



GALGOTIAS UNIVERSITY

Syllabus of

Course Book M.Tech.(CSE) 2017-18

Name of School: Computing Science and Engineering

Department: Computer Science and Engineering

Year: 2017-18

SEMESTER – I						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CENG5001	Professional Communication Skills	0	0	4	2
2	MATH5001	Advanced Numerical and Statistical Methods	3	1	0	4
3	MCSE5001	Advanced Design and Analysis of Algorithms	3	0	0	3
4	MCSE5002	Advanced Computer Networks	3	0	0	3
5	MCSE5003	Advanced Operating Systems	3	0	0	3
6	MCSE5004	Knowledge Based System Design	3	0	0	3
7	MCSE5005	Advanced Design and Analysis of Algorithms Lab	0	0	2	1
8	MCSE5006	Advanced Computer Networks Lab	0	0	2	1
9	MCSE5007	KBSD Lab Using MAT Lab	0	0	2	1

SEMESTER – II						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCSE5008	Network Security	3	0	0	3
2	MCSE5009	Advanced Computer Graphics	3	0	0	3
3	MCSE5010	Business Analytics	3	0	0	3
4	MCSE5022	Mobile Computing	3	0	0	3
5	MCSE5017	Parallel Algorithms	3	0	0	3
6	MCSE5011	Network Security Lab (NS/SUMO)	0	0	2	1
7	MCSE5012	Advanced Computer Graphics Lab	0	0	2	1

SEMESTER – III						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	SLMT5001	Quantitative and Communication Proficiency	0	0	4	2
2	MCSE6001	Requirement Analysis and Project Management	3	0	0	3
3	MCSE5023	Big Data Analytics	3	0	0	3
4	MCSE5016	Web Services	3	0	0	3
5	MCSE6002	Requirement Analysis and Project Management Lab	0	0	2	1
6	MCSE9998	Dissertation Part – I	0	0	10	5

SEMESTER – IV						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCSE9999	Dissertation Part – II	0	0	30	15

Program Elective 1						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCSE5022	Mobile Computing	3	0	0	3
2	MCSE5020	Data Compression	3	0	0	3
3	MCSE5021	Coding and Information Theory	3	0	0	3
4	MCSE5026	High Performance Computer Systems	3	0	0	3

Program Elective II						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCSE5017	Parallel Algorithms	3	0	0	3
2	MCSE5018	Advances in compiler Design	3	0	0	3
3	MCSE5019	Grid and Cluster Computing	3	0	0	3

Program Elective III						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCSE5025	Real Time Systems	3	0	0	3
2	MCSE5023	Big Data Analytics	3	0	0	3
3	MCSE5024	Natural Language Processing	3	0	0	3
4						

Program Elective IV						
S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MCSE5015	Transaction Processing	3	0	0	3
2	MCSE5016	Web Services	3	0	0	3
3	MCSE5014	Distributed Systems	3	0	0	3
4	MCSE5013	Interaction Design	3	0	0	3

Detailed Syllabus

CENG5001	PROFESSIONAL AND COMMUNICATION SKILL	0	0	4	2
Version No.	1.0				
Prerequisite	-				
Objectives:	<p>To develop the professional and communication skills of learners in a technical environment.</p> <p>To enable the students to acquire functional and technical writing skills.</p> <p>To acquire state-of-the-art presentation skills in order to present technical topics to both technical and non-technical audience.</p>				
Expected Outcome:	The learners will be able to exhibit their language proficiency and skill in <i>Describing, Investigating, Designing and Making and Using Technology.</i>				
Unit I					
Functional Language	Basic structures- Tense agreement, Prepositional phrases Techno-words : Basic Concepts 62, 63 Pronunciation : sounds of syllables: Past tense & plural endings				
Technical Expression	Organisational techniques in technical writing Guided writing: Paragraph Writing, Note Making				
Presentation Skills	Techniques of presentation (general topics : speech without visual aids) Listening to speeches and comprehending				
Graphical Skills	Flow chart : Process and Functional description				
Unit II					
Functional Language	Basic structures- Voice, Conditionals Techno-words : Basic Concepts 64,65,67 Pronunciation : Word Stress: two syllable words				
Technical Expression	Mechanics of Technical Writing and Syntax Guided writing: Letter and email				
Presentation Skills	Interpersonal Communication Skills Writing techniques for Power point presentation, Group Discussion				
Graphical Skills	Technical Illustrations and Instructions				
Unit III					
Functional Language	Basic structures- Modal Verbs and Phrasal verbs Techno-words : Basic Concepts 68,69,70,71 Pronunciation : Word Stress: compound words				
Technical Expression	Mechanics of Technical Writing and Syntax Guided writing: Technical Description				
Presentation Skills	Career advancement: Technical Resume and Company Profile Presentation and Group Discussion				
Graphical Skills	Pie chart, Bar chart, Line graphs: analysis and interpretation				
Unit IV					
Functional Language	Basic structures- Modal Verbs and Phrasal verbs Techno-words : Basic Concepts 72,73,74, Functional vocabulary 87 Pronunciation : Sentence Stress				
Technical Expression	Guided and Free writing: Abstract and Technical articles				
Presentation Skills	Nuances of Presentation to a Technical audience				
Graphical Skills	Oral Presentation of graphical representation				
Text Books and softwares					
1. English Vocabulary in Use Advanced, McCarthy & Felicity, CUP, 2003					

2. Sky Pronunciation CD-ROM
3. Cambridge Advanced Learner's Dictionary CD-ROM
4. English Master : Grammar

References	
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| <ol style="list-style-type: none">1. Writing, Researching, Communicating, Keith et al, Tata McGraw-Hill, 19892. Advanced English Grammar, Martin, CUP, 2006 | |
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MATH5001	Advanced Numerical and statistical Methods	L	T	P	C
Version No.	2.0	3	1	0	4
Prerequisite	Matrices and Calculus.				
Objectives:	To introduce the applications and trade off of various advanced methods used to solve a wide variety of engineering problems dealing with algebraic and differential equation that are often encountered in engineering and cannot be solved by analytical methods along with the introduction of design of experiment.				
Expected Outcome:	Student will be able to 1. Do numerical integration for various problems 2. Do interpolation using various interpolation techniques. 3. Understand the Ordinary & Partial Differential equations and their solutions. 4. Do numerical integration 5. Understand Probability and Distribution Use				
Module I	System of Equations				
Solution of system of linear equations- Direct Methods- Gauss elimination – Pivoting, Partial and Total Pivoting, Triangular factorization method using Crout LU decomposition, Cholesky method, Iterative Method- Gauss-Seidel and Jacobi method, ill conditioned matrix Solution of system of non linear equation- Newton Raphson and Modified Newton Raphson Method. Iterative methods.					
Module II	Interpolation and Approximation				
Lagrange, Spline and Hermite interpolation, Approximations, Error of approximation, Norms for discrete and continuous data, Least square approximation.					
Module III	Numerical Integration				
Newton Cotes closed Quadrature, Gauss Legendre Quadrature, Multiple Integration.					
Module IV	Numerical Solution of Differential Equations				
Finite Difference Schemes, Numerical solution of Ordinary differential equation using Modified Euler's method, Runge-Kutta method of 2nd, 3rd and 4th orders, Predictor- Corrector method, Solution of Laplace's and Poisson's equations by Liebmann's method, Solution of one dimensional time dependent heat flow.					
Module V	Probability and statistics				
Review of concept of probability, Random Variables, Continuous and discrete distribution function, moments and moments generating functions, Binomial, Poisson, Negative Binomial, Geometric and Hyper-geometric Distributions, Uniform, Normal, Exponential, Gamma and Beta distributions. Point and Interval estimation, Testing of Hypothesis (t-test and chi square test), Analysis of variance and Introduction of Design of experiments.					
Text Books					
1. 1. Rajasekaran,S., (2004), Numerical Methods in Science and Engineering, Wheeler and Company 2. Agostino Abbate, C.M.Decusatis, P.K.Das. "Wavelets and Sub-bands-Fundamentals and applications.", Birkhanser (2002). 3. John.M.K., Iyengar.S.R.K., Jain.R.K., (2002), Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd. 4. Marylees Miller and <u>Irwin Miller</u> , John E. Freund's Mathematical Statistics with Applications (7th Edition)					
References					
1. Numerical Method : E. Balagurusamy , Tata McGraw Hill Publication. 2. Applied Numerical Analysis : Curtis F. Gerald and Patrick O. Wheatley – Pearson Education Ltd. 3. Numerical Methods for Scientific and Engineering computation: M.K Jain, S.R.K Iyengar and R.K Jain , New age International Publishers. 4. Statistical Methods : S.P. Gupta , Sultan Chand and Sons 5. Introduction to Mathematical Statistics: A.M. Mood, F. Graybil and D.C.Boes , Mc Graw Hill Publication.					

MCSE5001	Advanced Design and Analysis of Algorithms			L	T	P	C
				3	0	0	3
Version No.	1.0						
Prerequisite							
Objectives:	<ol style="list-style-type: none"> 1. To know the importance of the complexity of a given algorithm. 2. To study various algorithmic design techniques. 3. To utilize data structures and/or algorithmic design techniques in solving new problems. 4. To know and understand basic computability concepts and the complexity classes P, NP, and NP-Complete. 						
Expected Outcome:	<ol style="list-style-type: none"> 1. Analyze the complexity of the algorithms and use technique divide and conquer to solve the problems 2. Identify feasible solutions for different problems through greedy method and minimize the solutions space and to solve the problems through dynamic programming. 3. Solve the problems through graph algorithms. 4. Justify that a certain problem is NP-Complete. 5. Understand and apply linear programming concepts to real time applications. 						
Module I	Introduction					9 Hours	
Overview of algorithmic design, asymptotic notation and its properties, Growth of Functions, Time complexity and Analysis of algorithms, Recurrence Relations.							
Module II	Sorting and Searching Algorithms					9 Hours	
Brute Force Method - Sorting in Quadratic time, insertion , selection and Bubble sort; Divide and conquer method-Sorting in Logarithmic time – Quick Sort , merge Sort , Shell Sort , Heap sort; Non-comparison sorts - Sorting in Linear Time - Counting Sort , Radix Sort , Bucket Sort; Worst Case and best case analysis of all sorting algorithms; Linear Search, Binary Search, Hashing, Randomized select , randomized quick sort.							
Module III	Algorithms for Trees					9 Hours	
Binary Tree - Binary Tree traversals, Binary Search Tree, heap, priority Queues, Red Black Trees, B-Trees.							
Module IV	Memory and Device Management					8 Hours	
Graph Searching- Breadth-First Search, Depth-First Search, DAGs and topological sorting, minimum spanning tree, shortest path, backtracking, Network flow algorithms.							
Module V	Greedy Algorithms, Amortized Analysis and Dynamic Programming					10 Hours	
Longest common subsequence, Greedy Algorithms - Knapsack problem; Huffman codes, Algorithms for String Matching, Theory of NP-completeness; Turing machines and the halting problem, Applications of Algorithms in Databases, Information Retrieval and Web Searching, Data Mining							
Text Books							
<ol style="list-style-type: none"> 1. Cormen, Leiserson, Rivest and Stein, "Introduction to Algorithms", 2nd Edition, by, McGraw-Hill, 2000. 2. E. Horowitz, and S. Sahni, "Fundamentals of Computer Algorithms", Computer Science Press (1978). 							
Reference Books							
<ol style="list-style-type: none"> 1. Jon Kleinberg and Eva Tardos. Algorithm Design. Pearson Education, 2007. 2. Sanjoy Das Gupta, Christos Papadimitriou, Umesh Vazirani, Algorithms 1st Edition, Mcgraw Higher Ed, 2006. 3. Alfred V. Aho, John E. Hopcroft, Jeffery D.Ulman, Data Structures and Algorithms, Pearson; 1st edition, 2001. 							

MCSE5002	Advanced Computer Networks			L	T	P	C
				3	0	0	3
Version No.	1.0						
Prerequisite							
Objectives:	<p>The objective of this course is to:</p> <ol style="list-style-type: none"> 1. An ability to understand the basic concept of data communications and computer networks (e.g., different network types, applications, protocols, OSI layered architecture model, switching methodologies) 2. Provide the skills needed for algorithms in computer networks for various situations that one may encounter in a career in Computer Science. 3. Learn different algorithmic methodologies to design efficient algorithms and protocols in network field. 						
Expected Outcome:	<ol style="list-style-type: none"> 1. To develop knowledge about physical structure of computer network 2. To understand the fundamental concepts in routing and addressing 3. To analysis the problem in different layer during the communication in network 4. To understand the congestion control and transport protocols 5. To became expert to use of Internet and public network 6. To able to understand the connection management in network at transport layer 						
Module I	Networking Standards and Specification					9 Hours	
Networking standards and specifications, Need for standardization, ISO and the IEEE standards, The IEEE 802 Project							
Module II	Addressing and Routing					9 Hours	
Network names and addresses, Physical layer addressing: the MAC address, Network layer addressing: The IP address, Network layer address: The IPX address.							
Module III	Overview of OSI and TCP/IP Protocol Suite					9 Hours	
Converting network names to IP addresses, Resolving IP addresses to physical addresses, Addressing and routing.							
Module IV	TCP/IP Protocol Suite					9 Hours	
TCP/IP Protocol Suite, TCP/IP Protocol Suite advantages, Internet Protocol (IP), Transport Layer Protocols -TCP and UDP, File Transfer protocols - FTP and TFTP, Mail and news protocols - SMTP, POP3, NNTP and IMAP, Other Protocols Suite – ICMP and ARP.							
Module V	Other Networking Protocols					9 Hours	
The IPX/SPX Protocol Suite, NetBEUI, AppleTalk Protocol, File sharing protocols - SMB, NCP, and NFS, Routing protocols - RIP, OSPF and BGP, Network Management Protocol – SNMP and CIMP, Convergent Protocols – H.323 and SIP							
Text Books							
<ol style="list-style-type: none"> 1. Behrouz A. Forouzan, TCP/IP Protocol Suite, Third Edition, Tata McGraw-Hill, 2005. 2. W. Richard Stevens, TCP/IP Illustrated, The Protocols, Pearson Education, 2004. 3. D. E. Comer, Internetworking with TCP/IP Principles, Protocols and Architecture Vol - I, Pearson Education, 2001 							
Reference Books							
<ol style="list-style-type: none"> 1. Internetworking with TCP/IP: Design, Implementation, and Internals by Douglas E. Comer, Stevens.Prentice Hall. Hardcover- 30 April, 2004. 2. Networks Fundamental Video 3 - the Transmission Control Protocol/internet Protocol (Tcp/ip) Stack by Delmar.Delmar. Unknown Binding- 1 December, 2002. 3. Advanced IP Routing in Cisco Networks (McGraw-Hill Technical Expert) by Terry Slattery, Bill Burton. Osborne McGraw-Hill. Paperback- 1 October, 2000. 							

MCSE5003	Advanced Operating Systems			L	T	P	C
				3	0	0	3
Version No.	1.0						
Prerequisite							
Objectives:	<p>The objective of this course is to:</p> <ol style="list-style-type: none"> 1. To learn the fundamentals of Operating Systems. 2. To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols. 3. To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols. 4. To know the components and management aspects of Real time, Mobile operating systems 						
Expected Outcome:	<ol style="list-style-type: none"> 1. Discuss the various synchronization, scheduling and memory management issues. 2. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system. 3. Discuss the various resource management techniques for distributed systems. 4. Identify the different features of real time and mobile operating systems. 5. Install and use available open source kernel. 6. Modify existing open source kernels in terms of functionality or features used. 						
Module I	Introduction					9 Hours	
Operating system concept - processes and threads, process model, process creation, process termination, process hierarchies, and process states, Implementation of processes, Threads-Thread model, thread usage, Implementation of threads in user space and kernel, Hybrid implementations.							
Module II	Inter Process Communication					9 Hours	
Race conditions, critical regions, Mutual Exclusion with busy waiting, sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing; Scheduling- scheduling in batch systems, Interactive systems, Real time systems, Thread scheduling.							
Module III	Deadlocks					9 Hours	
Deadlocks-Introduction, Deadlock Detection and Recovery – Deadlock Detection with one resource of each type, with multiple resource of each type, recovery from deadlock; Deadlock Avoidance, Deadlock Prevention							
Module IV	Memory and Device Management					9 Hours	
Introduction, Swapping, Paging, Virtual memory – Demand paging, page replacement Algorithms; File System Management- Organization of File System, File Permissions, MS DOS and UNIX file system case studies, NTFS; Device Management- I/O Channels, Interrupts and Interrupt Handling, Types of device allocation.							
Module V	Distributed Operating Systems					9 Hours	
Distributed operating system concept – Architectures of Distributed Systems, Distributed Mutual Exclusion, Distributed Deadlock detection, Agreement protocols, Threads, processor Allocation, Allocation algorithms , Distributed File system design; Real Time Operating Systems: Introduction to Real Time Operating Systems, Concepts of scheduling , Real time Memory Management.							
Text Books							
<ol style="list-style-type: none"> 1. Mukesh Singhal and Niranjana, “Advanced Concepts in Operating Systems”, TMH, 1st Edition, 2001 2. Andrew S. Tanenbaum, “Modern Operating Systems”, Pearson Education, 2nd Edition, 2006 3. Andrew S. Tanenbaum, “Distributed Operating Systems”, Pearson Education, 2nd Edition, 2001. 4. Pradeep K. Sinha, “Distributed Operating Systems and concepts”, PHI, First Edition, 2002 							
Reference Books							

1. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.
3. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.

MCSE5004	Knowledge Based System Design			L	T	P	C
				3	0	0	3
Version No.	1.0						
Prerequisite							
Objectives:	<ol style="list-style-type: none"> 1. The purpose of this course is to impart knowledge on decision support systems and implementation. 2. To familiarize decision support systems and their characteristics. 3. To learn the technologies related to decision support systems. 4. To study about Intelligent DSS and applications of DSS 						
Expected Outcome:	<ol style="list-style-type: none"> 1. Discuss the Decision making and Modeling. 2. Demonstrate the decision support systems 3. Discuss the Technologies and management. 4. Identify the Intelligent Support Systems. 5. Use and available in Business. 						
Module I	Decision making and Computerized Support					9 Hours	
Management Support Systems: An Overview - Decision Making, Systems, Modelling, and Support.							
Module II	Decision Support Systems					9 Hours	
Decision Support Systems: An Overview - Modeling and Analysis – Business Intelligence: Data Warehousing, Data Acquisition, Data Mining, Business Analysis, and Visualization - Decision Support System Development.							
Module III	Collaboration, Communication, Enterprise decision Support Systems and Knowledge Management					9 Hours	
Collaborative Computing Technologies: Group Support Systems –Enterprise Information Systems - knowledge Management.							
Module IV	Intelligent Decision Support Systems					9 Hours	
Artificial Intelligence and Expert Systems: Knowledge-Based System – Knowledge Acquisition, Representation, and Reasoning - Advanced Intelligent Systems - Intelligent Systems over the Internet.							
Module V	Implementing in the E-Business Era					9 Hours	
Electronic Commerce - Integration, Impacts, and the Future of the Management- Support Systems.							
Text Books							
1.Efraim Turban, Jay Aronson E., Ting-Peng Liang, " <i>Decision Support Systems and Intelligent Systems</i> ", 7th Edition, Pearson Education, 2006.							
Reference Books							
1. George M .Marakas , " <i>Decision Support Systems in the 21st century</i> ", 2 nd Edition, PHI, 2009.							
2. Janakiraman V.S., Sarukesi K., " <i>Decision Support Systems</i> ", PHI, 2009.							

MCSE5005	Advanced Design and Analysis of Algorithms Lab	L 0	T 0	P 4	C 2
Version No.	1.0				
Prerequisite	-				
Objectives:	To teach the students the ways to create data structures by making use of the data types of a specific programming language and the ways to store and retrieve the data.				
Expected Outcome:	On completion of this course the students will be able to know the various ways of implementing the data structures and can make use of them for real life applications				
List of Experiments					
<u>Cycle I</u>					
<ol style="list-style-type: none"> 1. Applications using unordered list and ordered list and performing list operations. 2. Applications using stack (implemented using arrays and linked structure) 3. Applications using queue (implemented as arrays and linked structure) 4. Unsorted List as a Linked Structure 5. Sorted List as a Linked Structure 6. Binary Tree creation, insertion and deletion of nodes. 7. Binary Search Tree creation, insertion, deletion and searching an element. 8. Graphs: BFS and DFS 					
<u>Cycle II</u>					
<ol style="list-style-type: none"> 1. Bubble sort. 2. Selection sort. 3. Insertion sort. 4. Merge sort. 5. Quick sort. 6. Heap sort. 7. Applications using linear search and Binary Search. 8. Implementing hash functions. 					

MCSE5006	Advance Computer Network Lab	L	T	P	C
Version No.	1.0	0	0	2	1
Prerequisite					
Objectives:	This course provides platform for implementing methods and algorithms of modern operating systems and networking. .				
Expected Outcome:	<p>On completion of this course the student should be able to accomplish the following:</p> <ol style="list-style-type: none"> 1. Understand and evaluate various operating system and networking environments. 2. Develop Network protocols and algorithms 				
List of Experiments					
<ol style="list-style-type: none"> 1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands. 2. Configuration of IP addressing for a given scenario for a given set of topologies. 3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address. 4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using netstat) 5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down. 6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb. Use a TFTP client and repeat the experiment. 7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails 8. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a linux PC. Using yellow pages and NIS/NFS protocols implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterise the NAS traffic using wireshark. 					

MCSE5007	KBSD Lab using MATLAB	L	T	P	C
Version No.	1.0				
Prerequisite					
Objectives:	This course provides platform for implementing methods in MAT Lab				
Expected Outcome:	On completion of this course the student should be able to accomplish the following: <ol style="list-style-type: none"> 1. Understand and evaluate various prolog. 2. Develop program for different Problems. 				
List of Experiments					
<ol style="list-style-type: none"> 1. Study of Prolog. 2. Write a program in prolog for first order predicates for person activity system. 3. Write a first order predicate logic in prolog for cars. 4. Write a program of first predicate logic in prolog for a family relation problem. 5. Write a program for factorial in prolog. 6. Write a program to implement Towers of Hanoi. 7. Write a program for menu driven program for member concatenation, permutation, add and delete function in prolog. 8. Write a program in prolog to find the union and intersection of two given list. 9. Write a program to implement Travelling Salesman Problem. 10. Write a program to implement 8 puzzle problem. 11. Write a program to implement water jug problem. 12. Write a program to solve monkey banana problem. 					
Experiments based on advanced topics:					
<ol style="list-style-type: none"> 13. Write a program to implement breadth first search, depth first search and best first search. 14. Write a program to solve traversal problem using mean end analysis. 					

SEMESTER – II

MCSE5008	Network Security				3	0	0	3
Version No	1.0							
Prerequisite								
Course Objectives	<ol style="list-style-type: none"> 1. Understand security concepts, Ethics in Network Security. 2. Understand security threats, and the security services and mechanisms to counter them 3. Comprehend and apply relevant cryptographic techniques 4. Comprehend security services and mechanisms in the network protocol stack 5. Comprehend and apply authentication services and mechanisms 							
Course Outcomes	<p>Provide students with a high-level understanding of how information security functions in an organization. Topics will be both business and technology-centric.</p> <ol style="list-style-type: none"> 1. To master information security governance, and related legal and regulatory issues 2. To master understanding external and internal threats to an organization 3. To be familiarity with information security awareness and a clear understanding of its importance 4. To be familiar with how threats to an organization are discovered, analyzed, and dealt with 5. To master fundamentals of secret and public cryptography 							
Module I							9 Hours	
<p>Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers.</p> <p>Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.</p>								
Module II							9 Hours	
<p>Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms.</p> <p>Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffe-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.</p>								
Module III							9 Hours	
<p>Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA).</p> <p>Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.</p>								
Module IV							9 Hours	
<p>Authentication Applications: Kerberos and X.509, directory authentication service, electronic mail security-pretty good privacy (PGP), S/MIME.</p>								
Module V							9 Hours	

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Web Security: Secure socket layer and transport layer security, secure electronic transaction (SET).

System Security: Intruders, Viruses and related threads, firewall design principals, trusted Systems.

Text book

1. The official course textbook is Cryptography and Network Security: Principles and Practice; Fourth or Fifth Edition. By William Stallings, Prentice Hall, Hardcover

Reference Books.

1. One useful book is Cryptography: Theory and Practice by Douglas R. Stinson, CRC press, hardcover, Published March, 1995. ISBN 0-8493-8521-0.
2. Another useful book, Network Security Essentials: Applications and Standards by William Stallings. Prentice Hall, Hardcover, Published November 1999, 366 pages, ISBN 0130160938.
3. You will also find another book useful later in the course: Secrets and Lies: Digital Security in a Networked World by Bruce Schneier John Wiley, Published August 2000, 412 pages, ISBN 0471253111.
5. There are also some good links from <http://www.cs.iit.edu/~xli/confref.html> and the class webpage.

MCSE5009	Advanced Computer Graphics	3	0	0	3
Version No	1.0				
Module I	Introduction				
	Graphics Hardware, Graphics Software, Graphics processing Units(GPUs), Output Primitives: points, lines, circles, ellipse. Graphical User Interface, Interactive input methods.				
Module II	3D Object representation				
	3D concepts, 3D object representation, Polygons, Curved, Quadric, Super quadric, Blobby objects, Splines, Cubic Splines, Bezier Curves, B-Splines, Solid Geometry, Fractals				
Module III	3D Modeling and Transformations				
	Translation, Rotation, Scaling, Reflections, Shears, Composite Transformations. Viewing pipeline, Projections, Clipping.				
Module IV	Surface Detecting and Rendering				
	Visible surface detection methods, Ray casting, curved surfaces, Illumination models, Polygon Rendering methods. Ray Tracing Methods, Radiosity, lighting Models.				
Module V	Animation and Multimedia				
	Design of Animation Sequences, Raster Animations, Computer Animation Languages, Key-frame Systems, Motion Specifications, Introduction to animation tools, components of multimedia, Digital Image Representation,				
References					
1	Hearn, Baker, Computer Graphics, Pearson				
2	Foley, Van Dam, Feiner, Hughes, Computer Graphics: principles and practice, Addison Wesley.				
3	Parent, Computer Animation, Algorithms and Techniques, Morgan Kaufman				
4	Tay Vaughan, Multimedia Systems, TMH				

MCSE5008	Business Analytics			3	0	0	3
Version No.	1.0						
Prerequisite	Data Mining & Data Warehousing						
Course Objectives	<ol style="list-style-type: none"> 1. Business Analytics and Data Science 2. Basic and Advanced Data Analytics knowledge 3. Knowledge of Data Warehousing and Data Mining Techniques 4. understand Business Analytics 5. understand analytics with R 						
Course Outcomes	<ol style="list-style-type: none"> 1. Business Analytics and Data Science 2. Basic and Advanced Data Analytics knowledge 3. Knowledge of Data Warehousing and Data Mining Techniques 4. Introduction to Business Analytics 5. Introduction to Analytics with R. 						
Module I	Business Analytics and Data Science					9 Hours	
What is business Analytics, Why business analytics, Challenges of business analytics, what is big data, Why big data, Challenges with big data, Analytics 1.0, Analytics 2.0, Analytics 3.0, Traditional BI vs. Big data environment, What is Data Science, Data Science is multi-disciplinary, essential skills for a data scientist.							
Module II	Basic and Advanced Data Analytics					9 Hours	
Machine Learning predictive analytics, Database technologies for advanced data analytics – No SQL & New SQL, Hadoop , Data Visualization and tools (Tableau software)							
Module III	Data warehousing and Data Mining Techniques					9 Hours	
Data Warehouse, Data Marts, OLAP, Classification – Decision Tree, Bayesian Classification, Association Rule Mining, Outlier Analysis, Clustering							
Module IV	Introduction to Business Analytics					9 Hours	
Digital Analytics, Supply Chain Analytics, Financial Risk Analytics, HR Analytics, Web Analytics							
Module V	Analytics with R					9 Hours	
Introduction to R, Advantages, Drawbacks, Installing and Running R, R Preliminaries, Statistics, Data Analysis & R							
Text book							
<ol style="list-style-type: none"> 1. Business Analytics: Data Analysis & Decision Making Book by S. Christian Albright and Wayne L. Winston 							
Reference Books.							
<ol style="list-style-type: none"> 1. Big Data Analytics – Seema Acharya, Wiley India 2. Business Analytics Book by James Evans 3. Essentials of Business Analytics Book by David Anderson, James J. Cochran, Jeffrey D. Camm, Jeffrey W. Ohlmann, and Michael J. Fry 							

MCSE5022	Mobile Computing			3	0	0	3
Version No.	1.0						
Prerequisite	Data Mining & Data Warehousing						
Course Objectives	<ol style="list-style-type: none"> To introduce the basic concepts and principles in mobile computing. This includes the major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications. To explore both theoretical and practical issues of mobile computing. To provide an opportunity for students to understand the key components and technologies involved in building mobile applications. To Understand the concept of Wireless LANs, PAN, Mobile Networks 						
Course Outcomes	<ol style="list-style-type: none"> Grasp the concepts and features of mobile computing technologies and applications. Understand of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support. Identify the important issues of developing mobile computing systems and applications. Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools. Acquire the knowledge to administrate and to maintain a Wireless LAN. Design and implement mobile applications to realize location-aware computing 						
Module I	Introduction					9 Hours	
Introduction of mobile computing, overview of wireless telephony: cellular concept, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, Multiple access techniques like Frequency division multiple access (FDMA), Time division multiple access (TDMA), Code division multiple access (CDMA), Space division multiple access (SDMA).							
Module II	Wireless Networking					9 Hours	
Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.							
Module III	Global System for Mobile Communications					9 Hours	
GSM Architecture, GSM Entities ,Call Routing in GSM, GSM Addresses and Identifiers ,Network Aspects in GSM , GSM Frequency Allocation, Authentication and Security, Mobile Computing over SMS, Short Message (SMS) , Value Added Services through, MS, Accessing the SMS Bearer, GPRS and packet Architecture GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS ,Application for GPRS, Limitation of GPRS, Billing and Charging in GPRS, WAP , MMS , GPRS Applications, Spread – Spectrum Technology.							
Module IV	Data Management					9 Hours	
Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, file system, disconnected operations. Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.							
Module V	Routing Adhoc Network & Security Issues					9 Hours	
Routing Protocols: Adhoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, Dynamic Source Routing, Adhoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm.Mobile Computing Security Issues,							

Authentication, Encryption, Cryptographic Tools: Hash, Message Authentication Code (MAC), Digital Signature, Certificate. Secure Socket Layer (SSL). Characteristics of SIM, Equipment Identification.

Text book

1. Jochen, M Schiller, "Mobile Communications, 2nd Edition Pearson Education, India, 2009.

Reference Books.

1. Charles Perkins, Ad hoc Networks, Addison Wesley.
2. Upadhyaya, "Mobile Computing", Springer
3. Kurnkum Garg "Mobile Computing", Pearson 2010

MCSE5017	Parallel Algorithms			L	T	P	C
				3	0	0	3
Version No.	1.0						
Prerequisite	Advanced Algorithmic Analysis, Advanced Computer Architecture						
Objectives:	To provide fundamentals in design, analysis, and implementation, of high performance computational science and engineering applications that serve the foundations for the advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.						
Expected Outcome:	Students will develop knowledge and skills concerning: 1. The key factors affecting performance of CSE applications 2. mapping of applications to high-performance computing systems, and 3. Hardware/software co-design for achieving performance on real-world applications.						
Module I	Parallel Algorithm Design						
Boundary Value Problem, Finding the Maximum, Complexity measure for parallel algorithms.							
Module II	Parallel Combinatorial Algorithms						
Permutations with and without repetitions, combinations, derangements.							
Module III	Parallel Searching Algorithms						
Maximum/ minimum, median, k^{th} largest/smallest element, Parallel sorting algorithms.							
Module IV	Parallel Graph Algorithms						
Parallel graph search and tree traversal algorithms, parallel algorithms for connectivity problems, parallel algorithms for path problems.							
Module V	Programming for Parallel Algorithms						
Shared-Memory Programming with OpenMP, Message-Passing Programming, Performance Analysis							
Reference Books							
1. Ananth Grama, Anshul Gupta, George Karypis, and, Vipin Kumar, Introduction to Parallel Computing, 2nd edition, Addison-Welsey, 2003. 2. David A. Bader (Ed.), Petascale Computing: Algorithms and Applications, Chapman & Hall/CRC Computational Science Series, 2007.							

MCSE5011	Networks Security Lab	L	T	P	C
		0	0	2	1
Version No.	1.0				
Prerequisite					
Objectives:	This course provides platform for implementing methods and algorithms of modern operating systems and networking. .				
Expected Outcome:	<p>On completion of this course the student should be able to accomplish the following:</p> <ol style="list-style-type: none"> Understand and evaluate various operating system and networking environments. Develop Network protocols and algorithms 				
List of Experiments					
<ol style="list-style-type: none"> Develop a C program that demonstrates inter process communication Develop a TCP client/server application Develop a UDP client/server application Develop an Iterative UDP server with 2 or 3 clients Develop a concurrent TCP server with 2 or 3 clients Develop a multiprotocol server with TCP and UDP and 2 clients Develop simple Python programs that use frequently used syntactic constructs Develop a Socket based application in Python Build client applications for major APIs (Amazon S3, Twitter etc) in Python Develop an application that interacts with e-mail servers in python Develop applications that work with remote servers using SSH, FTP etc in Python 					

MCSE5012	Advanced Computer Graphics Lab	L	T	P	C
		0	0	2	1
Version No.	1.0				
Prerequisite					
Objectives:	<p>To study the graphics techniques, packages and algorithms.</p> <p>To enable the Students to understand the Graphics rendering and hardware.</p> <p>To enable the Students to learn visualization techniques.</p>				
Expected Outcome:	<ol style="list-style-type: none"> Create interactive graphics applications using one or more graphics application programming interfaces. Use illumination models. Explain graphics hardware. Apply surface rendering and visualization techniques. 				
List of Experiments					
<ol style="list-style-type: none"> Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes Circle (Midpoint) 2D Geometric transformations – Translation Rotation Scaling Reflection Shear Window-Viewport Composite 2D Transformations 3D Transformations - Translation, Rotation, Scaling. 3D Projections – Parallel, Perspective. Creating 3D Scenes. Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization. 2D Animation – To create Interactive animation using any authoring tool. 					

SEMESTER – III

SLMT5001	Quantitative and Communication Proficiency			L	T	P	C
Version No.	1.0						
Prerequisite							
Objectives:	<ol style="list-style-type: none"> 1. This module would train the students on the quick ways to solve quantitative aptitude problems. 2. To equip the students with the required soft skills that would instill confidence and courage in them, to take up new opportunities for their career 						
Expected Outcome:	The students will gain the ability to solve quantitative aptitude problems in a simple way using short-cut methods, within a short time span given during the placement drives.						
Module I	Quantitative Aptitude						
Number System, Partnership, Compound Interest, Simple Interest, Profit and Loss, Problems on Clock, Calendar and Cubes, Permutation and Combination, Allegation and mixtures, Time and Distance, Height and Distance, Problems on Ages, Trains, Boats and Streams, Probability.							
Module II	Communication Proficiency						
<p>Self analysis to challenges., Attitude- perceptions– Positive approach – ideas & approach</p> <p>Goal setting – vision -Time management - planning -Entrepreneurial skills - Leadership skills People management – team work, leadership -Decision making – problem identification Interview skills – getting familiar with one’s CV – presentation and performance - giving and receiving feedback, setting expectations and exhibiting professional behavior.</p>							

MCSE6001	Requirement analysis and Project Management	L	T	P	C
		3	0	0	3
Version No.	1.0				
Prerequisite	-				
Objectives:	<ol style="list-style-type: none"> 1. Students should gain the project management related to managing software development projects. 2. students get familiar with the different activities involved in Software Project Management. 3. Students should obtain the successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget. 4. Identify the different project contexts and suggest an appropriate management strategy. 5. Practice the role of professional ethics in successful software development 				
Expected Outcome:	<ol style="list-style-type: none"> 1. Prepare SRS including the details of requirements engineering. 2. Identify and describe the key phases of project management. 3. Determine an appropriate project management approach through an evaluation of the business context and scope of the project 4. Describe the stages of requirements elicitation. 5. Analyze software requirements gathering. 				
Module I	Requirements Engineering Overview				
Software Requirement Overview – Software Development Roles –Software Development Process Kernels – Commercial Life Cycle Model – Vision Development – Stakeholders Needs & Analysis – Stakeholder needs –Stakeholder activities.					
Module II	Requirements Elicitation				
The Process of Requirements Elicitation – Requirements Elicitation Problems – Problems of Scope – Problems of Understanding – Problems of Volatility – Current Elicitation Techniques – Information Gathering – Requirements Expression and Analysis – Validation – An Elicitation Methodology Framework – A Requirements Elicitation Process Model – Methodology over Method – Integration of Techniques – Fact-Finding – Requirements Gathering – Evaluation and Rationalization – Prioritization – Integration and Validation.					
Module III	Requirements Analysis				
Identification of Functional and Non Functional Requirements – Identification of Performance Requirements – Identification of safety Requirements – Analysis – Feasibility and Internal Compatibility of System Requirements – Definition of Human Requirements Baseline.					
Module IV	Requirements Development				
Requirement’s analysis – Requirements Documentation – Requirements Development Workflow – Fundamentals of Requirements Development – Requirements Attributes Guidelines Document – Supplementary Specification Document – Use Case Specification Document – Methods for Software Prototyping – Evolutionary prototyping –Throwaway prototyping.					
Module V	Requirements Validation				
Validation objectives – Analysis of requirements validation – Activities – Properties – Requirement reviews – Requirements testing – Case tools for requirements engineering.					
Reference Books					
<ol style="list-style-type: none"> 1. Karl Eugene Wiegers, —Software Requirements , Word Power Publishers, 2000. 2. Ian Graham, —Requirements Engineering and Rapid Development , Addison Wesley, 1998. 3. Wiegers, Karl, Joy Beatty, Software requirements , Pearson Education, 2013. 					

MCSE5023	Big Data Analytics	L	T	P	C
		3	0	0	3
Version No.	1.0				
Prerequisite	Advanced Operating Systems, Advanced Computer Networks				
Objectives:	To understand the competitive advantages of big data analytics <ul style="list-style-type: none"> • To understand the big data frameworks • To learn data analysis methods • To learn stream computing 				
Expected Outcome:	<ul style="list-style-type: none"> • Understand how to leverage the insights from big data analytics • Analyze data by utilizing various statistical and data mining approaches • Perform analytics on real-time streaming data • Understand the various NoSql alternative database models 				
Module I	INTRODUCTION TO BIG DATA				
Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools					
Module II	HADOOP FRAMEWORK				
Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN					
Module III	DATA ANALYSIS				
Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.					
Module IV	MINING DATA STREAMS				
Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.					
Module V	BIG DATA FRAMEWORKS				
Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries					
Reference Books					
<ol style="list-style-type: none"> 1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley and SAS Business Series, 2012. 2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013. 3. Learning R – A Step-by-step Function Guide to Data Analysis, Richard Cotton, O'Reilly Media, 2013. 4. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, Second Edition, 2007. 5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013. 6. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012. 					

MCSE5016	Web Services			L	T	P	C
Version No.	1.0						
Prerequisite	Advanced Computer Networks, Advanced Database Systems						
Objectives:	To provide fundamentals on SOA, SOAP UDDI and XML that lays foundations for the advanced studies in the area of web services.						
Expected Outcome:	After completion of this course the students able to perform project in the area of XML						
Module I	SOA: (Service Oriented Architecture)						
Introduction to Services - Bind, Publish, Find – Framework for SOA – Web Services (A Realization of SOA) - Web Services Architecture (Transport Services, Messaging Services, Service Description, Discovery Services, Quality of Service), Interoperability – REST (Representational State Transfer) Services.							
Module II	XML Basics						
XML Messaging, SOAP, UDDI and WSDL – Basics of XML – XML-RPC Essentials – Real life web services – Standards of Web Service Stack – Web Services Vendor Landscape, Building & Consuming XML Web Services in .NET, State Management.							
Module III	SOAP: Simple Object Access Protocol						
Introduction to SOAP & XML – SOAP Specification – messages, Data Encoding, Data types – Writing SOAP Web Services – Discovering SOAP Services.							
Module IV	UDDI: Universal Description, Discovery and Integration						
Overview – UDDI Business Registry (UBR) – UDDI Model (UDDI Data Structures, Keys, APIs, Nodes and Registries) - UDDI Implementations.							
Module V	WSDL: Web Service Description Language						
WSDL Specification – Basic WSDL Example - Operations, Bindings, Service – Invocation Tools – XML Schema Data Typing, Case Studies							
Reference Books							
<ol style="list-style-type: none"> 1. Web Services Platform Architecture: SOAP, WSDL, WS-Policy, WS-Addressing, WS-BPEL, WS-Reliable Messaging, and More by Sanjiva Weerawarana, Francisco Curbera, Frank Leymann, Tony Storey, Donald F. Ferguson, Prentice Hall PRT, 2005. 2. XML Web Services for ASP.NET by Bill Evjen, Wiley Publishing Inc, 2002. 3. Web Services Essentials Distributed Applications with XML-RPC, SOAP, UDDI & WSDL by Ethan Cerami, O'Reilly, First Edition, February 2002. 4. Programming Web Services with SOAP by James Snell, O'Reilly First Edition Dec 2001. 5. Web Services Theory & Practice by Anura Guruge, Digital Press, 2004. 6. Executive's Guide to Web Services by Eric A. Marks & Mark J. Werrell, John Wiley & Sons, 2003. 							

MCSE6002	Requirement Analysis and Project Management LAB	L	T	P	C
Version No.	1.0	0	0	2	1
Prerequisite					
Objectives:	<ol style="list-style-type: none"> 1. Build a fully functional, interactive, layered, distributed, database-backed software system. 2. Students understand the ground-up as part of a small, agile, development team in a laboratory setting 3. Become acquainted with historical and modern software methodologies 4. Understand the phases of software projects and practice the activities of each phase. 				
Expected Outcome:	<ol style="list-style-type: none"> 1. Practice clean coding 2. Take part in project management 3. Become adept at such skills as distributed version control, unit testing, integration testing, build management, and deployment 				
<p>1. Develop one complete Application following the below mentioned process.</p> <p>OVERVIEW: Definitions, goals, and basic principles of software engineering; differences between software engineering and other fields within computing; engineering vs. craftsmanship; Clean Code.</p> <p>SOFTWARE PROCESSES: Modeling languages and methodologies, phases, metaphors for software construction; Scrum, Kanban; Setting up a project on GitHub; Basics of Git.</p> <p>ANALYSIS AND DESIGN: Upstream prerequisites, construction decisions, classes, routines, defensive programming.</p> <p>OVERVIEW OF UML: Whirlwind tour of UML, including examples from each diagram type.</p> <p>REVIEW OF COMMON PROGRAMMING LANGUAGES AND TECHNOLOGIES: Python, Java, JavaScript, HTML5, CSS, JSON, Unit testing, Lint tools, IDEs.</p> <p>ENTERPRISE APPLICATION TECHNOLOGIES: APIs, Relational databases, NoSQL databases, TCP/IP, HTTP, Web applications, Web services; Java stacks (e.g., JavaEE, JAX-RS, Spring, Hibernate), Python stacks (e.g. Flask), Node, Ajax.</p> <p>APIs: Technologies, REST, business issues, government issues, financial issues, legal issues.</p> <p>SOFTWARE BEST PRACTICES: Variables, Types, Conditionals, Loops, Disruption, Unusual control structures, Control complexity.</p> <p>SOFTWARE QUALITY: Measures of quality, improving code, inspections and code reviews, unit testing, integration testing, acceptance testing, code coverage, debugging, refactoring.</p> <p>PERFORMANCE: Complexity measures, profiling tools, tuning strategies, tuning techniques.</p> <p>SYSTEM DEPLOYMENT AND MAINTENANCE: Project management, integration, scalability, daily builds, system evolution.</p>					

MCSE9998	M.Tech Dissertation Part-1	L 0	T 0	P 10	C 5
Version No.	1.0				
Prerequisite					
Objectives:	The Dissertation Work for M.Tech consists of Dissertation Work – I and Dissertation Work–II. Dissertation Work–I is to be undertaken during III semester and Dissertation Work–II, which is generally a continuation of Dissertation Work–I and is to be undertaken during IV semester. At the end of the semester students present the following contents.				
At the end of the semester students present the following contents.					
<ul style="list-style-type: none"> • Title • Abstract • Introduction • Literature Survey • References 					

SEMESTER – IV

MCSE9999	M.Tech Dissertation Part-II	L	T	P	C
		0	0	30	15
Version No.	1.0				
Prerequisite					
Objectives:	The Dissertation Work for M.Tech consists of Dissertation Work – I and Dissertation Work–II. Dissertation Work–I is to be undertaken during III semester and Dissertation Work–II, which is generally a continuation of Dissertation Work–I and is to be undertaken during IV semester. At the end of the semester students present the following contents.				
	At the end of the semester students present the following contents.				
	<ul style="list-style-type: none"> • Title • Abstract • Introduction • Literature Survey • Methodology • Modules Split-up and Gantt Chart • Proposed System (Phase 1) • Equations /Design and software to be used • Algorithms / Techniques used • Expected outcomes 				

Program Elective 1

MCSE5022	Mobile Computing	3	0	0	3
Version No.	1.0				
Prerequisite	Data Mining & Data Warehousing				
Course Objectives	<ol style="list-style-type: none"> 1. To introduce the basic concepts and principles in mobile computing. This includes the major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications. 2. To explore both theoretical and practical issues of mobile computing. 3. To provide an opportunity for students to understand the key components and technologies involved in building mobile applications. 4. To Understand the concept of Wireless LANs, PAN, Mobile Networks 				
Course Outcomes	<ol style="list-style-type: none"> 1. Grasp the concepts and features of mobile computing technologies and applications. 2. Understand of how the underlying wireless and mobile communication networks work, their technical features, and what kinds of applications they can support. 3. Identify the important issues of developing mobile computing systems and applications. 4. Develop mobile computing applications by analyzing their characteristics and requirements, selecting the appropriate computing models and software architectures, and applying standard programming languages and tools. 5. Acquire the knowledge to administrate and to maintain a Wireless LAN. 6. Design and implement mobile applications to realize location-aware computing 				
Module I	Introduction	9 Hours			
Introduction of mobile computing, overview of wireless telephony: cellular concept, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, Multiple access techniques like Frequency division multiple access (FDMA), Time division multiple access (TDMA), Code division multiple access (CDMA), Space division multiple access (SDMA).					
Module II	Wireless Networking	9 Hours			
Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.					
Module III	Global System for Mobile Communications	9 Hours			
GSM Architecture, GSM Entities ,Call Routing in GSM, GSM Addresses and Identifiers ,Network Aspects in GSM , GSM Frequency Allocation, Authentication and Security, Mobile Computing over SMS, Short Message (SMS) , Value Added Services through, MS, Accessing the SMS Bearer, GPRS and packet Architecture GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS ,Application for GPRS, Limitation of GPRS, Billing and Charging in GPRS, WAP , MMS , GPRS Applications, Spread – Spectrum Technology.					
Module IV	Data Management	9 Hours			
Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, file system, disconnected operations. Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.					
Module V	Routing Adhoc Network & Security Issues	9 Hours			
Routing Protocols: Adhoc Network Routing Protocols, Destination Sequenced Distance Vector					

Algorithm, Cluster Based Gateway Switch Routing, Dynamic Source Routing, Adhoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm. Mobile Computing Security Issues, Authentication, Encryption, Cryptographic Tools: Hash, Message Authentication Code (MAC), Digital Signature, Certificate. Secure Socket Layer (SSL). Characteristics of SIM, Equipment Identification.

Text book

1. Jochen, M Schiller, "Mobile Communications, 2nd Edition Pearson Education, India, 2009.

Reference Books.

1. Charles Perkins, Ad hoc Networks, Addison Wesley.
2. Upadhyaya, "Mobile Computing", Springer
3. Kurnkum Garg "Mobile Computing", Pearson 2010

MCSE5020	Data Compression			L	T	P	C
Version No.	1.0						
Prerequisite	Higher Mathematics						
Objectives:	This subject aims to cover basic concepts of Graph theory						
Expected Outcome:	The students would be able to understand and explain fundamentals of Graph Theory their applications.						
Module I	Introduction						
<p>Compression techniques, lossless compression, lossy compression, measures of performance, modeling and coding.</p> <p>Mathematical preliminaries Overview, introduction to information theory, models, physical models, probability models, markov models.</p>							
Module II	Huffman coding and Arithmetic codes						
<p>Good codes, Huffman coding algorithm, minimum variance Huffman codes, length of Huffman codes, extended Huffman codes, non binary Huffman codes, adaptive Huffman codes, applications.</p> <p>Arithmetic codes Overview, coding a sequence, generating a binary code, compression of Huffman and arithmetic coding, applications.</p>							
Module III	Lossless image compression						
<p>Introduction, facsimile encoding, run length encoding, progressive image transmission, other approaches.</p>							
Module IV	Vector quantization						
<p>Introduction, advantages lbg-algorithm, empty cell problem, tree structured vector quantizer, other vector quantization schemes.</p>							
Module V	Differential coding						
<p>Overview, introduction, basic algorithm dpcm, adpcm, delta modulation, cdf, speech coding. Transform coding :Different transforms, quantization and coding of transforms, application to image compression. Wave let transforms and data compression introduction, transform coding, dtwt for image compression, audio compression, and video coding using multi-resolution techniques</p>							
Reference Books							
<ol style="list-style-type: none"> 1. Khalid Sayood : Introduction To Data Compression: Second Edition Jan 1996, Morgan Kaufmann Publications. (Chapters 1.1 To 1.2, 2.1 To 2.3, 3.1 To 3.6, 4.1 To 4.6, 6.1 To 6.5, 9.1 To 9.6, 10.1 To 10.7, 12.1 To 12.6) 2. Ralf Steinmetz and Klara Nahrstedt, Multimedia Computing and Communication and Applications, Prentice Hall Intl. 1995. 3. Raghuvver M. Rao, Wavelet Transforms: Introduction to Theory and Applications, Addison Wesley Pub. Co. Ltd. 1998. 							

MCSE5021	Coding and Information Theory			L 3	T 0	P 0	C 3
Version No.	1.0						
Prerequisite	Higher Mathematics, Advanced Computer Networks						
Objectives:	To learn how to formulate and tackle fundamental problems in communications and signal processing through the exposition to 4 main results in information theory.						
Expected Outcome:	On completion of this course the student would be able to deal communication systems.						
Module I	Information Theory Basics						
Entropy, mutual information, chain rules, inequalities, asymptotic equipartition property (AEP), entropy of random processes.							
Module II	Source Coding						
Unique decodability, prefix-free codes, Kraft inequality, AEP-based compression, Huffman coding, arithmetic coding, universal coding.							
Module III	Channel Capacity						
Discrete memory less channels, joint typicality, and achievability & converse proofs of channel capacity theorem, feedback channels, source-channel separation, practical channel codes.							
Module IV	Differential Entropy and Gaussian Channels						
Differential entropy, capacity of AWGN channels, band-limited channels, parallel & fading channels.							
Module V	Rate-Distortion (Lossy Source Coding)						
Quantization, proofs of achievability & converse of rate distortion function							
Reference Books							
<ol style="list-style-type: none"> 1. B.P. Lathi, <i>An Introduction to Random Signals and Communication Theory</i>, Intl. 2. S. Haykin, <i>Communication Systems</i>, Wiley 3. T. Cover and J. Thomas, <i>Elements of Information Theory</i>, Wiley-Interscience, 1991 4. R.W. Hamming, <i>Coding and Information Theory</i>, Prentice Hall 							

MCSE5026	High Performance Computer Systems	L	T	P	C
Version No.	1.0	3	0	0	3
Prerequisite	Advanced Computer Architecture, Advanced Operating Systems				
Objectives:	To create new technologies that can increase the computational speed accomplishing with accuracy of computing.				
Expected Outcome:	On completion of this course the students will be able to know about various concepts such as vector processing, out-of-order execution etc., which are used for designing a high performance machine				
Module I	Modern Computer Architectures				
	Introduction, High Performance Microprocessors, CISC, Fundamentals of RISC, Second, Generation RISC Processors, Out, of, Order Execution: The Post, RISC Architecture. Memory, Memory Technology, Registers, Caches, Cache Organization, Virtual Memory, Improving Memory Performance.				
Module II	Floating, Point Numbers				
	Reality , Representation , Effects of Floating, Point Representation , Improving Accuracy Using Guard Digits , IEEE Floating, Point Standard , IEEE Storage Format , IEEE Operations Special Values , Exceptions and Traps Compiler Issues.				
Module III	Programming and Tuning Software				
	Optimization Levels , Classical Optimizations , Timing and Profiling , Timing , Subroutine Profiling , Basic Block Profilers , Virtual Memory , Eliminating Clutter , Subroutine Calls , Branches , Branches within Loops.				
Module IV	Shared, Memory Parallel Processors				
	Understanding Parallelism, Shared, Memory Multiprocessors, Symmetric Multiprocessing Hardware Multiprocessor Software Concepts, Techniques for Multithreaded Programs , A Real Example.				
Module V	Scalable Parallel Processing				
	Large, Scale Parallel Computing, Amdahl's Law, Interconnect Technology, A Taxonomy of Parallel Architectures , Shared Uniform Memory MIMD, Shared Non, Uniform Memory MIMD Systems, Distributed, Memory MIMD Architecture , Single Instruction Multiple Data				
Reference Books					
	<ol style="list-style-type: none"> 1. Charles Severance, Kevin Dowd, High Performance Computing, Second Edition July 1998. 2. High Performance TCP/IP Networking Concepts, Issues and solutions, Mahbub Hassan, Raj Jain, First Edition, PHI, 2005. 				

Program Elective – II

MCSE5017	Parallel Algorithms			L	T	P	C
Version No.	1.0						
Prerequisite	Advanced Algorithmic Analysis, Advanced Computer Architecture						
Objectives:	To provide fundamentals in design, analysis, and implementation, of high performance computational science and engineering applications that serve the foundations for the advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.						
Expected Outcome:	Students will develop knowledge and skills concerning: 1. The key factors affecting performance of CSE applications 2. mapping of applications to high-performance computing systems, and Hardware/software co-design for achieving performance on real-world applications.						
Module I	Parallel Algorithm Design						
Boundary Value Problem, Finding the Maximum, Complexity measure for parallel algorithms.							
Module II	Parallel Combinatorial Algorithms						
Permutations with and without repetitions, combinations, derangements.							
Module III	Parallel Searching Algorithms						
Maximum/ minimum, median, k^{th} largest/smallest element, Parallel sorting algorithms.							
Module IV	Parallel Graph Algorithms						
Parallel graph search and tree traversal algorithms, parallel algorithms for connectivity problems, parallel algorithms for path problems.							
Module V	Programming for Parallel Algorithms						
Shared-Memory Programming with OpenMP, Message-Passing Programming, Performance Analysis							
Reference Books							
<ol style="list-style-type: none"> 1. Ananth Grama, Anshul Gupta, George Karypis, and, Vipin Kumar, Introduction to Parallel Computing, 2nd edition, Addison-Welsey, 2003. 2. David A. Bader (Ed.), Petascale Computing: Algorithms and Applications, Chapman & Hall/CRC Computational Science Series, 2007. 							

MCSE5018	Advances in Compiler Design			L	T	P	C
Version No.	1.0						
Prerequisite	Advanced Computer Architecture, Advanced Algorithmic Analysis						
Objectives:	To improve programming skills by learning how a compiler works and also provides knowledge in design and implement the parts of a compiler for a sample programming language.						
Expected Outcome:	At the end of the course students should able to 1. Analysis code optimization techniques 2. Design, code, test, and debug efficiency of simple programs 3. Implement a phases of compiler for a sample language						
Module I	Introduction						
Processor architectures, code generation, intermediate representations, tools, Foundations, e.g., control and data dependence, data flow analysis							
Module II	Optimizations						
Overview of optimizations, SSA and its construction, SSA based optimizations, Memory SSA, Firm, Chi functions in lazy memory SSA based analysis, Firm, Compiler generators.							
Module III	Semantics						
Generating semantics modules from Natural Semantics using RML, Automatically generating code generators. Some examples. Interprocedural optimization. Code selection. Instruction scheduling.							
Module IV	Code Generation						
Register allocation. Mutation scheduling. Loop scheduling / Software pipelining. Memory hierarchy optimization.							
Module V	Languages						
Description languages for irregular architectures, DSPs. Special code generation problems for irregular architectures, DSPs. Other topics, e.g., code motion, binary translation, automatic parallelization, design patterns for parallelization							
Reference Books	<ol style="list-style-type: none"> 1. Steven Muchnick: Advanced Compiler Design and Implementation. Morgan Kaufmann, 1997. 2. Alfred Aho, Ravi Sethi, Jeffrey Ullman, Monica Lam: 21st Century Compilers. Addison-Wesley, 2004. 3. Keith Cooper, Linda Torczon: Engineering a Compiler. Morgan Kaufmann, ,2003 4. Y.N. Srikant, P. Shankar (ed.): The compiler design handbook: optimizations and machine code generation, CRC Press, 2003. 						

MCSE5019	Grid and Cluster Computing	L	T	P	C
		3	0	0	3
Version No.	1.0				
Prerequisite	Advanced Operating Systems, Advanced Computer Networks				
Objectives:	To create a framework that effectively makes use of the computational powers and resources of the computer systems within that framework.				
Expected Outcome:	On completion of this course the students will be able to know about various technologies and tools used to create a grid and can create a framework that can effectively utilize the resources and computational powers.				
Module I	Introduction				
	The Grid – Beginning of the Grid – Evolution of the Grid – A CommModuley Grid Model – Building Blocks of Grid – An overview of Grid Business Areas - Grid Application – Grid infrastructure.				
Module II	Grid Computing Organizations and their Roles				
	Organizations developing Grid standards and the Global Grid Forum – Organizations developing Grid Computing Toolkits and Frameworks – Grid Computing Anatomy – Grid Computing Road Map.				
Module III	New Generation of Grid Computing Applications				
	Service Oriented Architecture – Web Service Architecture – XML, Related Technologies – XML Messages and Enveloping – Service Message Description Mechanisms – Relationship between Web Services and Grid Services.				
Module IV	Grid Computing Technology				
	Open Grid Services Architecture (OGSA) – OGSA Platform Components – Open Grid Services Infrastructure (OGSI) - OGSA Basic Services.				
Module V	Grid Computing Toolkits				
	GLOBUS GT3 Toolkit: Architecture, Programming Model, implementation, High Level Services				
Reference Books					
	<ol style="list-style-type: none"> 1. Joshy Joseph, Craig Fellenstein, Grid Computing, Pearson Education, 2004. 2. Fran Berman, Geoferry C. Fox, Anththony J.G. Hey, Grid Computing Making the Global Infrastructure a Reality, Wiley Series in Communications Networking & Distributed Systems, 2000. 				

Program Elective – III

MCSE5019	Real Time Systems	L	T	P	C
Version No.	1.0				
Prerequisite	Advanced Operating Systems, Advanced Computer Networks				
Objectives:	<ol style="list-style-type: none"> 1. Real-time scheduling and schedulability analysis 2. Formal specification and verification of timing constraints and properties 3. Design methods for real-time systems 4. Development and implementation of new techniques to advance the state-of-the-art real-time systems research 				
Expected Outcome:	<ol style="list-style-type: none"> 1. Apply principles of real time system design techniques to develop real time applications. 2. Make use of database in real time applications. 3. Make use of architectures and behavior of real time operating systems. 4. Apply evaluation techniques in application. 				
Module I	Real Time System and Scheduling				
Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.					
Module II	Software Requirements Engineering				
Requirements engineering process – types of requirements – requirements specification for real time systems – Formal methods in software specification – structured Analysis and Design – object oriented analysis and design and unified modelling language – organizing the requirements document – organizing and writing documents – requirements validation and revision.					
Module III	Intertask Communication and Memory Management				
Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.					
Module IV	Real Time Databases				
Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.					
Module V	Evaluation Techniques and Clock Synchronization				
Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy–Software error models. Clock Synchronization–Clock, A Nonfault– Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.					
Reference Books					
<ol style="list-style-type: none"> 1. Real Time Systems by Liu Jane W.S. Pearson LPE 2. REAL TIME SYSTEMS by C.M. Krishna and K.G. Shin 					

MCSE5023	Big Data Analytics	L	T	P	C
Version No.	1.0	3	0	0	3
Prerequisite	Advanced Operating Systems, Advanced Computer Networks				
Objectives:	To understand the competitive advantages of big data analytics <ul style="list-style-type: none"> • To understand the big data frameworks • To learn data analysis methods • To learn stream computing 				
Expected Outcome:	<ul style="list-style-type: none"> • Understand how to leverage the insights from big data analytics • Analyze data by utilizing various statistical and data mining approaches • Perform analytics on real-time streaming data • Understand the various NoSql alternative database models 				
Module I	INTRODUCTION TO BIG DATA				
Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools					
Module II	HADOOP FRAMEWORK				
Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN					
Module III	DATA ANALYSIS				
Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.					
Module IV	MINING DATA STREAMS				
Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.					
Module V	BIG DATA FRAMEWORKS				
Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries					
Reference Books	<ol style="list-style-type: none"> 1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 2012. 2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013. 3. Learning R – A Step-by-step Function Guide to Data Analysis, Richard Cotton, O'Reilly Media, 2013. 4. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition, 2007. 5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013. 6. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012. 				

MCSE5024	Natural Language Processing	L	T	P	C
Version No.	1.0	3	0	0	3
Prerequisite	Higher Mathematics, Advanced Database Systems				
Objectives:	To introduce the fundamental techniques of natural language processing, to develop an understanding of the limits of those techniques and of current research issues, and to evaluate some current and potential applications.				
Expected Outcome:	<p>At the end of the course students should</p> <ol style="list-style-type: none"> 1. be able to discuss the current and likely future performance of several NLP applications, such as machine translation and email response 2. Be able to describe briefly a fundamental technique for processing language for several subtasks, such as morphological analysis, parsing, word sense disambiguation etc. 3. understand how these techniques draw on and relate to other areas of (theoretical) computer science, such as formal language theory, formal semantics of programming languages, or theorem proving. 				
Module I	Introduction				
Introduction to the Morphology, Syntax, Semantics by linking the “linguistics view” (computational linguistics) with the “artificial intelligence view” (natural language processing).					
Module II	Morphology				
Analysis and generation of language on word level: e.g. problems with compounding and idiomatic phrases, homophonous strings as well as loan words and their processing using e.g. finite state automata as well as semantic networks. Ambiguities in words like “pen” and “pipe”, but will also discuss some complex strings.					
Module III	Syntax				
Analysis and generation of language on phrasal and sentence level: e.g. applications such as machine translation and grammar checking and the processing using phase structure grammars as well as unification based formalisms and relating those formalisms to recursive transition networks (RTNs) as well as augmented transition networks (ATNs).					
Module IV	Semantics				
Language ambiguities on the level of “meaning”: represented by case structures and conceptual dependency structures. We will look at famous utterances such as: Colourless green ideas sleep furiously. And will discuss why the machine runs into problems during analysis, and how these problems can be overcome.					
Module V	Applications of NLP				
Machine Translation, Grammar Checkers Dictation, Automatic Document Generation, NL Interfaces					
Reference Books	<ol style="list-style-type: none"> 1. Daniel Jurafsky, James H. Martin “Speech and Language Processing” Prentice Hall, 2001 2. Chris Manning and Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, MA: May 1999. 				

Program Elective – IV

MCSE5015	Transaction Processing			L	T	P	C
Version No.	1.0						
Prerequisite	Advanced Database Systems						
Objectives:	To cover transaction processing systems which includes serializability theory, concurrency control, recovery, distributed commit protocols, replication, parallelism, distribution design, and federated and multi-databases. A TP system is fundamentally a system.						
Expected Outcome:	On completion of this course the student would be able to deal issues related to transaction processing and able to implement a state of art transaction processing subsystem.						
Module I	Introduction						
Intro to transactions, Problems that transactions solve, OLTP, e-Commerce, TP Monitors; Database Structure -- File Organization and Access Paths: Reference architectures, Memory hierarchies, File organization, Access paths and indexes.							
Module II	Serializability and Conflict Equivalence						
Transaction semantics, Partial and full orderings, Conflict serializability, Commutativity; Spatial Indexing Scientific Databases: Space filling curves, Quad-trees, HTM; Transaction Models: TxN models, Write-ahead logging, Undo, Redo, Undo/Redo protocols, Steal and Force; Introduction to ARIES:LSNs, ARIES Principles, Page-oriented logging, Checkpoints.							
Module III	Locking Schedulers						
Lock compatibility, Wormhole transactions, Two-Phase Locking (2PL); Slowdowns and Deadlock: Convoys, Priority Inversion, Deadlock detection and avoidance; Phantoms and Locking Exotics: Granular locking, Escrow locking, Optimistic locking, Timestamp ordering.							
Module IV	Distributed Commit Protocols						
Two-phase commit, presumed abort/commit optimizations, Three-phase commit; Voting Protocols and Replication: Quorums, Dynamic Voting, Optimizations; Replication -- Advanced Topics: Anti-entropy protocols, Epidemic replication, Weak consistency replication, Distribution design.							
Module V	Isolation Levels in SQL						
Isolation Degrees, Manual tuning of Isolation/Performance tradeoffs; Image/Object Representations and Query Optimization: Tessellations, Representing Spatial Objects, Query Evaluation Plans, Histograms; Joins, Views and Network Joins: Isolation Degrees, Manual tuning of Isolation/Performance tradeoffs							
Reference Books							
<ol style="list-style-type: none"> 1. Weikum, Gerhard and Gottfried Vossen. Transactional Information Systems: Theory, Algorithms, and the Practice of Concurrency Control. Morgan Kaufmann Publishers. Copyright 2002 2. Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan. Database Systems Concepts, 4/e., McGraw-Hill Publishers. Copyright 2001 3. Garcia-Molina, H., J. D. Ullman and J. Widom. Database System Implementation, Prentice-Hall, Inc., 2000. 4. Gray, J., and A. Reuter, <i>Transaction Processing: Concepts and Techniques</i>, Morgan Kaufmann, 1993. 5. Bernstein, P. and E. Newcomer, Principles of Transaction Processing for the Systems Professional, Morgan Kaufmann, 1997. 							

MCSE5016	Web Services			L	T	P	C
				3	0	0	3
Version No.	1.0						
Prerequisite	Advanced Computer Networks, Advanced Database Systems						
Objectives:	To provide fundamentals on SOA, SOAP UDDI and XML that lays foundations for the advanced studies in the area of web services.						
Expected Outcome:	After completion of this course the students able to perform project in the area of XML						
Module I	SOA: (Service Oriented Architecture)						
Introduction to Services - Bind, Publish, Find – Framework for SOA – Web Services (A Realization of SOA) - Web Services Architecture (Transport Services, Messaging Services, Service Description, Discovery Services, Quality of Service), Interoperability – REST (Representational State Transfer) Services.							
Module II	XML Basics						
XML Messaging, SOAP, UDDI and WSDL – Basics of XML – XML-RPC Essentials – Real life web services – Standards of Web Service Stack – Web Services Vendor Landscape, Building & Consuming XML Web Services in .NET, State Management.							
Module III	SOAP: Simple Object Access Protocol						
Introduction to SOAP & XML – SOAP Specification – messages, Data Encoding, Data types – Writing SOAP Web Services – Discovering SOAP Services.							
Module IV	UDDI: Universal Description, Discovery and Integration						
Overview – UDDI Business Registry (UBR) – UDDI Model (UDDI Data Structures, Keys, APIs, Nodes and Registries) - UDDI Implementations.							
Module V	WSDL: Web Service Description Language						
WSDL Specification – Basic WSDL Example - Operations, Bindings, Service – Invocation Tools – XML Schema Data Typing, Case Studies							
Reference Books							
<ol style="list-style-type: none"> 1. Web Services Platform Architecture: SOAP, WSDL, WS-Policy, WS-Addressing, WS-BPEL, WS-Reliable Messaging, and More by Sanjiva Weerawarana, Francisco Curbera, Frank Leymann, Tony Storey, Donald F. Ferguson, Prentice Hall PRT, 2005. 2. XML Web Services for ASP.NET by Bill Evjen, Wiley Publishing Inc, 2002. 3. Web Services Essentials Distributed Applications with XML-RPC, SOAP, UDDI & WSDL by Ethan Cerami, O'Reilly, First Edition, February 2002. 4. Programming Web Services with SOAP by James Snell, O'Reilly First Edition Dec 2001. 5. Web Services Theory & Practice by Anura Guruge, Digital Press, 2004. 6. Executive's Guide to Web Services by Eric A. Marks & Mark. J. Werrell, John Wiley & Sons, 2003. 							

MCSE5014	Distributed Systems			L	T	P	C
				3	0	0	3
Version No.	1.0						
Prerequisite	Advanced Computer Architecture, Advanced Operating Systems						
Objectives:	To provide the fundamentals for the distributed systems that serve foundation for the advanced studies in the area of distributed systems.						
Expected Outcome:	On completion of this course the student would be able to deal distributed databases, file systems and also know about the languages for distributed systems.						
Module I	Introduction						
Fundamental issues in distributed systems, Distributed System Models and Architectures, Classification of Failures in Distributed Systems, Basic Techniques for Handling Faults in Distributed Systems.							
Module II	Time and Global States						
Logical clocks and physical clocks, events, process states, global states; Inter process Communication- Distributed Mutual Exclusion, Leader Election, Distributed Deadlock Detection, Remote Procedure Calls, Broadcast Protocols.							
Module III	Naming in Distributed Systems						
Name services and the DNS- Directory Services-X 500 protocol; Distributed File System and implementation; coordination and agreement.							
Module IV	Transactions and Concurrency Control						
Distributed transaction-concurrency control-transaction recovery; replication-transaction with replication; Distributed Shared Memory.							
Module V	Mobile and Ubiquitous Computing						
Context aware computing; web services; distributed coordination of services; case study on CORBA							
Reference Books							
<ol style="list-style-type: none"> 1. Randy Chow and Theodore Johnson. Distributed Operating Systems and Algorithms. Addison-Wesley, 1997. 2. G. Coulouris, J. Dollimore, and T. Kindberg, "Distributed Systems: Concepts and Designs, Fourth Edition, Addison Wesley, 2005. 3. Mukesh Singhal, and N. G. Shivaratri. Advanced Concepts in Operating Systems, Distributed, Database, and Multiprocessor Operating Systems, Mc Graw Hill, 1994. 4. Vijay K. Garg, Elements of Distributed Computing, Wiley & Sons, 2002. 5. Relevant papers from various IEEE and ACM Transactions/Journals and Conference Proceedings. 							

MCSE5013	Interaction Design			L	T	P	C
Version No.	1.0						
Prerequisite	NIL						
Objectives:	To provide the fundamentals for interaction design which is important aspect of designing any product, involving interaction.						
Expected Outcome:	On completion of this course the student would be able to analyse and design an efficient interaction model.						
Module I	Introduction						
Introduction, Good and poor design, What is interaction design? , The user experience The process of interaction design, Interaction design and the user experience. Understanding the problem space , Conceptualizing the design space , Theories, models and frameworks							
Module II	Understanding users, Understanding the problem space						
What is cognition? Applying knowledge from the physical world to the digital world , Conceptual frameworks for cognition Conceptualizing the design space ,Theories, models and frameworks ,Social mechanisms in communication and collaboration ,Technology-mediated social phenomena							
Module III	Affective aspects, Interfaces and interactions						
What are affective aspects? Expressive interfaces and positive emotions , Frustrating interfaces and negative emotions , Persuasive technologies , Anthropomorphism ,Interface agents, virtual pets and interactive toys , Models of emotion and pleasure, Paradigms, Interface types ,Which interface?							
Module IV	Data gathering, Data analysis, interpretation, and presentation						
Four key issues, Data recording, Interviews, Questionnaires, Observation, choosing and combining techniques, Qualitative and quantitative, Simple quantitative analysis ,Simple qualitative analysis ,Using Theoretical Frameworks ,Tools to support analysis ,Presenting your findings							
Module V	Identifying needs, Design, prototyping and construction						
What, how, and why? , What are requirements? , Data gathering for requirements, Data analysis, Task description, Task analysis. Prototyping and construction ,Conceptual design: moving from requirements to first design ,Physical design: getting concrete ,Using scenarios in design ,Using prototypes in design							
Reference Books							
<ol style="list-style-type: none"> 1. "Interaction Design, Beyond Human Computer Interaction", Jenny Preece ,Yvonne Rogers , & Helen Sharp ,John Wiley 2. Human-Computer Interaction (3rd Edition) Alan Dix , Janet E.Finlay , Gregory D. Abowd , Russell Beale. Pearson Education 3. Designing the User Interface: Strategies for Effective Human-Computer Interaction , Ben Shneiderman , Catherine Plaisant , Maxine Cohen , Steven Jacobs,Pearson Education. 							