	Course	L	P	Credits	Maximum Marks			Exam Duration	Category
						Internal Assessment	End Sem Exam	Total		
1	CST651	Program Elective -II	4	0	4	40	60	100	3Hrs.	PE
2	CST652	Program Elective - III	4	0	4	40	60	100	3Hrs.	PE
3	CSP653	Project Phase-I	0	3	6	50	50	100	--	PC
		TOTAL	**8**	**3**	**14**	**130**	170	300		

Course code	Program Elective -II
CST651 - 1	Statistical Machine Learning
CST651 - 2	Cryptography
CST651 - 3	Big Data Analysis
CST651 - 4	Industry Offered Elective

Course Code	Program Elective - III
CST652-1	Reconfigurable and Cloud Computing
CST652-2	Information Retrieval
CST652-3	Ubiquitous Computing

Teaching scheme for Second Year (Semester IV) Master Technology

Sr. No.	Course Code	Course	L	P	Credits	Maximum Marks			Exam Duration	Category
						Internal Assessment	End Sem Exam	Total		
1	CSP654	Project Phase-II	0	6	12	200	200	400	--	PC
		TOTAL	**0**	**6**	**12**	200	200	**400**		

Category	PC	PE	GE	OE	FC	Total
Credits	45	12	4	3	7	71

	Theory	Practical	Project	Total
Credits	46	7	18	71

I SEMESTER

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code : CST551 **Course : Advanced Computer Architecture**

(Foundation Course-I) **Total Credits : 04**

L:4Hrs,T:0Hr, P: 0 Hrs, Per Week

Course Outcomes :

On successful completion of the course, students will be able to:

1. Understand the classification & architecture of modern computer systems.
2. Understanding & Implementation of performance enhancements techniques in advanced processors.
3. Able to compare the performance of different architectures and their applications.

Syllabus :

Parallel Computer Models :

The state of computing, Multiprocessors and multi-computers, Multivector and SIMD computers, Architectural development tracks. Program And Network Properties: Conditions of parallelism, Data and resource dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Program flow mechanisms, Control flow versus data flow, Data flow architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

System Interconnect Architectures :

Network properties and routing, Static interconnection networks, Dynamic interconnection Networks, Multiprocessor system interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Processors and Memory Hierarchy:

Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors, Pipelining, Basic concepts, instruction and arithmetic pipeline, data hazards, Exception handling, Pipeline optimization techniques, Compiler techniques for improving performance,

Memory Technology:

Hierarchical memory technology, Inclusion, Coherence and Locality, Memory capacity planning, Virtual Memory Technology. Backplane Bus System: Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt, Cache addressing models, direct mapping and associative caches.

Pipelining and Instruction-level parallelism:

Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Arithmetic Pipeline Design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipelines. ILP, Techniques for increasing ILP, super scalar, super pipelined and VLIW processor architectures,

Multi-core/Many-core Architectures :

Array and vector processors, Multiprocessor architecture, taxonomy of parallel architectures, centralized shared-memory architecture, synchronization, memory consistency, interconnection networks, Distributed shared-memory architecture, Cluster computers, Non von Neumann architectures, data flow computers, reduction computer architectures, systolic architectures. GPGPU architecture: GPU basics and architecture, Graphics and Computing.

Text and Reference Books :

1. Kai Hwang, “Advanced Computer Architecture”; TMH.
2. J. P. Hayes, “Computer Architecture And Organization”; MGH.
3. Harvey G. Cragon, “Memory System and Pipelined Processors”; Narosa Publication.
4. V. Rajaranam & C. S. R. Murthy, “Parallel Computer”; PHI.
5. R. K. Ghose, Rajan Moona& Phalguni Gupta, “Foundation of Parallel Processing”; Narosa Publications.
6. Kai Hwang and Zu, “Scalable Parallel Computers Architecture”; MGH.
7. Randi J. Rost, “OpenGL Shading Language”, Third Edition.
8. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors: A Hands-on Approach”, First Edition, ISBN-10: 123814723, ISBN-13: 978-0-12-381472-2, Morgan Kauffman, 2010.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code: CST552 **Course : Software Architecture**
L:4Hrs, P: 0 Hrs, Per Week **Total Credits : 04**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Understand software architecture and its importance.
2. Understand software architectural patterns, desired qualities, and their implementation.
3. Learn software architecture documentation and evaluation.
4. Understand new trends in software architecture.

Syllabus :

Systems engineering and software architectures; HatleyPirbhai architectural template; architectural flow diagrams;
Requirements engineering and software architecture; architectural design processes; real-time architectures;
Architectural design patterns; Pattern Systems, Patterns and Software architecture.
Software architecture and maintenance management;
Object oriented architectures; client server architectures;
Forward engineering for object oriented and client server architectures; emerging software architectures.

Text and Reference Books :

1. Software Architecture in Practice 2nd ed.: Bass, Len & others.. Pearson Edu., (2003).
2. Pattern Oriented Software Architecture Vol. I: Buschmann, F. WSE, (1996).
3. The Art of Software Architecture: Stephen T. Albin, Wiley dreamtech, (2003).
4. Large Scale Software Architecture: A Practical Guide Using UM: Jeff Garland, Richard Anthony, Wiley dreamtech, (2003).
5. Software Architecture - Perspectives on an Emerging Discipline: Mary Shaw & David Garlan, , PHI, (1996).
6. Design Patterns : Elements of Reusable Object Oriented Software: Gamma, E. et. Al., Addison Wesley, (1995).
7. Software Engineering 7th ed.: Ian Sommerville, Addison Wesley, 2004.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code : CSP552 **Course : Software Architecture Lab**
L:0Hrs, P : 2 Hrs, Per Week **Total Credits : 01**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Illustrate the current state of the discipline of Software Architecture and examine the ways in which architectural design can affect software design.
2. Understand implementation and evaluation of various architectural styles used in software engineering.
3. To present concrete examples of actual system architectures that can serve as model for new designs having well-understood architectural paradigms.

Syllabus :

The instructor should design the practical such that the student should be able :

- To illustrate the current state of the discipline of Software Architecture and examine the ways in which architectural design can affect software design.
- To study the various architectural styles used in software engineering.
- To understand and evaluate designs of existing software systems from an architectural perspective.
- To provide the intellectual building blocks for designing new systems in principled ways, using well understood architectural paradigms.
- To present concrete examples of actual system architectures that can serve as model for new designs

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code: CST553 **Course : Advances in Algorithm**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :
On successful completion of the course, students will be able to:
1. Understand the algorithm design paradigm, methods of analysis of algorithms and classify algorithms in P and NP domains.
2. Understand applications of algorithms in real life problems, like searching, social network analysis, constraint handling and implementation of algorithms for distributed and parallel systems.
3. Understand the application of algorithms in Internet programming, search engines design and data compression.
4. Understand the applications of Randomized, Geometric and Numerical algorithms for solving real life problems and designing solutions.

Syllabus :
Algorithmic paradigms: Dynamic Programming, Greedy, Branch-and-Bound.
Asymptotic complexity, Amortized analysis.
Graph Algorithms, Shortest paths, Flow networks,
NP-completeness.
Approximation algorithms, Randomized algorithms, Linear programming.
Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primarily testing, cryptographic computations),
Internet algorithms (text pattern matching, tries, information retrieval, data compression, Web caching).
Text and String handling Algorithms: Naïve algorithm, Knuth-Morris-Pratt Algorithm, Boyer-Moore-Algorithm, Krapp-Rabin Algorithm, Approximate String Matching.
Parallel Algorithms and Architectures: Approaches to Design of Parallel Algorithm, Performance Measures of Parallel Algorithm, Parallel Sorting.
Distributed Computation Algorithm: SPMD Distributed Computation Model, Message Passing, Distribution Even-Odd Transposition Sort, Distributed Depth First Search.

Text and Reference Books :
1. Fundamentals of Computer Algorithms by Horowitz and Sahani, University Press,2K,2008
2. Introduction to Algorithm by Cormen, Rivest and Stein, PHI Publications-New Delhi,Second Edition,2001
3. Design and Analysis of Computer Algorithms byA.Aho and John Hopcroft, Pearson Education, India.
4. Algorithm Design by Jon Kleinberg and Eva Tardus, Pearson Education, India.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code: CST554 **Course : Advanced Techniques in Data Management**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :
On successful completion of the course, students will be able to:
1. Identify influencing factors responsible for modern day database evolution and understand new trends in database systems.
2. Understand the basic concepts and techniques of data mining and data warehousing.
3. Perform multidimensional analysis and descriptive mining of complex data objects.
4. Study applications and trends in data mining.

Course Syllabus :
Introduction to object oriented database development, object relational mapping, Object oriented versus Object relational, Spatial and Geographic data, multimedia databases, mobility and personal databases
Data mining introduction, data preprocessing, Data warehousing & OLAP technology an overview, multidimensional data model, data warehouse architecture, data warehousing to data mining
Mining data streams, Stream OLAP and Stream Data Cubes, Frequent-Pattern Mining in Data Streams, Clustering Evolving Data Streams, Mining Time-Series Data, Trend Analysis, Similarity Search in Time-Series Analysis
Multidimensional analysis and descriptive mining of complex data objects, Spatial Data Mining, Spatial Data Cube Construction and Spatial OLAP, Spatial Clustering Methods, Spatial Classification and Spatial Trend Analysis, Multimedia Data Mining, Similarity Search in Multimedia Data Multidimensional Analysis of Multimedia Data, Classification and Prediction Analysis of Multimedia Data
Text Mining, Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Text Mining Approaches, Mining the World Wide Web , Mining the Web Page Layout Structure, Mining Multimedia Data on the Web Automatic Classification of Web Documents, Web Usage Mining
Applications and Trends in Data Mining, Data Mining for Financial Data Analysis, Data Mining for the Retail Industry, Data Mining for the Telecommunication Industry, Data Mining for Biological Data Analysis, Data Mining in Other Scientific Applications, Data Mining for Intrusion Detection
Text & Reference books
1. "Database system concepts" by Silberschatz, Korth & Sudatshan (McGrawHill) 6th addition, MGRAW education.
2. "Data Mining: Concepts and Technique" by Jaiwai hen and Michekinekamber Second addition, ELSEVIER publication.
3. "Data Mining : Introductory and Advanced topics" by Marget h. dunham, Pearson education
4. "Database system concepts" by Silberschatz, Korth & Sudatshan (McGrawHill) 6th addition, MGRAW education.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code: CSP554 **Course : Advanced Techniques in Data Management Lab**
L:0Hrs, P:2Hrs, Per Week **Total Credits : 01**

Course Outcomes :

1. To understand the basic principles, concepts and applications of data warehousing and data mining.
2. Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.
3. Have a good knowledge of the fundamental concepts and the recent trends in this field.

Course Syllabus

The instructor should design the practical such that the student should be able :

- To study and understand basic structure of Dataware-house architecture.
- To understand basic operations of Mining.
- To understand working in different applications of Mining.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code : CST555-1
(Program Elective-I) **Course : Graph Mining**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Understand the basic of Graph and trees and mathematical enumeration.
2. Understand the applications of bipartite graph, Euler's graph, Hamiltonian graphs.
3. Understand applications of maximum flow network, stable matching and planer graphs.
4. Understand varios graphs mining patterns and methods.

Syllabus:

Graphs : Basic concepts and their applications, Euler's graphs, Hamiltonian graphs. Binary trees, minimum spanning trees, the Matrix-Tree theorem

Vertex and Edge connetivity, Menger theorem, Maximum flow minimum cut Networks.

Bipartite graphs, Maximum matching in bipartite, graphs, algorithms for matching and weighted matching in bipartite graphs, stable matching,

Vertex and edge Covering, Vertex and edge coloring, Chromatic polynomial for a graph, Planer graphs, Detection of planarity, Thickness and crossing.

Graph database, What is graph matching, Graph matching methods, Learning edit costs, Discovery of frequent substructures in graph, Apriori-based approach, pattern growth approach, variant substructures pattern

Text and Reference Books:

1. Graph Theory with Applications to Engineering and Computer Science, Narsingh Deo, PHI.
2. Mining Graph Data, L. B. Cook and D. J. Holder, Wiley Publications India.
3. Introduction to Graph Theory, Gary Chartrand and Ping Zhang, McGraw Hill Higher Education.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code : CST555-2
(Program Elective-I) **Course : Pattern Recognition**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Understand the concept and application of statistical decision making in pattern recognition.
2. Understand the applications of parametric and Non-parametric decision making techniques in Machine Learning.
3. Understand the concept of supervised and unsupervised learning in pattern classification.
4. Understand the implementation of various machine learning algorithms.

Syllabus :

Introduction :

Bayes Decision Theory: Bayes Decision Rule, Minimum Error Rate Classification, Normal Density and Discriminant Functions, Error Integrals and Bounds, Bayesian Networks, Compound Decision Theory.

Generative Methods:

Maximum-Likelihood and Bayesian Parameter Estimation: Maximum-Likelihood Estimation, Bayesian Parameter Estimation, Sufficient Statistics, Some Common Statistical Distributions, Dimensionality and Computational Complexity, Principal Components Analysis, Fisher Linear Discriminant, Expectation Maximization, Sequential Data and Hidden Markov Models.

Nonparametric Techniques: Density Estimation.

Discriminative Methods:

Distance-based Methods: Nearest neighbor Classification, Metrics and Tangent Distance, Fuzzy Classification.

Linear Discriminant Functions:

Hyper plane Geometry, Gradient Descent and perceptrons, Minimum Squared Error Procedures, Support Vector Machines.

Artificial Neural Networks: Biological Motivation and Back-Propagation.

Non-Metric Methods: Recognition with Strings, String Matching.

Algorithm-Independent Machine Learning:

No-Free Lunch Theorem, Bias and Variance, Resampling for Estimation, Bagging and Boosting, Estimation of Misclassification, Classifier Combination.

Unsupervised Learning and Clustering: Unsupervised Learning and Clustering.

Text and Reference Books:

1. Pattern Classification (2nd. Edition) by R. O. Duda, P. E. Hart and D. Stork, Wiley 2002,
2. Pattern Recognition and image analysis by Earl Gose, Richard Johnsobaugh, Steve Jost, EEE adition, PHR publication.
3. Pattern Recognition and Machine Learning by C. Bishop, Springer 2006,
4. Statistics and the Evaluation of Evidence for Forensic Scientists by C. Aitken and F. Taroni, Wiley, 2004.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code: CST555-3
(Program Elective-I) **Course : Advanced Topics in Networks**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Understand the main abstract concepts related to the layered communication architecture
2. Analyze and implement some of the most advanced routing and congestion control algorithms.
3. Evaluate the performances of computer networks (through mathematical modeling and simulation).
4. Understand basics and principles of new generation of computer networks (VPN, wireless networks, mobile networks...).

Syllabus:

Routing and Internetworking :

Network-Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intradomain Routing Protocols, Interdomain Routing Protocols, Congestion Control at Network Layer. Logical Addressing: IPv4 Addresses, IPv6 Addresses -Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6 - Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intradomain Multicast Protocols, Interdomain Multicast Protocols, Node-Level Multicast algorithms.

Transport and End-to-End Protocols:

Mobile Transport Protocols, Mobile IP : Mobile IP, Wireless Mesh Networks (WMNs),TCP Congestion Control Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server.

Non Blocking I/O,Client server design alternatives-TCP test client,TCP iterative server,TCp concurrent server one child per client TCP Prevoked Server No Locking Around accept, Prevoked Server File Locking Around accept, Prevoked Server Thread Locking Around accept. Streams.

Optical Networks and WDM Systems:

Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All-Optical Switch.

VPNs, Tunneling and Overlay Networks:

Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks-VoIP and Multimedia Networking: Overview of IPTelephony, VoIP Signaling Protocols, Real-Time Media Transport Protocols, Distributed Multimedia Networking, Stream Control Transmission Protocol.

Mobile Ad-Hoc Networks:

Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

Text and Reference Books :

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, Keith W.Ross, Third Edition, Pearson Education, 2007
2. Computer and Communication Networks, Nader F. Mir, Pearson Education, 2007.
3. Unix Network Programming The Socket networking API Volume 1.Third edition by W. Richard Stevens Bill Fenner and Andrew M. Rudoff. Pearson Education.
4. Data Communications and Networking, Behrouz A. Forouzan, Fourth Edition, Tata McGraw Hill, 2007
5. Guide to Networking Essentials, Greg Tomsho, EdTittel, David Johnson, Fifth Edition, Thomson.
6. An Engineering Approach to Computer Networking, S.Keshav, Pearson Education.
7. Campus Network Design Fundamentals, Diane Teare, Catherine Paquet, Pearson Education (CISCO Press).
8. Computer Networks, Andrew S. Tanenbaum, Fourth Edition, Prentice Hall.
9. The Internet and Its Protocols, A.Farrel, Elsevier.

Syllabus for Semester I, M.Tech (Computer Science & Engineering)

Course Code: CSP555 **Course : Software Lab I**

L:0Hrs, P:2Hrs, Per Week **Total Credits : 02**

Course Syllabus:

The instructor should design the practical such that the student should be able to:

1. Learn latest tools and techniques in computer science and engineering.

2. Apply and implement advance algorithms, pattern recognition methods.

II SEMESTER

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code : CST556 **Course : Compiling for High Performance Architecture**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes:
On successful completion of the course, students will be able to:
1. Understand the compiling issues for various parallel architectures.
2. Implementation of transformation techniques for code parallelization.
3. Understand memory management and scheduling for parallel machine.

Syllabus:
Parallel and vector architectures:
Compiling for scalar pipeline, compiling for vector pipeline, superscaler and VLIW processors, compiling for multiple issue processors, Processor parallelism, Bernstein's conditions. The role of dependence. Dependence analysis: Concept of dependence, classification of dependences, dependence in loops, dependence distance, dependence direction, loop carried and loop independent dependences, level of loop carried dependence.
Simple dependence testing, vectorization and parallelization, Preliminary transformations required to make dependence testing more accurate Loop normalization, scalar data flow analysis, induction variable substitution, scalar renaming.

Concept of Granularity :
Fine-Grained parallelism and Coarse- Grained parallelism.Enhancing Fine-Grained parallelism (useful in vector machines and Machines with instruction-level parallelism) using loop distribution.Use of loop interchange for vectorization, scalar and array renaming, use of loop skewing. Enhancing Coarse-Grained parallelism(Required for machines with multiple processors): using privatization and scalar expansion, loop alignment, loop fusion, use of loop interchange for parallelization

Handling control Dependence:
Types of branches. If conversion. Management of Memory Hierarchy: scalar register allocation and management of the cache memory hierarchy. Topics include scalar replacement, unroll-and-jam, loop alignment, cache blocking, and prefetching.
Scheduling for Superscalar and Parallel Machines :
List Scheduling. Software Pipelining. Work scheduling for parallel systems. Guided Self-Scheduling

Text and Reference Books:
1. Allen and Kennedy, Optimizing Compilers for Modern Architectures, Morgan-Kaufmann, Second Printing, 2005.
2. Banerjee, Dependence Analysis, Kluwer Academic Publishers.
3. Wolfe, High Performance Compilers for Parallel Computing, Addison-Wesley, 1996.
4. Wolfe, Optimizing Supercompilers for Supercomputers, MIT Press.
5. Zima and Chapman, Supercompilers for Parallel and Vector Computers, ACM Press

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code: CSP556 **Course : Compiling for High Performance Architecture Lab**
L:0Hrs, P:2 Hrs, Per Week **Total Credits : 01**

Course Outcomes :
On successful completion of the course, students will be able to:
1. Analyze input program code to find scope of optimization.
2. Implementation of various transformation techniques for code parallelization.

Syllabus:
The instructor should design the practical such that the student should be able:
- To study and understand the advanced compiler techniques.
- To illustrate the knowledge base earned after studying this course.
- To develop the code for loop handling.
- To develop the code for the demonstration of dependences.

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code: CST557 **Course : Advanced Digital Image Processing**

L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :

On successful completion of the course, will be able to :

1. Learn and use different approaches to image enhancement and image analysis.
2. Apply various image segmentation methods with effective object recognition and classification techniques.
3. Understand the need for image transform and compression and able to apply different compression techniques.

Syllabus

Introduction :

Intensity transformation function, Histogram processing, Spatial Filtering: Smoothing and sharpening Frequency Domain Filtering: Smoothing and Sharpening.

Image Morphology :

Dilation, Erosion, Opening, Closing, Boundary extraction, Region filling, Hit or Miss Transform, Thinning, Thickening, Skeletonization, Pruning.

Image Segmentation :

Pixel-based method: thresholds level adjustment, continuity-based method:-multi-thresholding, detection of regions of interest thresholding and binarization, region growing, watershed algorithm, Edge Detection : Computing the gradient, Robert, Prewitt, Sobel operators, Second derivative-Laplacian, Canny edge detector, Edge linking-Local processing, Hough transform.

Image Transform :

Discrete Sine Transforms, Discrete cosine transform, Discrete Fourier Transform, karhunen-Loeve transform, Slant transform, Walsh-Hadamard, Haar Transform.

Image Analysis and Image Registration:

Representation of shapes and contours, shape factors, Fourier descriptors, statistical analysis of texture, Law's measures of texture energy, Fourier domain analysis of texture, structural analysis of texture, Image Registration : Feature Detection, Feature matching, Transform model estimation, image Re-sampling and Transformation.

Image Coding and Data Compression :

Lossy versus lossless compression, distortion measures and fidelity criteria, fundamental concepts of coding (direct source coding, Huffman coding, run-lenght coding, arithmetic coding, Lempel-Ziv coding, Lempel-Ziv coding, contour coding), the need for decorrelation : transform coding, interpolative coding, predictive coding, compression standards: the jbig standard, the jpeg standard and jpeg 2000.

Object Recognition and Classification :

Pattern and pattern clesses, Statistical Decision Making (Bayesian Classifiers), Non-Parametric Decision Making (Histogram based, k Nearest Neighbors), neural Networks (Single and Multi layer perceptron, Back propagation algorithem).

Video Processing :

Introduction to video signal processing, video processing standards, MPEG block diagram and data flow, MPEG-2 and MPEG-4 standards, motion estimation and compensation algorithms, block matching algorithms, video compression and decompression, interactive video techniques.

Text and Reference Books :

1. Gonzalez and Richard E Woods, Digital Image Processing, Addison-Wesley, 2000 3rd Edition
2. S Jayaraman, S Esakkirajan, Digital Image Processing, McGraw Hill Education.
3. Barbara Zitova, Jan Flusser Image registration methods: a survey image and Vision Computing 21 (2003) 977-1000 Elsevier journal.
4. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Brooks, 1999
5. Gonzalez, Steven Eddins and Richard E Woods, Digital Image Processing using MATLAB, Prentice-Hall, 200 3 rd Edition.
6. Anil K Jain, Fundamentals of Digital Image Processing, Prentice-Hall India, 2001.

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code: CSP557 **Course : Advanced Digital Image Processing Lab**

L:0Hrs, P:2Hrs, Per Week **Total Credits: 01**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Demonstrate use of various edge detection algorithms in image segmentation and extraction of ROI.
2. Demonstrate use of morphological operations and image transforms in image segmentation.
3. Analyze and apply data compression, coding techniques for efficient image processing.
4. Demonstrate object recognition and classification for motion estimation.

Syllabus :

The instructor should design the practical such that the student should be able:

To design and simulate the following exercises using MATLAB:

- Edge detection and linking
- Image morphological operators
- Image segmentation
- Shape and texture analysis
- Registration
- Coding and compression
- Object recognition
- Classification
- Motion estimation

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code : CST558

(Foundation Course- II) **Course : Research Methodology**

L:3Hrs, P:0Hrs, Per Week **Total Credits : 03**

Course Outcomes :

1. Ability to critically evaluate current research and propose possible alternate directions for further work
2. Ability to develop hypothesis and methodology for research
3. Ability to comprehend and deal with complex research issues in order to communicate their scientific results clearly for peer review.

Syllabus :

Introduction to research methodology:

Meaning of Research, Objectives of Research, Motivation in Research, Types ofResearch, Research Approaches, Significance of Research, research Methods versusMethodology, Research and Scientific Method, Research Process, Criteria of good Research, Necessity and Techniques of Defining the Problem,Meaning and need of Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Design, Research ethics, Stress management

Literature review, Data collection and sampling design:

Review concepts and theory, review previous findings, Sources of data: Primary and secondary data, Methods of data collection, Sampling fundamentals

Modeling and Analysis:

Probability distributions, Processing and analysis of data, Data analysis skills, Distributions, Statistical and multivariate analysis, Correlation and regression, Fundamentals of Time series analysis, spectral analysis, Error analysis, Simulation techniques

Algorithmic processes in Computer science research domains:

Soft computing, Artificial intelligence, NLP, Image processing, Data management techniques, Networks and security, Software systems

Research reports:

Structure and components of Research report, Types of report, Layout of research report, Mechanisms and tools for writing research report, LaTeX

Text and Reference Books:

1. C.R. Kothari, Research Methodology Methods and Techniques, 2ndRevised edition, New Age
2. Richard I Levin amp; David S.Rubin, Statistics for Management, 7/e. Pearson Education, 2005.
3. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd.,2006.
4. Bendat and Piersol, Random data: Analysis and Measurement Procedures, Wiley Interscience, 2001.
5. Shumway and Stoffer, Time Series Analysis and its Applications, Springer, 2000.
6. Jenkins, G.M., and Watts, D.G., Spectral Analysis and its Applications, Holden Day, 1986

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code: EET562
(Group Elective-I) **Course : Microcontroller In Power Controllers**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Objectives :

1. To introduce Microcontroller as a tool for the development of applications in Power converter.
2. To introduce Microcontrollerprogramming using assembly/C language.
3. To introduce the on-chip peripherals useful in development of power converter control system.
4. To introduce applications of Microcontroller in AC/DC drives, Power supplies and power converters.

Course Outcomes :

On completion of this course, the students will be able to,

CO1. Understand the architecture and use of varipus on-chip peripherals of microcontroller.
CO2. Develop programs using assembly language/C for microcontroller.
CO3. Develop algorithms for various control system blocks for power converters.
CO4. Discuss the use of Microcontroller in power converters using block diagrams.

Syllabus:

Evolution of micro-controller, comparison between micro processor and micro controllers. Micro-controller development systems, Microcontrollers-architecture-hardware description.
Introduction to GPIO, memory, Interrupt structure, Timer, ADC,UART, I2C bus operation and programming.
Typical application in the control of power electronic converters for Power supplies, Electric motor drives and Power system.

Text books :

1. Microprocessor and Interfacing-Programming and Hardware: Dauglas V.Hall, TMH, 2003.
2. Design with microcontrollers: John.B. Peatman, McGraw Hill International Ltd.,1997
3. Modern Power Electronics and AC Drives: B.K.Bose, Prentice Hall; First edition.
4. PIC Microcontroller and Embedded Systems: Using Assembly and C: for MC18 by Muhammad Ali Mazidi, Sarmad naimi and Sepehr Naimi. Pearson Custom Electronics Technology.
5. www.microchip.com

References :

Data sheets of hardware components.

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code: ENT560
(Group Elective-I) **Course : VLSI Design Automation**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Objectives:

The objective of this course is to provide students with

1. Fundamental Knowledge of VLSI CAD tool chain.
2. Techniques of Partitioning, floor-planning and routing
3. Basic Concepts of High level Synthesis

Course Outcomes :

Upon completion of this course, students should demonstrate the ability to:

I. Describe the VLSI design flow
II. Explain the algorithms for partitioning, floorplaning, placement and routing the digital designs.
III. Compare the various scheduling algorithms

Syllabus:

Introduction to VLSI CAD: VLSI design methodologies, use of VLSI CAD tools, Algorithmic Graph Theory and computational Complexity.
Partitioning: Introduction, Types of Partitioning, Classification of partitioning Algorithm, KL algorithm, FM algorithm etc.
Floorplanning: Introduction, Sliced and non-sliced planning, Polish expression
Placement: Introduction, Classification of Placement Algorithms: Simulated annealing, partition based placement
Routing: Fundamental Concepts such as Maze running, Line Searching, Steiner trees, Two phases of Routing: Global routing & detailed routing, Routing Algorithms
High-level Synthesis: Hardware Models for High-level Synthesis, Internal Representation of the Input Algorithm, Allocation, Assignment and Scheduling, ASAP, Mobility based Scheduling, List scheduling, Force directed scheduling
Basic Concepts of Static Timing Analysis

Text Books:

1. Algorithms for VLSI Design Automation:Sabih H. Gerez and John Wiley,(1998).
2. An Introduction to VLSI Physical Design: Majid Sarrafzadeh and C. K. Wong, McGraw Hill, (1996).
3. Algorithms for VLSI Physical Design Automation: NaveedSherwani, Kluwer Academic Pub., (1999).

Reference Book:

1. Physical Design Essentials: An ASIC Design Implementation Perspective: KhosrowGolshan, Springer, (2007)
2. Handbook of Algorithms for Physical Design Automation: Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, CRC Press, (2008).
3. Static Timing Analysis for Nanometer Designs: A Practical Approach: J. Bhasker and Rakesh Chadha, Springer, (2009).
4. Advanced ASIC Chip Synthesis: Using Synopsys Design Compiler, 2nd Edition: HimanshuBhatnagar, Kluwer Academic, (2001).

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code : CST561-1
(Group Elective-I) **Course : Optimization Techniques in Artificial Intelligence**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :
On successful completion of the course, students will be able to:
1. Explain how biological systems exploit natural processes.
2. Analyze how complex and functional high-level phenomena can emerge from low-level interactions.
3. Understand how large numbers of agents can self-organize and adapt.
4. Design and implement simple bio-inspired algorithms.

Syllabus:
INTRODUCTION - What is Life? Life and Information, The Logical Mechanisms of Life, What is Computation? Universal Computation and Computability, Computational Beauty of Nature (fractals, L-systems, Chaos) Bio-inspired computing, Natural computing, Biology through the lens of computer science
COMPLEX SYSTEMS AND FUZZY SYSTEMS - Complex Systems and Artificial Life, Complex Networks - Self-Organization and Emergent Complex Behavior, Cellular Automata, Boolean Networks, Development and Morphogenesis, Open-ended evolution, Introduction to Fuzzy Set Theory, Uncertainty and Fuzzy, Hedges and Alpha Cuts, Fuzzification Models, Methods of Defuzzification
NATURAL COMPUTATION AND NEURAL NETWORKS - Biological Neural Networks, Artificial Neural Nets and Learning, pattern classification & linear separability, single and multilayer perceptrons, backpropagation, associative memory, Hebbian learning, Hopfield networks, Stochastic Networks, Unsupervised learning
EVOLUTIONARY SYSTEMS AND ALGORITHMS - Evolutionary Programming: biological adaptation &evolution, Autonomous Agents and Self-Organization: termites, ants, nest builiding, flocks, herds, and schools. Geneticalgorithms: Schema theorem, Reproduction, Crossover, Mutation operators
COMPETITION, COOPERATION AND SWARM INTELLIGENCE - Collective Behavior and Swarm Intelligence, Social Insects, Stigmergy and Swarm Intelligence; Competition and Cooperation, zero - and nonzero, sum games, iterated prisoner's dilemma, stable strategies, ecological & spatial models, Communication and Multi-Agent simulation - Immuno computing.

Text and Reference Books:

1. Leandro Nunes De Castro, Fernando Jose Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Publishing, 2005.
2. Leandro Nunes De Castro , "Fundamentals of Natural Computing: Basic concepts, Algorithms and Applications", Chapman & Hall/ CRC Computer & Information Science Series, 2006.
3. Dario Floreano, Claudio Mattiussi, "Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies", MIT Press, 2008.
4. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 2005

Websites and External Links
1. http://informatics.indiana.edu/rocha/i-bic/
2. http://web.eecs.utk.edu/~mclennan/Classes/420/
3. http://www.cs.stir.ac.uk/courses/31YB/

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code : CST561-2
(Group Elective-I) **Course : Social Network Analysis**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :
On successful completion of the course, students will be able to:
1. Understand the fundamental principles of social network analysis and applications.
2. Apply network-based reasoning to elicit social policy recommendations.
3. Understand the measures of network composition and structures in social phenomenon.
4. Understand the opportunities and challenges due to pervasive social network data on the internet

Syllabus:
Social network data :
Introduction &What's different about social network data? Nodes, boundaries, Modality Relations , Sampling ties, Multiple, Scales. Why formal methods? Using graphs to represent social relations.Using matrices to represent social relations. Connection and distance ,Networks and actors ,exchange, Connection ,demographics, Density,Reachability,Connectivity,Distance ,Walks etc., diameter, Flow.

Network centrality :
Density,Reciprocity,Transitivity,Clustering,Krackhardt's Graph Theoretical Dimensions of Hierarchy. Ego networks, Centrality and power, Degree centrality Degree: Freeman's approach, Closeness, Betweenness Centrality

Cliques and Sub-groups :
Groups and sub-structures, Bottom-up approaches ,Top-down approaches, Defining equivalence or similarity ,Structural equivalence, Automorphic, Regular equivalence,
Measures of similarity and structural equivalence
Measuring similarity/dissimilarity:
Pearson correlations covariance's and cross-products, distances, Binary , Matches: Exact , Jaccard , Hamming, Visualizing similarity and distance ,Describing structural equivalence sets :Clustering similarities or distances profiles.

Automorphic Equivalence :
Defining automorphic equivalence, Uses of the concept, Finding equivalence Sets, All permutations (i.e. brute force), Optimization by tabu search, Equivalence of distances: Maxsim

Small world network models, optimization, strategic network formation and search Concepts :
Small worlds, geographic networks, decentralized search, Contagion, opinion formation, coordination and cooperation, SNA and online social networks

Reference Books :

1. Hanneman, Robert A. and Mark Riddle. 2005. Introduction to social network methods. Riverside, CA: University of California
2. Stanley Wasserman and Katherine Faust; Social Network Analysis - Methods & Applications; Cambridge Univ. press; 1998.
3. John Scott: Social Network Analysis - A Handbook; Second Edition ; SAGE Publication; 2000.
4. CharuAgrawal; Social Network Data Analytics ; Springer; 2011.
5. WouterNooy, Andrei Movar and Vladimir Batagelj; Exploratory Social Network Analysis with Pajek; Cambridge Univ. press; 2005.

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code : CST599-1 **Course : Advance Programming Techniques**
(Open Elective-I)
L:3Hrs, P:0Hrs, Per Week **Total Credits : 03**

Course Outcomes :

1. Use basic programming and object oriented concepts of Python programming.
2. Design advanced, multidisciplinary applications using built-in objects and standard libraries.
3. Understand basic concepts and programming of Java server pages.
4. Create JSP pages using the Expression Language, JSP Directives, Actions, Java Bean and Tags.

Syllabus :

Python concepts:
Expressions, values, types, variables, programs & algorithms, control flow I/O, the Python execution model

Data structure:
List, set, dictionary (mapping), tuple, graph (from a third-party library)
List slicing (sublist), list comprehension (shorthand for a loop)
Mutable and immutable data structures
Distinction between identity and (abstract) value

Functions :
Procedural abstraction, functions as values, recursion, function design methodology
Introduction to Object Oriented concepts :
Class, objects methods, inbuilt objects and library, programming example, etc.
Pattern matching :
basics concept of Regular expressions and programming with inbuilt functions for pattern matching, searching and replacement.

Introduction to JSP :
Introduction to Java Server Pages, Features of JSP, Access Models, Advantages of JSP over competing technologies.
Writing Java Server Pages :
Developing a Simple Java server Pages, JSP Processing Model, Comments and Character Coding Conventions.

JSP Scripting Elements :
Forms of Scripting Elements, Predefined Variables, Examples, using Elements.
JSP Directives, Actions, Java Bean and Tags:
JSP Pages Directive, JSP Include Directive, jsp:include Action, jsp"forward Action, jsp:plugin Action, Java Beans, Custom tags, JSP Standard Tag Library.

Text and Reference Books :

1. Martin C Brown., Python : The Complete Reference, **Publisher** McGraw Hill Education.
2. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media
3. Allen Downey, Jeffrey Elkner, Chris Meyers, Learning with Python, Dreamtech Press.
4. Jason Hunter and William Crawford, Java Servlet Programming, Publisher O'Reilly Media.
5. Jayson Falkner and Kevin Jones, Servlets and Java Server Pages : The J2EE Technology Web Tier, Publisher Addison-Wesley Professional.

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code: CSP559 **Course : Software Lab II**
L:0Hrs, P:2Hrs, Per Week **Total Credits : 01**

Course Syllabus :

The instructor should design the practical such that the student should be able to:

1. Learn latest tools and techniques in computer science and engineering.
2. Apply and implement advance data techniques, algorithm in cryptography and wireless sensor networks.

Syllabus for Semester II, M.Tech (Computer Science & Engineering)

Course Code: CSP560 **Course : Seminar**

L:0Hrs, P:2Hrs, Per Week **Total Credits : 01**

Course Syllabus :

The students have to deliver the seminar on the recent happenings in the research domain and IT industry. They can formulate the project problem around the identified theme. Seminar presentation will be followed by the report submission.

Syllabus for Semester III, M.Tech (Computer Science & Engineering)

Course Code: CST651-1

(Program Elective-II) **Course : Statistical Machine Learning**

L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Understand the basic concept and need of machine learning.
2. Understand and analyze different models of learning.
3. Understand applicability of various learning models.
4. Design hybrid machine learning model.

Syllabus :

Introduction, Types of Machine Learning, Supervised Learning, Regression and Classification, Linear discriminants, The Perceptron.

Multilayer perceptron, Back Propagation of Error, Multilayer perceptron in practice, Examples using MLP, Radial Basis functions and Splines, Interpolation and basis functions.

Support Vector Machine, Optimal separation, Kernels, Learning with trees, Using Decision Trees, Implementation of decision trees, Classification and Regression trees CART, Decision by committee: Ensemble Learning.

Probability and learning, Turning data into probabilities, Gaussian Mixture model and nearest neighbourhood model, Unsupervised learning, K-means algorithm, Vector Quantization, Self-Organized feature map.

Dimensionality Reduction, Linear Discriminant analysis (LDA), Factor Analysis, Independent Component Analysis, Reinforcement Learning, Markov Chain, Monte Carlo Methods, Graphical Methods.

Text and Reference Books :

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Chapman and Hall publications
2. Pattern Recognition and Machine Learning, Bishop, Christopher M., Springer
3. Machine learning: Drew Conway and John White, Oreille publications
4. Machine Learning, Tom M.Mitchell, McGraw Hill Publications

Syllabus for Semester III, M.Tech (Computer Science & Engineering)

Course Code : CST651-2
(Program Elective-II) **Course : Cryptography**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes:
On successful completion of the course, students will be able to:
1. Understand the classification of computer security techniques.
2. Identify the security weaknesses in different networking environment.
3. Implement appropriate cryptography scheme & security mechanism for different computing environment and information systems.

Syllabus:
Classical Cryptography:
The Shift Cipher, The Substitution Cipher, The Affine Cipher, Cryptanalysis Cryptanalysis of the Affine Cipher, Cryptanalysis of the Substitution Cipher, Cryptanalysis of the Vigenere Cipher, Shannon's Theory.
Block Cipher and the Advanced Encryption Standard-Substitution:
Permutation Networks, Linear Cryptanalysis, Differential Cryptanalysis, The Data Encryption Standard, The Advanced Encryption Standard, Modes of Operation ,Cryptography Hash Function- Hash Function and Data Integrity, Security of Hash Function ,Iterated Hash Functions, Message Authentication Codes.

The RSA Cryptosystem and Factoring Integers:
Introduction to Public -key Cryptography, Number theory, The RSA Cryptosystem ,Other Attacks on RSA, The ELGamal Cryptosystem, Shanks' Algorithm, Finite Fields, Elliptic Curves over the Reals, Elliptical Curves Modulo a Prime, Signature Scheme -Digital Signature Algorithm.

Identification Scheme and Entity Attenuation:
Challenge-and-Response in the Secret-key Setting, Challenge and-Response in the Public key Setting, The Schnorr Identification Scheme, Key distribution-Diffie-Hellman Key, Pre distribution, Unconditionally Secure key Pre distribution, Key Agreement Scheme-Diffie-Hellman Key agreement, Public key infrastructure-PKI, Certificates, Trust Models.

Secret Sharing Schemes:
The Shamir Threshold Scheme, Access Structure and General Secret key sharing, Information Rate and Construction of Efficient Schemes, Multicast Security and Copyright production Multicast Security, Broadcast Encryption, Multicast Re-keying, Copyright Protection, Tracing Illegally Redistribution keys.

Text and Reference Books:

1. Cryptography Theory and Practice: Third Edition Douglas R. Stinson, Chapman & Hall/CRC, (2006).
2. Handbollk of Applied Cryptography: Menzes A. J., Oorschot P, Vanstone S. ACRC Press, 1997.
3. Cryptography and Network Security: Principles and Practices: William Stallings, Third Edition, Pearson Education, (2006).
4. Modern Cryptography-Theory and Practice: Wenbo Mao, Pearson Education, First Edition, (2006).
5. Security in Computing: Charles B. Pfleeger, Shari Lawrence Pfleeger, Fourth Edition, Pearson Education, 2007.
6. Cryptography and network security - 2nd edition - Behrouz A. Forouzan, DebdeepMukhopadhyay. Introduction to Cryptography with Coding Theory: Wade Trappe and Lawrence C. Washington, Second Edition, Pearson Education, (2007).

Syllabus for Semester III, M.Tech (Computer Science & Engineering)

Course Code : CST651-3
(Program Elective-II) **Course : Big Data Analysis**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :
On successful completion of the course, students will be able to :
1. Explain the big data fundamentals, its evolution, characteristics and challenges.
2. Employ non-relational databases for storage and processing of large volumes of structured, unstructured and streaming data.
3. Understand and apply Hadoop and Map Reduce for big data implementations.

Syllabus:
A New paradigm for Big Data - What is Big Data?; The evolution of Big Data; Scaling with traditional database; Desired properties of a Big Data system; Problems with fully incremental architectures; Lambda architecture; Recent trends in technology. Business problems suited to Big Data analytics.

Data Quality - Structured, unstructured and semi-structured data; Black Swan and incomplete data; Issues in data representation/interpretation; Biases; Ishikawa diagram, Interrelationship digraph and Force field analysis. Data model for Big Data - The properties of data; Fact-based model; Graph schemas; Serialization framework.

Big Data Tools - ZooKeeper, Hive, Pig, Mahout, R and RHipe. Hadoop - Power through distribution, cost-effectiveness. HBase and Other Big Data databases - Evolution from flat files to the three V's; Transition to Big Data databases; Graph databases; Document databases; Key-value databases and Column-oriented databases. The Nuts and Bolts of Big Data - The Storage Dilemma; Building a Platform; Processing Power; Choosing the Best Approach. Data Storage - Using the Hadoop Distributed File System; the Hadoop ecosystem; Recomputation algorithms versus incremental algorithms; MapReduce: a paradigm for Big Data computing; Low-level nature of MapReduce and Pipe diagrams. Best practices for Big Data analytics.

Big Data solutions in the real world - The Importance of Big Data to business; Analyzing data in motion; Improving business processes with Big Data analytics. Big Data Do's and Don'ts.

Textbooks and References :

1. Pries, Kim H. and Dunnigan, Robert; Big Data Analytics - A Practical Guide for Managers; CRC Press; 2015.
2. Ohlhorst, Frank; Big Data Analytics - Turning Big Data into Big Money; John Wiley and Sons; 2013.
3. Loshin, David; Big Data Analytics - From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph; Morgan Kaufmann; 2013.
4. Marz, Nathan and Warren, James; Big Data - Principles and Best Practices of Scalable Real-Time Data Systems; Manning Publication; 2015.
5. Prajapati, Vignesh; Big Data Analytics with R and Hadoop; Packt Publishing; 2013.
6. Hurwitz, Judith et al.; Big Data for Dummies; John Wiley and Sons; 2013.
7. White, Tom; Hadoop - The Definitive Guide; O'Reilly Media; 2009.
8. Lublinsky. Boris et al.; Professional Hadoop Solutions; John Wiley and Sons (Wrox); 2013.

Syllabus for Semester III, M.Tech (Computer Science & Engineering)

Course Code : CST652-1
(Program Elective-III) **Course : Reconfigurable and Cloud Computing**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :
On successful completion of the course, students will be able to:
1. Understand the principles, techniques, protocols and algorithms that can be adapted from other distributed computing paradigms to the development of successful clouds
2. Examines cloud-practices and applications, and highlights early deployment experiences
3. Understanding about the cloud security and privacy concepts and implementation strategies.
4. Understand and explore various cloud service providers, facilities provided, costing involved etc.

Syllabus :
Cloud Base Tools and Technologies for Building Clouds, Taxonomy, Survey and Issues of Cloud Computing Ecosystems Towards Taxonomy for Cloud Computing from an e-Science Perspective Examining Cloud Computing from the Perspective of Grid and Computer-Supported Cooperative Work Overview of Cloud Standards

Cloud Seeding Open and Interoperable Clouds :
The Cloud@HomeWay A Peer-to-Peer Framework for Supporting MapReduce Applications in Dynamic Cloud Environments Enhanced Network Support for Scalable Computing Clouds YML-PC : A Reference Architecture Based on Workflow for Building Scientific Private Clouds, Efficient Framework for Running Applications on Clusters, Grids and Clouds Resource Management for Hybrid Grid and Cloud Computing Peer-to-Peer Cloud Provisioning: Service Discovery and Load-Balancing Mixing Grids and Clouds: High-throughput science using the Nimrod Tool Family

Security Management in the Cloud :
Security Management Standards, Security Management in the Cloud, Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management

Privacy
What Is Privacy? What Is the Data Life Cycle? What Are the Key Privacy Concerns in the Cloud? Who Is Responsible for Protecting Privacy? Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing Legal and Regulatory Implications U.S. Laws and Regulations International Laws and Regulations

Examples of Cloud Service Providers
Amazon Web Services (IaaS) Google (SaaS, PaaS) Microsoft Azure Services Platform (PaaS) Proofpoint (SaaS, IaaS) RightScale (IaaS) Salesforce.com (SaaS, PaaS) Sun Open Cloud Platform Workday (SaaS)

Text and Reference Books:
1. Cloud Computing: Principles, Systems and Applications, Antonopoulos, Nikos, Gillam, Lee (Eds.), Springer
2. Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance By Tim Mather, SubraKumaraswamy, ShahedLatif Publisher: O'Reilly Media
3. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, ZaighamMahmood, Ricardo Puttini

Syllabus for Semester III, M.Tech (Computer Science & Engineering)

Course Code: CST652-2
(ProgramElective-III) **Course : Information Retrieval**
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :
On successful completion of the course, students will be able to:
1. Understand issues in information retrieval.
2. Learn metadata organization for effective information access.
3. Understand, analyze and implement different language models.

Syllabus :
Boolean retrieval, The term vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction, Index compression.

Scoring, Term weighting and the vector space model Computing scores in a complete search system, Evaluation in information retrieval.

Relevance feedback and query expansion, XML retrieval, Probabilistic information retrieval
Language models for information retrieval, Text classification and Naive Bayes, Vector space classification, Support vector machines and machine learning on documents.

Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing,
Web search basics, Web crawling and indexes, Link analysis

Text and Reference Books :
1. An Introduction to Information Retrieval: Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, Cambridge University Press.
2. Speech and Language Processing :Jurafsky Dan and Martin James, Pearson Publication.
3. Natural Language Understanding : Allen James , Pearson Publication.

Syllabus for Semester III, M.Tech (Computer Science & Engineering)

Course Code : CST652-3 **Course : Ubiquitous Computing**
({Program Elective-III)
L:4Hrs, P:0Hrs, Per Week **Total Credits : 04**

Course Outcomes :

On successful completion of the course, students will be able to:

1. Understand the basic concepts of Ubiquitous computing.
2. Understand applications and requirements of ubiquitous computing.
3. Describe the important issues and concerns on security and privacy in ubiquitous computing.
4. Understand the applications of Human Computer interaction and smart devices and services.

Syllabus :

Ubiquitous Computing :

Basics and Vision: Living in a Digital World, Illustrative Ubiquitous Computing Applications, Modelling the Key Ubiquitous Computing Properties, Core Properties of UbiCom Systems, Implicit Human Computer Interaction (iHCI), Context Awareness, Reducing Human Interaction, Easing System Maintenance Versus Self Maintaining Systems, Architectural Design for UbiCom Systems: Smart DEI Model, Smart Devices, Smart Environments, and Smart Interaction.

Applications and Requirements:

Introduction, Example Early UbiCom Research Projects,

Smart Devices: CCI, Smart Environments: CPI and CCI, Smart Devices: CPI, Everyday Applications in the Virtual, Human and Physical World, Ubiquitous Networks of Devices: CCI, Human Computer Interaction, Human to Human Interaction (HHI) Applications, Transaction based M Commerce and U Commerce Services, Smart Utilities, Smart Buildings and Home Automation, Smart Living Environments and Smart Furniture.

Smart Devices and Services:

Introduction, Smart Device and Service Characteristics, Distributed System Viewpoints, Abstraction versus Virtualisation, Service Architecture Models, Partitioning and Distribution of Service Components ,Multi tier Client Service Model, Distributed Data Storage, Distributed Processing,Client Server Design 83,Proxy based Service Access, Middleware, Service Oriented Computing (SOC) Grid Computing, Peer to Peer Systems, Device Models ,Service Provision Life Cycle, Network Discovery, Web Service Discovery, Virtual Machines and Operating Systems, Virtual Machines, BIOS.

Smart Mobiles, Cards and Device Networks :

Introduction ,Smart Mobile Devices, Users, Resources and Code, Operating Systems for Mobile Computers and Communicator Devices, Microkernel Designs ,Mobility Support ,Resource Constrained Devices, Power Management ,Smart Card Devices ,Smart Card OS ,Smart Card Development , Device Networks.

Human-Computer Interaction:

Introduction, Explicit HCI: Motivation and Characteristics, Complexity of Ubiquitous Explicit HCI, Implicit HCI: Motivation and Characteristics, User Interfaces and Interaction for Four Widely Used Devices, Diversity of ICT Device Interaction, Personal Computer Interface, Mobile Hand Held Device Interfaces, Hidden UI Via Basic Smart Devices Multi Modal Visual Interfaces, Gesture Interfaces, Touchscreens, Natural Language Interfaces, Human Centred Design (HCD).

Tagging, Sensing and Controlling

Tagging the Physical World, Life Cycle for Tagging Physical Objects, Tags: Types and Characteristics, Physical and Virtual Tag Management, RFID Tags, Active RFID Tags, Passive RFID Tags, Sensors and Sensor Networks, Micro Actuation & Sensing: MEMS, Embedded Systems and Real Time Systems, Robots, Robot Manipulators, Nanobots.

Text and Reference Book:

Ubiquitous Computing: Smart Devices, Environments and Interactions Stefan Poslad, John Wiley and Sons, Ltd, Publication

Syllabus for Semester III, M.Tech (Computer Science & Engineering)

Course Code: CSP653 **Course : Project Phase - I**
L:0Hrs, P:3Hrs, Per Week **Total Credits : 6**

Project Phase-1 :

In this phase, student has to go for two seminars :

Progress Seminar-1: Based on Literature Review & Problem Definition.

Progress Seminar-2: Based on Partial Implementation & Preliminary Results.

Syllabus for Semester IV, M.Tech (Computer Science & Engineering)

Course Code: CSP654 **Course : Project Phase - II**

L:0Hrs, P:6Hrs, Per Week **Total Credits : 12**

Project Phase - 2 :

In this phase, student has to go for :

Progress Seminar-1: Based on the progress done in the implementation and results obtained.

Progress Seminar-2: Based on the Complete Implementation and Results analysis.

Demonstration followed by Report Submission.