ANDHRA UNIVERSITY: : VISAKHAPATNAM

M.Tech Computer Science & Technology

Course Structure and Scheme of Valuation w.e.f. 2015-16

I SEMESTER

Code	Name of the subject	Periods/week Theory	Lab	Max. Marks Ext.	Int.	Total	Credits
MTCST1.1	Mathematical Foundations of Computer Science	3	-	70	30	100	4
MTCST1.2	Data Structures & Algorithms	3	-	70	30	100	4
MTCST1.3	Adv Database Management Systems	3	-	70	30	100	4
MTCST1.4	Advanced Operating Systems	3	-	70	30	100	4
MTCST1.5	Elective-I	3	-	70	30	100	4
MTCST1.6	Elective-II	3	-	70	30	100	4
MTCST1.7	Data Structures & Programming Lab	3		50	50	100	2
MTCST1.8	Database Management Systems Lab	3		50	50	100	2
	Total	18	6	520	280	800	28

Elective-I: Computer Organization & Architecture/ E-commerce/Embedded systems

Elective II: Computer Networks/Cloud Computing/ Grid Computing/ Computer Graphics &Visual Computing

II SEMESTER

Code	Name of the subject	Periods/week Theory	Lab	Max. Marks Ext.	Int.	Total	Credits
MTCST2.1	Artificial Intelligence	3	-	70	30	100	4
MTCST2.2	Object Oriented Software Engineering	3	-	70	30	100	4
MTCST2.3	Compiler Design	3	-	70	30	100	4
MTCST2.4	Data ware Housing &Data Mining	3	-	70	30	100	4
MTCST2.5	Elective III	3	-	70	30	100	4
MTCST2.6	Elective IV	3	-	70	30	100	4
MTCST2.7	Data warehousing & Mining Lab	3	50	50	100	2	
MTCST2.8	OOSE Lab	3	50	50	100	2	
MTCST2.9	Seminar	-	-	-	100	100	2
	Total	18	6	520	380	900	30

Elective III: Parallel Programming/Semantic Web/ Big Data Analytics/Database Security
Elective IV: Mobile Computing/Soft Computing/ Cluster Computing/ Image Processing

III SEMESTER

M. Tech (CST, IT, CSTAIR, CSTBI, CST CN)

Code	Name of the subject	Periods/week		Max. Marks		Total Credits
		Theory	Lab	Ext.	Int.	
MTCST3.2	Thesis Work Part 1		Grade		Grade	10

1. **Candidates can do their thesis work within the department or in any industry/research organization for two semesters (i.e. 3rd and 4th semesters). In case of thesis done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (CO-Guide) should be from the industry/research organization.**
2. **Thesis part I should be submitted at the end of 3rd semester and it will be evaluated by a committee consisting of Chairman Board of Studies, Head of the Department and thesis guide.**
3. **Although credits are allotted for the thesis work they will not be taken for the calculation of CGPA.**

IV SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits
		Theory	Lab	Ext.	Int.	
MTCST3.2	Thesis Work Part 2		Grade		Grade	14

1. **A publication of a paper on the thesis work in a National/International Conference proceedings with presentation certificate or a paper on the thesis work be communicated to a National/International Journal & accepted for publication for the submission of thesis at the end of 4th semester is mandatory.**
2. **Final Thesis with Part I & Part II should be submitted at the end of 4th semester and it will be evaluated by a committee consisting of Chairman Board of Studies, Head of the Department, External Examiner and thesis guide.**
3. **The candidate has to defend his thesis in a Viva-voce examination to be conducted by the above committee. The committee should submit a report, with signatures of all the members, candidate wise, with grade A-Excellent/ Grade B-Good/Grade C- fair/ Grade D- Reappear.**
4. **The external examiner shall be nominated by the Hon'ble Vice Chancellor as per the norms of the University.**
5. **Although credits are allotted for the thesis work they will not be taken for the calculation of CGPA.**

Detailed Syllabus for M.Tech (CST) First Semester

MTCST 1.1 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Common for M. Tech (CST, IT, CSTAIR, CSTBI, CSTCN, BTMTSE)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**

Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. Mathematical notions of sets, sequences and tuples, functions and relations, Primitive recursive functions, computable functions, examples, graphs, strings and languages,

2. Boolean logic – properties and representation, theorems and types of proofs, deductive, inductive, by construction, contradiction and counter-examples.

3. Introduction to Number theory, Divisibility, modular arithmetic (addition modulo and multiplication modulo); Statements and applications of Euler and Fermat Theorems, Primitive Roots, Discrete Logarithms, Primality Test, Finding Large primes, Definition of Elliptic Curves and their applications to Cryptography.

4. Introduction To Finite Automata: Alphabets and languages- Deterministic Finite Automata – Non- deterministic Finite Automata – Equivalence of Deterministic and Non-Finite Automata – Languages Accepted by Finite Automata – Finite Automata and Regular Expressions – Properties of Regular sets &Regular Languages and their applications.

5. Context Free Languages: Context –Free Grammar – Regular Languages and Context-Free Grammar – Pushdown Automata – Pushdown Automata and Context-Free Grammar – Properties of Context-Free Languages – pushdown automata and Equivalence with Context Free Grammars.

6. Turing Machines: The Definition of Turing Machine – Computing with Turing Machines – Combining Turing Machines, , programming techniques for Turing Machines,

7. Variants of Turing Machines, Restricted Turing Machines Universal Turing Machines. The Halting Problem, Decidable & undecidable problems- Post Correspondence Problems

Text books:

1. Introduction to Automata Theory, Languages and Computations – J.E. Hopcroft, & J.D. Ullman , Pearson Education Asia.

2. Cryptography and Network Security, William Stallings.(Second Edition)Pearson Education Asia.

Reference books:

1. Introduction to languages and theory of computation – John C. Martin (MGH)
2. Discrete Mathematical structures with application to Computer Science – J.P. Tremblay and R. Manohar
3. Introduction to Theory of Computation – Michael Sipser (Thomson Nrools/Cole)
4. Cryptanalysis of number theoretic Cyphers, Samuel S. Wagstaff Jr.Champan & Hall/CRC Press 2003.
5. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes –Ousley, Keith Strassberg Tata McGraw-Hill.

MTCST 1.2 DATA STRUCTURES AND ALGORITHMS

Common with M.Tech (CST, IT, CSTAIR, CSTBI, CSTCN)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**

Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. ALGORITHM ANALYSIS:
Overview of C++ classes, pointers, parameters passing, templates, using Matrices
Basics of time complexity estimates, General norms for running time calculation

2. LISTS, STACKS & QUEUES:
Abstract Data Types, Representation & implementation of ADT list, Doubly linked list, Circular linked lists, Representation, Implementation and applications of ADT stack and Queue.

3. TREES:
Implementation and traversal of trees, Binary Trees and Binary search trees in C++, Concepts of AVL Trees, Splay Trees and B-Trees.

4. HASHING:
Hash Function, Separate chains, Open addressing, rehashing, Extendible Hashing.

5. INTERNAL SORTING ALGORITHMS:
Sorting like insertion Sort, shell Sort, Heap Sort, Merge Sort, Quick Sort and Simple external Sorting algorithm.

6. DISJOINT SET:
Equivalence Relations, Find and Union algorithms an dynamic sets, Path compression and Union-by-Rank algorithm analysis.

7. GRAPH ALGORITHMS:
Representation of graph Topological Sort, shortest-path Algorithm, Network flow problem, Minimum spanning tree algorithm, Applications of Depth – First search, Introduction to NP-Completeness.

Text Book: Data Structures & Algorithm Analysis in C++, Mark Allen Weiss. Second edition, Pearson Edition. Asia.

Reference Books:

1. Data Structures & Algorithm in C++, Adam Drozdek. Vikas publication House.

2. Data Structure, Algorithm and OOP, Gregory L. Heileman (Tata Mc Graw Hill Edition).

3. Data Structures, Algorithms and Applications in C++,Sartaj Sahni,Mc Graw-Hill International Edition.

MTCST 1.3 ADVANCED DATABASE MANAGEMENT SYSTEMS

Common for M.Tech (CST, IT, CSTAIR, CSTBI, CST CN)

Instruction: 3 Periods/week	**Credits:4**	**Time: 3 Hours**
Internal: 30 Marks	**External: 70 M arks**	**Total: 100 Marks**

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1. **Database Systems**: Introduction to the Database Systems, Concepts of Relational Models and Relational Algebra. SQL: Introduction to SQL Queries, Integrity Constraints, Joins, Views, Intermediate and Advanced SQL features and Triggers.

2. **Database Design**: Overview of the Design process, E-R Models, Functional dependencies and other kinds of dependencies, Normal forms, Normalization and Schema Refinement.

3. **Database Application Design and Development**: User Interfaces and Tools, Embedded SQL, Dynamic SQL, Cursors and Stored procedures, JDBC, Security and Authorization in SQL, Internet Applications.

4. **Query Evaluation:** Overview, Query processing, Query optimization, Performance Tuning.

5. **Database System Architectures**: Centralized and Client-Server Architecture, Server system Architecture, Parallel and Distributed database, Object based databases and XML. Advanced data types in databases. Cloud based data storage systems.

6. **Transaction Management**: Overview of Transaction Management, Transactions, Concurrency control, Recovery systems, Advanced Transaction Processing.

7. **Case Studies**: Postgre SQL, Oracle, IBM DB2 Universal Database, Microsoft SQL Server.

Text Books:

1. Database System Concepts, Avi Silberschatz , Henry F. Korth , S. Sudarshan McGraw-Hill, Sixth Edition, ISBN 0-07-352332-1.

Reference Books:

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke,McGraw-Hill.

MTCST 1.4 ADVANCED OPERATING SYSTEMS

Common for M.Tech (CST, IT)

Instruction: 3 Periods/week	**Time: 3 Hours**	**Credits: 4**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

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1. Introduction To Operating Systems, Types Of Operating Systems, Operating System Structures. Operating-System Services, System Calls, Virtual Machines, Operating System Design and Implementation.
2. **Process Management**: Process Concepts, Operations On Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple -Processor Scheduling. Thread Scheduling.
3. **Process Synchronization & Deadlocks**: The Critical Section Problem, Semaphores, And Classical Problems Of Synchronization, Critical Regions, Monitors, Deadlocks,- System Model, Deadlocks Characterization, Methods For Handling Deadlocks, Deadlock- Prevention, Avoidance, Detection,& Recovery from Deadlocks.
4. **Memory Management & File System Implementation:** Logical Versus Physical Address Space, Paging And Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Thrashing, File System Implementation -Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers
5. **Distributed Operating Systems:** Distributed System Goals**,** Types Of Distributed Systems, and Styles & Architecture Of Distributed Systems, Threads, Virtualization, Clients, Servers, Code Migration, and Communication in Distributed Systems.
6. **Distributed Systems & Synchronization:** Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning Of Nodes, Data-Centric Consistency Models, Client-Centric Consistency Models, Consistency Protocols.
7. **Fault Tolerance, Security:** Introduction To Fault Tolerance, Process Resilience,, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery, Secure Channels, Access Control, Security Management

Text Books:

1. Silberschatz & Galvin, 'Operating System Concepts', Wiley.
2. "DISTRIBUTED SYSTEMS", Second edition, Andrew S.Tanenbaum, Maarten Van teen.

Reference Books:

1. William Stallings-"Operating Systems"- 5th Edition - PHI
2. Charles Crowley, 'Operating Systems: A Design-Oriented Approach', Tata Hill Co.,1998 edition.
3. Andrew S.Tanenbaum, 'Modern Operating Systems', 2nd edition, 1995, PHI.

MTCST 1.5 Elective I COMPUTER ORGANIZATION AND ARCHITECTURE

Common for M.Tech (CST, IT, CSTAIR, CSTBI, CSTCN)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**

Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. Register Transfer and Micro operations:
Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

2. Basic Computer Organization and Design:
Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

3. Micro programmed Control:
Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

4. Central Processing Unit:
Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC)

5. Input/output Organization:
Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

6. Memory Organization:
Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

7. Overview of Computer Architecture:
Evolution of Computer Systems, Parallelism in Uni- processor System, Parallel Computer Structures, Architectural Classification Schemes, Parallel Processing Applications.

Text Book:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008 .
2. Computer Architecture and Parallel Processing, Kai Hwang and Faye A. Briggs, McGraw Hill, International Edition1985.

Reference Book:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. "Computer System Architecture", John. P. Hayes.
3. Computer Architecture A quantitative approach 3rd edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier).

MTCST 1.5 Elective I E-COMMERCE

Common for M.Tech (CST, IT, CSTAIR, CSTBI)

Instruction: 3 Periods/week Time: 3 Hours Credits: 4
Internal: 30 Marks External: 70 Marks Total: 100 Marks

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1. **Introduction:** Electronic Commerce-Frame Work, Anatomy of E-Commerce Applications, E-Commerce Consumer Applications, E-Commerce Organization Applications. Consumer Oriented Electronic Commerce - Mercantile Process Models, Digital Economy and e-business Models

2. **Electronic Payment Systems** – Types of Electronic Payment Systems, Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment Systems, Designing Electronic Payment Systems Electronic Data Inter Change, Inter Organizational Commerce - EDI, EDI Implementation, Value Added Networks.

3. **Intra Organizational Commerce**, Macro Forces and Internal Commerce, Work Flow Automation and Coordination, Customization and Internal Commerce, Supply Chain Management. Business Cases for Document Library, Digital Document Types, Corporate Data Ware-Houses.

4. **Advertising And Marketing:** Information Based Marketing, Advertising On Internet, Online Marketing Process, Market Research. Consumer Search and Resource Discovery, Information Search and Retrieval, Commerce Catalogues, Information Filtering.

5. **Multimedia-Key Multimedia Concepts,** Digital Video and Electronic Commerce, Desktop Video Processing, Desktop Video Conferencing.

6. **Business to consumer e-commerce:** On line Marketing and Selling, Information Goods, Electronic Markets and Auctions on the Internet

7. **E-Business Intelligence:** Data Mining, Web Merchandising and Recommender Systems, Intelligent Agents in e-commerce, Business-to-Business e-commerce and Supply Chain Management

8. **Security of Internet** Hosts and Networks, Public Key Infrastructure, Safety of e-commerce Applications

Text Books:

Frontiers of Electronic Commerce, Kalakata and Whinston, Pearson.

References

1. E-Commerce fundamentals and Applications, Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal, Galgotia.
3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
4. E-Commerce - Business, Technology and Society, Kenneth C.Taudon, Carol Guyerico Traver.

MTCST 1.5 Elective I EMBEDDED SYSTEMS

Common for M.Tech (CST, IT, CSTAIR, CSTBI)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Examples of Embedded Systems** – Typical Hardware – Memory – Microprocessors – Busses – Direct Memory Access – Introduction to 8051 Microcontroller – Architecture-Instruction set – Programming.

2. **Microprocessor Architecture** – Interrupt Basics – The Shared-Data problem – Interrupt Latency.

3. **Round–Robin Architecture -** Round–Robin with Interrupts Architecture - Function-Queue- Scheduling Architecture – Real-Time Operating Systems Architecture – Selection of Architecture.

4. **Tasks and Task States** – Tasks and Data – Semaphores and Shared Data – Semaphore Problems – Semaphore variants.

5. **Message Queues** – Mailboxes – Pipes – Timer Functions – Events – Memory Management – Interrupt Routines in RTOS Environment.

6. **RTOS design** – Principles – Encapsulation Semaphores and Queues – Hard Real-Time Scheduling Considerations – Saving Memory Space – Saving Power.

7. **Host and Target Machines** – Linker/Locator for Embedded Software- Getting Embedded Software into the Target System.

8. **Testing on your Host Machine** – Instruction Set Simulators – Laboratory Tools used for Debugging.

Text Book:

1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.

2. An Embedded Software Primer, David E. Simon, Pearson Education , 2005.

Reference Book:

Embedded Systems: Architecture , Programming and Design, Raj Kamal, Tata McGraw-Hill Education, 2008

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MTCST1.6 Elective II COMPUTER NETWORKS

Common for M.Tech (CST, IT)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**

Internal: 30 Marks **External: 70 Marks** **Total: 100**

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1. **Introduction to Computer Networks:** Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications.

2. **Data Communications:** Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, **Broad** Band ISDN , ATM Networks,

3. Data Link Control, Error Detection & Correction, Sliding Window Protocols, LANs & MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5, 802.6, High Speed LANs.

4. **Design Issues in Networks:** Routing Algorithms, Congestion Control Algorithms, Net work Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.

5. **Internet Transport Protocols:** TRANSPORT Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues.

6. Over View of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.

7. **Network Devices:** Over View of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, Brouters, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies.

8. **Advanced Concepts in Networks:** Over View of Cellular Networks, Adhoc Networks, Mobile Adhoc Networks, Sensor Networks, Virtual Private Networks .Delay Tolerant Networks DTN, Ipvs,.

Text Book:

1. Computer Networks, Andrews S Tanenbaum,, Edition 5, PHI, ISBN:-81-203-1165-5

References:

1. Data Communications and Networking , Behrouz A Forouzan , Tata McGraw-Hill Co Ltd, Second Edition,
2. Computer networks, Mayank Dave, CENGAGE.

3. Computer networks, A System Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier.
4. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
5. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

MTCST1.6 Elective II CLOUD COMPUTING

Common for M.Tech (CST, IT, CSTCN)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Cloud Computing Basics** - Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the Cloud. The Business Case for Going to the Cloud - Cloud Computing Services, Business Applications, Deleting Your Datacenter, Salesforce.com, Thomson Reuters.

2. **Organization and Cloud Computing** - When You Can Use Cloud Computing, Benefits, Limitations, Security Concerns, Regulatory Issues, Cloud Computing with the Titans - Google, EMC, NetApp, Microsoft, Amazon, Salesforce.com, IBM Partnerships.

3. **Hardware and Infrastructure** - Clients, Security, Network, Services. Accessing the Cloud - Platforms, Web Applications, Web APIs, Web Browsers. Cloud Storage - Overview, Cloud Storage Providers, Standards - Application, Client, Infrastructure, Service.

4. **Software as a Service** - Overview, Driving Forces, Company Offerings, Industries Software plus Services - Overview, Mobile Device Integration, Providers, Microsoft Online.

5. **Developing Applications** - Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development, Troubleshooting, Application Management.

6. **Local Clouds and Thin Clients** - Virtualization in Your Organization, Server Solutions, Thin Clients, Case Study: McNeilus Steel.

7. **Migrating to the Cloud** - Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise-Class Cloud Offerings, Migration, Best Practices and the Future of Cloud Computing - Analyze Your Service, Best Practices, How Cloud Computing Might Evolve.

Text Books:

1. Cloud Computing-A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGrawHill.

MTCST1.6 Elective II GRID COMPUTING

Common with M.Tech (CST, IT)

Instruction: 3 Periods/week	**Time: 3 Hours**	**Credits: 4**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

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1. **Introduction:** Introduction to Parallel, Distributed Computing, Cluster Computing and Grid Computing, Characterization of Grids, Organizations and their Roles, Grid Computing Road Maps.

2. **Architecture:** Architecture of Grid and Grid Computing, Review of Web Services-OGSA-WSRF.

3. **Grid Monitoring:** Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- GridICE - JAMM -MDS-Network Weather Service-R-GMA-Other Monitoring Systems- Ganglia and GridM

4. **Grid Middleware:** List of globally available Middlewares - Case Studies-Recent version of Globus Toolkit and gLite - Architecture, Components and Features.

5. **Data Management And Grid Portals:** Data Management, Categories and Origins of Structured Data, Data Management Challenges, Architectural Approaches, Collective Data Management Services, Federation Services, Grid Portals, First-Generation Grid Portals, Second Generation Grid Portals.

6. **Semantic Grid and Autonomic Computing:** Meta data and Ontology in the Semantic Web, Semantic Web services, Layered structure of the Semantic Grid, Semantic Grid activities, Autonomic Computing

7. **Grid Security and Resource Management:** Grid Security, A Brief Security Primer, PKI-X509 Certificates, Grid Security, Scheduling and Resource Management, Scheduling Paradigms, Working principles of Scheduling, A Review of Condor, SGE, PBS and LSF-Grid Scheduling with QoS.

Text Books:

1. Grid Computing, Joshy Joseph and Craig Fellenstein, Pearson Education 2004.
2. The Grid Core Technologies, Maozhen Li, Mark Baker, John Wiley and Sons , 2005.

Reference Books:

3. The Grid 2 - Blueprint for a New Computing Infrastructure, Ian Foster and Carl Kesselman, Morgan Kaufman - 2004.
4. Grid Computing: Making the Global Infrastructure a reality, Fran Berman, Geoffrey Fox, Anthony J.G. Hey, John Wiley and sons

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MTCST1.6 Elective II Computer Graphics &Visual Computing

Common for M.Tech (CST, IT, CSTAIR, CSTBI)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction:** Computer Graphics and their applications, Computer Aided Design- Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Over view of Graphics systems: Video Display Devices, Raster Scan systems, random scan systems, Graphics monitors and workstations, Input devices, hard copy devices, GUI and Interactive Input Methods, Windows and Icons , Virtual Reality Environments, Graphics software

2. **Output primitives:** Points and Lines, **,** Line and Curve Attributes-Color and Gray scale levels Line Drawing Algorithms, Loading the Frame buffer, Line function, Circle Generating Algorithms, Ellipse Generating Algorithms, Other Curves, Parallel Curve Algorithms, Curve Functions , Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Inquiry Functions ,Antialiasing

3. **Three Dimensional Concepts and Object representations:** 3D display methods-3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, Spline Representations , Cubic Spline methods, Bézier Curves and Surfaces, B Spline Curves and Surfaces,

4. **Two & Three Dimensional Transformations:** Two Dimensional Transformations: Basic Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations -, Transformation Functions-, Raster methods for Transformation Three Dimensional Transformatio**ns:** Translation-, Rotation, scaling, Other Transformations, Composite Transformations , 3D Transformation Functions , Modeling and Coordinate Transformations,

5. **Viewing Pipeline and structures :** Viewing Coordinates, Projections , View Volumes, General Projection Transformations , Clipping-, Hardware Implementations **,** Concepts of Structures and Basic models, Editing , Hierarchical Modeling with Structures,

6. **Visualization:** Three Dimensional Viewing, Visualization- Image Processing- The viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions , Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping-Curve Clipping, Text and Exterior Clipping.

7. **Visual Computing:** Computational and mathematical methods for creating, capturing, analyzing and manipulating digital photographs, Introductory Topics on computer graphics, computer vision, and machine learning, Programming assignments intended to give hands-on experience with creating graphical user interfaces, and with implementing programs for synthesizing and manipulating photographs.

8. **Visual Transformation & Projection:** Graphics pipeline, perception and color models, camera models, transformations and projection, projections, lighting, shading, global illumination, texturing, sampling theorem, Fourier transforms, image representations, convolution, linear filtering, diffusion, nonlinear filtering, edge detection, optical flow, image and video compression, Creation of Visual Effects Optical Flow Video Compression, Radon Transform Texture

Text Book:

1. Computer Graphics C Version, Donald Hearn & M. Pauline Baker , Pearson Education, New Delhi, 2004
2. D. Forsyth and J. Ponce, *Computer Vision: A Modern Approach*, Prentice Hall Inc., 2003

ReferenceBooks:

3. Procedural Elements for Computer Graphics,_David F. Rogers, Tata McGraw Hill Book Company, New Delhi, 2003
4. Computer Graphics: Principles & Practice in C, J. D. Foley, S. K Feiner, A VanDam F. H John Pearson Education, 2004
5. Computer Graphics us ing Open GL, Franscis S Hill Jr, Pearson Education, 2004.
6. *Computer Vision and Image Processing: A Practical Approach using CVIPtools*, S. E. Umbaugh,, Prentice Hall, 1998

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MTCST 1.7 DATA STRUCTURES& PROGRAMMING LAB

Common with M.Tech (CST, IT, CSTAIR, CSTBI, CSTCN)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 2**

Internal: 50 Marks **External: 50 Marks** **Total: 100 Marks**

Implementation of Data Structures and Algorithms using C++

1. To perform various operations such as insertion, deletion, display on single linked lists.
2. To implement

   (i) Stacks using linked list. (ii) Queues using linked list.
3. To perform different types of searching techniques on a given list

   (i) Sequential search (ii) Binary search (iii) Fibonacci search
5. To perform different types of sortings on a given list

   (i) Bubble sort (ii) Insertion sort (iii) Selection sort(iv) Merge sort
6. To perform different types of sortings on a given list

   (i) Quick sort (ii) Shell sort (iii) Radix sort
7. To perform the following

   (i) To convert the given infix expression to postfix expression
   (ii) To evaluate the given postfix expression.
8. To perform various operations on graphs

   (i) Vertex insertion. (ii) Vertex deletion.
   (iii) Edge insertion. (iv) Edge deletion.
   (v) Breadth First traversal. (vi) Depth First traversal.
9. To implement dictionaries using hashing technique
10. To perform various operations on binary heap.
11. To perform various operations on Binary search tree.
12. To perform operations on AVL trees.
13. To perform various operations on B-tree.

MTCST 1.8 DATA BASE MANAGEMENT LAB

Common with M.Tech (CST, IT)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 2**
Internal: 50 Marks **External: 50marks** **Total: 100Marks**

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1. **Accessing the Database**: The first laboratory exercise is to connect to a database, populate it with data, and run very simple SQL queries. (Data Definition, Table Creation, Constraints, Insert, Select Commands, Update & Delete Commands.)
2. **Basic SQL:** This lab covers simple SQL queries. (Inbuilt functions in RDBMS.)
3. **Intermediate SQL:** This lab covers more complex SQL queries. (Nested Queries & Join Queries, Control structures)
4. **Advanced SQL:** This lab covers even more complex SQL queries. (Procedures and Functions, .PL/SQL, Cursors and Triggers)
5. **Database Access from a Programming Language:** This lab introduces you to database access from a programming language such as Java or C#. Although phrased using Java/JDBC, the exercise can be done using other languages, OBDC or ADO.NET APIs.
6. **Building Web Applications:** This lab introduces you to construction of Web applications. Although phrased using the Java Servlet API, the exercise can be done using other languages such as C# or PHP.
7. **Project:** Each student is assigned with a problem. The student is to develop a logical and physical database design for the problem and develop Forms, Menu design and Reports.

A. The logical design performs the following tasks:

1. Map the ER/EER diagrams to a relational schema. Be sure to underline all primary keys, include all necessary foreign keys and indicate referential integrity constraints.

2. Identify the functional dependencies in each relation

3. Normalize to the highest normal form possible

B. Perform physical design based above logical design using Oracle/MSSQL on Windows platform and MySQL/PostgreSQL on Linux platform.

Sample Term Projects

1. Retailer database
2. Automobile sales database
3. Electronics vendor database
4. Package delivery database
5. Real estate database

References:

1. Database System Concepts, Avi Silberschatz , Henry F. Korth , S. Sudarshan ,McGraw-Hill, Sixth Edition, ISBN 0-07-352332-1.
2. ORACLE PL/SQL by example. Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rd Edition
3. ORACLE Database Log PL/SQL Programming Scott Urman, TMG Hill.
4. SQL & PL/SQL for Oracle 10g, Black Book, Dr.P.S. Deshpande.
5. Oracle PL/SQL Programming, Steven Feuerstein, O'Reilly Publishers.

Detailed Syllabus for M.Tech (CST) Second Semester

II SEMESTER

Code	Name of the subject	Periods/week	Max. Marks			Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST2.1	Artificial Intelligence	3	-	70	30	100	4
MTCST2.2	Object Oriented Software Engineering	3	-	70	30	100	4
MTCST2.3	Compiler Design	3	-	70	30	100	4
MTCST2.4	Data ware Housing &Data Mining	3	-	70	30	100	4
MTCST2.5	Elective III	3	-	70	30	100	4
MTCST2.6	Elective IV	3	-	70	30	100	4
MTCST2.7	Data warehousing & Mining Lab Lab						
MTCST2.8	OOSE Lab	-	3	50	50	100	2
MTCST2.9	Seminar	-	-	-	100	100	2
	Total	18	6	520`	380	900	30

Elective III: Parallel Programming/Semantic Web/ Big Data Analytics

Elective IV: Mobile Computing/Soft Computing/ Cluster Computing/ Image Processing

MTCST 2.1 Artificial Intelligence

Common for M.Tech (CST, CSTAIR, CSTBI)

Instruction: 3 Periods/week	**Time: 3 Hours**	**Credits: 4**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

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1. **Introduction:** Artificial Intelligence, AI Problems, AI Techniques, the Level of the Model, Criteria for Success. Defining the Problem as a State Space Search, Problem Characteristics, Production Systems, Search: Issues in The Design of Search Programs, Un-Informed Search, BFS, DFS; Heuristic Search Techniques: Generate-And- Test, Hill Climbing, Best-First Search, A^* Algorithm, Problem Reduction, AO^*Algorithm, Constraint Satisfaction, Means-Ends Analysis.

2. **Knowledge Representation:** Procedural Vs Declarative Knowledge, Representations & Approaches to Knowledge Representation, Forward Vs Backward Reasoning, Matching Techniques, Partial Matching, Fuzzy Matching Algorithms and RETE Matching Algorithms; Logic Based Programming- AI Programming languages: Overview of LISP, Search Strategies in LISP, Pattern matching in LISP , An Expert system Shell in LISP, Over view of Prolog, Production System using Prolog

3. **Symbolic Logic:** Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Syntax & Semantics of FOPL, Normal Forms, Unification &Resolution, Representation Using Rules, Natural Deduction; Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts, CYC;.

4. **Reasoning under Uncertainty:** Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Model and Temporal Logics; Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic: Crisp Sets ,Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems.

5. **Experts Systems:** Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells, Fuzzy Expert systems.

6. **Machine Learning:** Knowledge and Learning, Learning by Advise, Examples, Learning in problem Solving, Symbol Based Learning, Explanation Based Learning, Version Space, ID3 Decision Based Induction Algorithm, Unsupervised Learning, Reinforcement Learning, Supervised Learning: Perceptron Learning, Back propagation Learning, Competitive Learning, Hebbian Learning.

7. **Natural Language Processing:** Role of Knowledge in Language Understanding, Approaches Natural Language Understanding, Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems; Planning: Components of a Planning System, Goal Stack Planning, Hierarchical Planning, Reactive Systems

Text Book:

1. Artificial Intelligence, George F Luger, Pearson Education Publications

2. Artificial Intelligence, Elaine Rich and Knight, Mcgraw-Hill Publications

References:

1. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI

2. Multi Agent systems- a modern approach to Distributed Artificial intelligence, Weiss.G, MIT Press.
3. Artificial Intelligence : A modern Approach, Russell and Norvig, Printice Hall

MTCST2.2 Object Oriented Software Engineering

Common for M.Tech(CST, IT)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction to Object Oriented Software Engineering**

   Nature Of The Software, Types Of Software , Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction To Object Orientation, Concepts Of Data Abstraction, Inheritance & Polymorphism, Software Process Models-Waterfall Model, The Opportunistic Model , The Phased Released Model, The Spiral Model, Evolutionary Model, The Concurrent Engineering Model

2. **Requirements Engineering:** Domain Analysis, Problem Definition And Scope, Requirements Definition, Types Of Requirements, Techniques For Gathering And Analyzing Requirements, Requirement Documents, Reviewing, Managing Change In Requirements.

3. **Unified Modeling Language & Use Case Modeling:** Introduction To UML, Modeling Concepts, Types Of UML Diagrams With Examples; User-Centred Design, Characteristics Of Users, Developing Use Case Models Of Systems, Use Case Diagram, Use Case Descriptions, The Basics Of User Interface Design, Usability Principles, User Interfaces.

4. **Class Design and Class Diagrams:** Essentials Of UML Class Diagrams, Associations And Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features Of Class Diagrams, Interaction And Behavioural Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component And Deployment Diagrams.

5. **Software Design And Architecture:** The Process Of Design, Principles Leading To Good Design, Techniques For Making Good Design Decisions, Writing A Good Design Document., Pattern Introduction, Design Patterns: The Abstraction-Occurrence Pattern, General Hierarchical Pattern, The Play-Role Pattern, The Singleton Pattern, The Observer Pattern, The Delegation Pattern, The Adaptor Pattern, The Façade Pattern, The Immutable Pattern, The Read-Only Interface Pattern And The Proxy Pattern; Software Architecture Contents Of An Architecture Model, Architectural Patterns: The Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter And MVC Architectural Patterns

6. **Software Testing:** Overview Of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OO Test Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.

7. **Software Project Management:** Introduction To Software Project Management, Activities Of Software Project Management, Structure Of Project Plan, Software

Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking And Monitoring.

8. CASE STUDY

1. Simple Chat Instant Messaging System
2. GPS Based Automobile Navigation System
3. Waste Management Inspection Tracking System (WMITS)
4. Geographical Information System

Text Book:

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert, Langaniere Mcgraw-Hill

References:

2. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.
3. Software Engineering: A Practitioner's Approach, Roger S Pressman.
4. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A. Sykes, Addison-Wesley Professional.

MTCST2.3 Compiler Design

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction:** Introduction to Compilers and Language processors, , Programming Language basics, Extended Backus- Naur Form Syntax Notation, Applications of Compiler Technology, Design of New Computer Architecture, Structure & Different Phases of a Compiler, Review of Compiler Structure, Structure of Optimizing Compilation.

2. **Finite Automata & Lexical Analysis:** introduction to Lexical Analysis, Lexical Analyzers, Approaches to design Lexical Analyzers, Language for specifying lexical analyzers, Introduction to Finite automata, Regular Expressions & Languages, Recognition of Tokens, Transition Diagrams, Look ahead Operator, Implementation of lexical analyzers, Lexical Analyzer Generator LEX.

3. **Syntax Analysis:** Syntactic Specification of Programming Languages, Context Free Grammars & Languages, Introduction to Parsers, Parser Generators, Yacc, Creating Yacc Lexical Analyzer with LEX, Basic Parsing Techniques: Shift Reduce Parsing, Operator Precedence Parsing, Top-down Parsing, Recursive Descent Parsing, Predictive Parsers, LR Parsers: SLR, LALR & Canonical LR parsing, Construction of Parse Tree, Error Recovery in Parsers.

4. **Semantic Analysis:** Semantic Actions, Syntax Directed Translations, Translation on the parse Tree, Implementation of Syntax Directed Translator, Intermediate Codes, Syntax Directed translation to Postfix code, Syntax Trees, Intermediate Code Generation, Three Addr5ess Code-Translation of Expressions, Type Checking& Type Conversions.

5. **Code Optimization:** Principal sources of Code Optimization, Loop Optimization, Basic Blocks& Flow Graphs, DAG Representation of Basic Blocks, Applications of DAG, Local Optimization, Unreachable Code Elimination, Dead Code Elimination, Data Flow Analysis, Data Flow Equations & Computations, Peep-Hole Optimization. Machine Dependent Optimizations, Overview of Informal Compiler Algorithm Notation(ICAN), If Simplification, Loop Simplification, Loop Inversion, Branch Optimization and Prediction ,

6. **Code Generation:** Issues in Code Generation, Input to Code Generator, Instruction Selection, Register Allocation, Simple Target Machine Model, Program and Instruction Costs, Register allocation & Assignments, Code Generation Algorithm, Code Generators, Optimal Code Generation for Expressions, Code Generation From DAG.

7. **Symbol Table Management**, Contents of a Symbol Table, Data Structures for Symbol Tables; Run time Environments, Implementation of a simple Stack allocation, Heap Management, Block Structured Languages; Error Detection & Recovery, Lexical Phase Errors, Syntactic & Semantic Errors, Error Handling Routines.

8. **Code Scheduling & Case Studies:** Instruction Scheduling, Speculative Loads & Boosting, Speculative Scheduling, Software Pipe Lining, Trace Scheduling, Percolation Scheduling, Case Studies: Sun Compilers, SPARC, IBM XL Compiler for the POWER& Power PC , Digital Equipment Compiler for Alpha, Intel Reference Compilers, Future Trends In Compiler Design and Implementations.

Text Books:

1. Principles of Compiler Design by Aho, D. Ullman, Lam and Ravi Sethi, Pearson Education Second Edition

2. Advanced Compiler Design and Implementation, Steven Muchnic, Elsevier Publications

Reference Books:

1. Compiler Construction by Kenneth. C. Louden, Vikas Pub. House.
2. Compiler Design, A.A. Pentambekar, TechnicalPublications
3. Modern Compiler Design, Grune.D,Van Reeuwijk K, Bal H.E, Jacobs C J H, Langendoen K Springer,

MTCST 2.4 Data Warehousing & Data Mining

Common for M. Tech (CST, CSTAIR, BTMTSE)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction to Data Mining**: Evolution of I T into DBMS, Motivation and importance of Data Warehousing and Data Mining, Kinds of Patterns, Technologies, Basic Data Analytics: Data Objects and Attributes Types, Statistical Descriptions of Data, Data Visualization, Estimating Data Similarity and Dissimilarity, Major Issues in Data Mining., Data Mining Applications

2. **Data Warehouse and OLAP Technology**: Basic Concepts of Data warehouse, Data Modeling using Cubes and OLAP, DWH Design and usage, Implementation using Data Cubes and OLAPs, Data Generalization with AOI.

3. **Data Mining Primitives & Data Cubes**: Data Mining Primitives, Data Mining Tasks, Data Mining Query Language, Designing Graphical user Interfaces based on a Data Mining Query language, Preliminary Concepts of Data Cube Computation, Data Cube Computation Methods: Multi-way Array Aggregation for Full Cube, BUC Computing for Iceberg Cubes, Star-Cubing Using Dynamic Star-Tree Structure, Pre-computing Shell Fragments for Fast High-Dimensional OLAPs.

4. **Data Mining Concept Description**: Data Preprocessing: Pre-processing the Data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation; Data Architectures of Data Mining Systems; Characterization and Comparison, Concept Description, Data Generalization and Summarization; Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons, Discriminating between Different Classes, Mining Descriptive & Statistical Measures in Large Databases.

5. **Mining Frequent Patterns Based on Associations and Correlations**: Basic Concepts, Frequent Itemset Mining Methods: Apriori Algorithm, Association Rule Generation, Improvements to A Priori, FP-Growth Approach, Mining Frequent Patterns using Vertical Data Formats, Mining Closed and Max Patterns, Pattern Evaluation Methods

6. **Classification**: Basic Concepts, Decision Tree Induction, Bayes Classification, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy Advanced Methods: Classification by Back Propagation, SVM, Associative Classification, Lazy Learning, Fuzzy Sets, Rough Sets, Genetic Algorithms, Multiclass Classification, Semi-Supervised Classification

7. **Cluster Analysis**: Basic Concepts, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Evaluation of Clustering Solutions

Text Book:

Data Mining- Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei –Morgan Kaufmann publishers –---3rd edition

References:

1. Data Mining Techniques, A.K.Pujari, University Press Data mining concepts by Tan, Steinbech, and Vipin Kumar - Pearson Edu publishers
2. Data Mining –Introductory and Advanced by Margarett Dunham -- Pearson Education publishers
3. Data Warehousing for Real –world by Sam Annahory-- Pearson Education publishers

MTCST2.5 Elective III Parallel Programming

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction to Parallel Computing:** Parallel Programming and Parallel Computing, Overview of Parallel Architectures and Parallel Programming Models, MIMD and SPMD Models, Problems Unique to Parallel Programming,

2. **Supercomputers and Grand Challenge Problems**, Modern Parallel Computers, Data Dependence Graph, Data Parallelism, Functional Parallelism, Pipelining and Data Clustering.

3. **Interconnection Networks:** Switch Network Topologies, Direct and Indirect Network Topology, Bus, Star, Ring, Mesh, Tree, Binary Tree Network, Hyper Tree Network, Hybrid, Hypercube, Perfect Shu E Network, Torus and Butterfly Network.

4. **Performance Analysis:** Introduction, Execution Time, Speedup, Linear and Super linear Speedup, Efficacy and Efficiency, Amdahls Law and Amdahl Effect, Gustafson-Barsiss Law, Minsky's Conjecture, The Karp-Flatt Metric, The Iso-Efficiency Metric, Iso-Efficiency Relation, Cost and Scalability.

5. **Parallel Computational Models:** Flynns Taxonomy, PRAM, EREW, CREW, ERCW, CRCW, Simulating CRCW, CREW and EREW, PRAM Algorithms.

6. **Introduction To Parallel Algorithms:** Parallel Programming Models, PVM, MPI Paradigms,

7. **Parallel Programming Languages:** , Brents Theorem, Simple Parallel Programs in MPI Environments, Parallel Algorithms on Network, Addition of Matrices, Multiplication of Matrices.

Text Books:

1. Computer Architecture and Parallel Processing, Hwang and Briggs, McGraw Hill.
2. Parallel Programming in C with MPI and Open MP, Michael J.Quinn, McGrawHill , 2004

Reference Books:

1. Introduction to Distributed and Parallel Computing, Crichlow, PHI.
2. Designing Efficient Algorithms for Parallel Computers, M.J.Quinn, McGraw-Hill.
3. Introduction to Parallel Processing, Shashi Kumar M et al., PHI New Delhi.
4. Elements of Parallel Computing, V.Rajaraman, Prentice-Hall of India.
5. The Design and Analysis of Parallel Algorithms, S.G.Akl, PHI.

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MTCST 2.5 Elective III Semantic Web

Common for M.Tech (CST, CSTAIR, CSTBI)

Instruction: 3 Periods/week	**Time: 3 Hours**	**Credits: 4**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

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1. **Introduction to Semantic Web**: Introduction, Semantic Web, URI, RDF, Ontologies, Inferences, DAML, Semantic Web Languages, Semantic Annotation, Classification, Information Extraction, Ontology Assignment, XML, Syntax of XML,XML Schema, Semantic Web Applications to E-Commerce, E-Government and E-Banking, Semantic Web in Life Sciences, RIF Applications.

2. **Semantic Web Structure**: Semantic Web Layers Architecture, Different Layers, Match Making, Multi Information Retrieving, Digital Signature, Semantic Memory, Semantic Web Enabled Service Oriented Architecture (SESA), SESA Services, SESA Middle Ware.

3. **Resource Descriptive Languages RDF**: Introduction to RDF, Syntax of RDF, Advanced Feature,Simple Ontologies in RDF Schema, Encoding Special Data Structures, Semantics Model Theoritic Sentics for RDFs, Syntactic Reasoning with Deduction Rules Syntactic Limits of RDFs,

4. **Web Ontology Languages**: OWL Syntax, OWL Species, OWL2 Standards, OWL Formal Semantics, Description Logics, Model Theoretic Semantics of OWL, SWRL, Semantic Web Rules, Languages, Syntax of SWRL, Rules and Safety, Implementation & Applications.

5. **Ontology Engineering**: Requirement Analysis, Ontology Knowledge Creation, Ontologies and Rules: Definition of a Rule, Datalog as First order Rule Language, Combining Rules with OWDL, Rule Interchanging Formats RIF, Quality Assurance of Ontologies, Modular Ontologies, Divide and Conquer, Software Tools.

6. **Ontology Query Languages**: Semantic Web Query Languages and Implementations, ROPS (RDF OWL Processing Systems),SWOPS(SWRL Ontology Processing System, Bench Marking Results, SPARQL, Query Languages for RDF, Conjunctive Queries for OWLDL.

7. **Semantic Web Mining**: Introduction, Concepts in Semantic Web Mining, XML, RDF & Web Data Mining, Ontologies and Web Data Mining, Agents in Web Data Mining, Web Mining and Semantic Web As a Data Base, semantic Interoperability and Web Mining Web Mining Vs Semantic Web Mining

8. **Semantic Web Tools & Applications**: Web Data Exchange and Syndication, Semantic WIKI's, Semantic Portals, Semantic Meta Data in Data formats, Semantic Web Services Modeling Ontologies, Semantic Web Service Design Tools, Ontologies for Standardizations WMO and SWMO Applications

Text Book:

Foundations of Semantic Web Technologies, Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, CRC Press.

Reference Books:

1. Web Data Mining and Applications in Business Intelligence and Counter Terrorism, Bavani Thuraisingham, CRC Press, June 2003
2. Implementing Semantic Web Services-The SESA Frame Work, D. Fensel;M.Kerrigan; M.Zaremba, Springer
3. Enabling Semantic Web Services- The Web Service Modeling Ontology, Fensel,D; Lausen,H;Pollers,ABruijn,J;Stollberg,M; Spriger
4. A Semantic Web Primer, Paul Groth, Frank van Harmelen, Rinke Hoekstra, The MIT Press, 2012
5. Programming the Semantic Web, Toby Segaran, Colin Evans, Jamie Taylor Oreilly Publications, July 2009

MTCST2.5 Elective III Big Data Analytics

Common for M.Tech (CST, CSTAIR,CSTBI)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction:**, Velocity, Variety, Veracity; Drivers for Big Data, Sophisticated Consumers, Automation, Monetization, Big Data Analytics Applications: Social Media Command Center, Product Knowledge Hub, Infrastructure and Operations Studies, Product Selection, Design and Engineering, Location-Based Services, Online Advertising, Risk Management

2. **Architecture Components:** Massively Parallel Processing (MPP) Platforms, Unstructured Data Analytics and Reporting: Search and Count, Context-Sensitive and Domain-Specific Searches, Categories and Ontology, Qualitative Comparisons, Data Privacy Protection, Real-Time Adaptive Analytics and Decision Engines

3. **Advanced Analytics Platform:** Real-Time Architecture for Conversations, Orchestration and Synthesis Using Analytics Engines, Entity Resolution, Model Management, .Discovery Using Data at Rest, Integration Strategies

4. **Implementation of Big Data Analytics:** Revolutionary, Evolutionary, or Hybrid, Big Data Governance, Integrating Big Data with MDM, Evolving Maturity Levels

5. **Map-Reduce and the New Software Stack**: Distributed File Systems .Physical Organization of Compute Nodes, Large-Scale File-System Organization, Map-Reduce features: Map Tasks, Grouping by Key, Reduce Tasks, Combiners, Map-Reduce Execution, Coping With Node Failures, Algorithms Using Map-Reduce for Matrix multiplication, Relational Algebra operations, Workflow Systems, Recursive Extensions to Map-Reduce,

6. **Communication Cost Models**, Complexity Theory for Map-Reduce, Reducer Size and Replication Rate, Graph Model and Mapping Schemas, Lower Bounds on Replication Rate

7. **Mining Data Streams**: Stream Data Mode l and Management Stream Source, Stream Queries, and issues, Sampling Data in a Stream , Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Ones in a Window, Decaying Windows

8. **Link Analysis**: PageRanking in web search engines, Efficient Computation of PageRank using Map-Reduce and other approaches, Topic-Sensitive PageRank , Link Spam, Hubs and Authorities

Text Books:

1. Big Data Analytics:Disruptive Technologies for Changing the Game, *Dr. Arvind Sathi,*, First Edition October 2012, IBM Corporation
2. Mining of Massive Datasets, Anand Rajarama, Jure Leskovec, Jeffrey D. Ullman.E-book, 2013

References:

Big Data Imperatives, Soumendra Mohanty, Madhu Jagadeesh, Harsha Srivatsa, Apress, e-book of 2012

MTCST2.5 Elective III Database Security

Common for M. TECH (CST, IT,CSTAIR, CSTBI)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction To Database Security**: Fundamental Data Security Requirements, Data Security Concerns, Compliance Mandates, Security Risks, Developing Enterprise Security Policy, Defining a Security Policy, Implementing a Security Policy, Techniques to Enforce Security

2. **Database Access Control**: User Authentication, Protecting Passwords, Creating Fixed Database Links, Encrypting Database Link Passwords, Using Database Links Without Credentials, Using Database Links And Changing Passwords, Auditing With Database Links, Restricting A Database Link With Views, Trust Management & Negotiation,

3. **Database Security Issues**: Database Security Basics, Security Checklist, Reducing Administrative Effort, Applying Security Patches, Default Security Settings, Secure Password Support, Enforcing Password Management, Protecting The Data Dictionary, System and Object Privileges, Secure Data Outsourcing, Security in Advanced Database Systems, Security in Data Warehousing and OLAP Systems, Managing Enterprise User Security

4. **Framework For Database Security,:** Security for Workflow Systems, Secure Semantic Web Services, Spatial Database Security, Security Reengineering, Strong Authentication, Single Sign-On, Public Key Infrastructure (PKI) Tools, Configuring SSL on the Server, Certificates, Using Kerberos for Authentication

5. **Database Security Solutions**: Maintaining Data Integrity, Protecting Data, Controlling Data Access, Combining Optional Security Features, Compliance Scanner, Policy Trends in Database Control, Watermarking: Copyright Protection, Trustworthy Record Retention and Recovery, Privacy-Preserving Data Mining & Data Publishing. Privacy in Location-Based Services

6. **Database Auditing :** Auditing Database Users, User Privileges And Objects: Monitoring for Suspicious Activity, Standard Database Auditing, Setting the AUDIT_TRAIL, Specifying Audit Options, Viewing Auditing Options, Auditing the SYSDBA Users, Audit to XML Files, Value-Based Auditing, Auditing DML Statements, Triggering Audit Events, Maintaining the Audit Trail

7. **Database Privileges And Roles**: Authorization, Privileges, Benefits of Roles, Using Proxy Authentication With Roles, Creating An Enterprise Role, Securing Objects and Application Roles, Data Masking Primitives And Routines, Privacy in Location- Based Services

8. **Data Encryption For Database Security**: Problems Solved by Encryption, Storing the Key in Database, Key Management by User, Application-Based Encryption, Cipher Block Modes , Hash and Message Authentication Code, Transparent Data Encryption (TDE) & File Encryption Methods.

Text Books

1. Database Security, S.Castano, M. Fugini, G. Martella,P. Samarati, Addision-Wesley
2. Database Security By Alfred Basta, Melissa Zgola, Cengage Publication, 2012

References

1. Database Security & Auditing By Hassan A Afyouni, Cengage Delmar Learning India Pvt, 2009
2. Handbook Of Database Security:Applications And Trends,Michael Gertz, Sushil Jajodia, Springer

MTCST2.6 Elective IV Mobile Computing

common for M.Tech(CST,IT, CSTCN)

Instruction: 3 Periods/week	**Time: 3 Hours**	**Credits: 4**
Internal: 30 Marks	**External: 70 Marks**	**Total: 100 Marks**

1. **Introduction to Mobile Computing,** Overview of Mobile Technologies, Limitations, The Ubiquitous Network, Architecture for Mobile Computing, Three-Tier Architecture, Design Considerations for Mobile Computing, Mobile Computing Through Internet, Mobile Devises and Mobile-Enabled Applications.

2. **Introduction To Wireless Networking**, Various Generations of Wireless Networks, Wireless LANs, Advantages and Disadvantages of WLANs, Fixed Network Transmission Hierarchy, Differences in Wireless and Fixed Telephone Networks, Traffic Routing in Wireless Networks, WAN Link Connection Technologies, Cellular Networks.

3. **WLAN Topologies,** WLAN Standard IEEE 802.11, Comparison Of IEEE 802.11a, B, G and N Standards, Wireless PANs, Hiper LAN, Wireless Local Loop, ATM, Virtual Private Networks, Wireless Data Services, Common Channel Signaling, Various Networks for Connecting to The Internet.

4. **Emerging Technologies:** Introduction - Bluetooth - Radio Frequency Identification (RFID), WIMAX -Mobile IP - Ipv6 - Java Card, TCP/IP in the Mobile Setting, GSM and GPS

5. **Data Management Issues**, Data Replication For Mobile Computers, Adaptive Clustering for Mobile Wireless Networks, File System, Disconnected Operations, Data Services in GPRS - Applications for GPRS - Limitations - Billing and Charging.

6. **Communications** Asymmetry, Classification of New Data Delivery Mechanisms, Push-Based Mechanisms, Pull-Based Mechanisms, Hybrid Mechanisms, Selective Tuning (Indexing) Techniques. CDMA, GSM , Wireless Data, 3GNetworks and Applications

7. **Introduction to Mobile IP**, Introduction To Wireless Application Protocol, Application Layer MMS - GPRS Applications, Short Message Service (SMS): Mobile Computing Over SMS - SMS - Value Added Services Through SMS -Accessing the SMS Bearer.

Text Books:

1. Mobile Computing - Technology Applications And Service Creation, Asoke K Talukder and Roopa R.Yavagal, TMH 2006.
2. Mobile Cellular Communication, Gottapu Sasibhushana Rao,, Pearson Education, First Edition, 2013.

Reference Books:

1. Principles Of Computing, Uwe Hansmann, Lother Merk, Martin S.Nicklous, Thomas Staber, 2nd Ed., Springer International Edition.
2. Mobile Communications, J.Schiller, Addison-Wesley, 2003
3. Stojmenovic And Cacute, "Handbook Of Wireless Networks And Mobile Computing", Wiley, 2002.

MTCST 2.6 Elective IV: SOFT COMPUTING

common for M.Tech(CST,IT)

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Soft Computing:** Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

2. **Fuzzy Sets and Fuzzy Logic:** Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications,

3. **Interference in fuzzy logic**: fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

4. **Artificial Neural Network:** Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, re-current networks. Various learning techniques, perception and convergence rule, Auto-associative and hetro-associative memory , Hebb's Learning, Adaline, Perceptron

5. **Multilayer Feed Forward Network**, Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self-Organizing, Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

6. **Evolutionary and Stochastic Techniques:** Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

7. **Rough Set:** Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications.

8. **Hybrid Systems:** Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

Text Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rajsekaran and G.A. Vijayalakshmi Pai, Prentice Hall of India.
2. Rough Sets, Z.Pawlak, Kluwer Academic Publisher, 1991.
3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997.

References:

1. Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford University Press.
2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR. Addison-Wesley
3. Learning and Soft Computing, V. Kecman, MIT Press, 2001
4. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997

MTCST2.6 Elective IV: CLUSTER COMPUTING

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Introduction: Overview of Cluster Computing**, The Role of Clusters, Definition and Taxonomy Of Parallel Computing, Hardware System Structure, Node Software, Resource Management, Distributed Programming, Limitations

2. **Cluster Planning**, Architecture , Node Hardware and Node Software, Design Decisions
3. **Network Hardware:** Internet technologies, Ethernet, cLAN, QsNet, Infiniband, Packet Format, NIC Architecture, hubs & Switches.

4. **Network Software:** TCP/IP, Sockets, Higher Level Protocols, Distributed File systems, Remote Command Execution,
5. **Cluster Setup:** Installation & Configuration, System Access Models, Assigning Names, Installation of Node Software, Basic System Administration
6. **Clusters Management:** Cluster Workload Management Activities, Queuing, scheduling and monitoring, Resource Management and Accounting
7. **Virtualization technologies;** Parallel and Virtual file systems, Introduction, Programming with parallel File systems, Benchmarks

Text Books:

1. Beowulf Cluster Computing with Linux, 2nd Edition, edited by William Gropp, Ewing Lusk, Thomas Sterling, MIT Press, 2003

References:

1. In Search of Clusters: The ongoing battle in Lowly Parallel Computing, Gregory F. P Fister, Second Edition, Prentice Hall Publishing Company, 1998.
2. How to Build a Beowulf - A Guide to the Implementation and Application of PC Clusters, Thomas Sterling, John Salmon, Donald J. Becker and Daniel F. Savarese, MIT Press, 1999

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MTCST2.6 Elective IV Image Processing

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 4**
Internal: 30 Marks **External: 70 Marks** **Total: 100 Marks**

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1. **Fundamentals of Image Processing**: Image Acquisition, Image Model, Sampling, Quantization, Relationship between Pixels, Distance Measures, Connectivity, Image Geometry, Photographic Film. Histogram: Definition, Decision Of Contrast Basing On Histogram, Operations Basing on Histograms Like Image Stretching, Image Sliding, Image Classification. Definition and Algorithm of Histogram Equalization.

2. **Image Transforms** : A Detail Discussion On Fourier Transform, DFT,FFT, Properties WALSH Trans Form , WFT, HADAMARD Transform, DCT

3. **Image Enhancement**:

    a. Arithmetic and Logical Operations, Pixel or Point Operations, Size Operations,
    b. Smoothing Filters-Mean, Median, Mode Filters – Comparative Study
    c. Edge Enhancement Filters – Directorial Filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity
    d. & DIFF Filters, Prewitt Filter, Contrast Based Edge Enhancement Techniques – Comparative Study
    e. Low Pass Filters, High Pass Filters, Sharpening Filters. – Comparative Study
    f. Colour Fundamentals and Colour Models
    g. Colour Image Processing.
    h.

4. **Image Enhancement**: Design of Low Pass, High Pass, EDGE Enhancement, Smoothening Filters in Frequency Domain. Butter Worth Filter, Homomorphic Filters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

5. **Image Compression:** Run Length Encoding, Contour Coding, Huffman Code, Compression Due to Change in Domain, Compression Due to Quantization Compression at the Time of Image Transmission. Brief Discussion on:- Image Compression Standards.

6. **Image Segmentation**: Characteristics of Segmentation, Detection of Discontinuities, Thresholding Pixel Based Segmentation Method. Region Based Segmentation Methods, Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, Histogram Based Segmentation, Spilt and Merge Technique, Motion in Segmentation

7. **Morphology**: Dilation, Erosion, Opening, Closing, Hit-And-Miss Transform, Boundary Extraction, Region Filling, Connected Components, Thinning, Thickening, Skeletons , Pruning Extensions to Gray – Scale Images Application of Morphology in I.P

8. **Image , Video & Multimedia Communications:** Multi-scale and multi-orientation representation; Geometry and texture representation; Object based representation; Hierarchical representation; Sparse representation, Multimedia with image and video content; Multimedia event synchronization;

Text Book:

Digital Image Processing, Rafael C. Gonzalez And Richard E. Woods, Addision Wesley

Reference Books:

1. Fundamentals Of Electronic Image Processing By Arthyr – R – Weeks, Jr.(PHI)
2. Image Processing, Analysis, and Machine Vision by Milan Sonka Vaclan Halavac Roger Boyle, Vikas Publishing House.
3. Digital Image Processing, S. Jayaraman, S. Esakkirajan& T. Veera Kumar, TMH
4. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon, Wiley-Blackwell

MTCST2.7 Data Warehousing & Mining LAB

(Common for M.Tech (CST, AIR))

Instruction: 3 Periods/week **Time: 3 Hours** **Credits: 2**
Internal: 50 Marks **External: 50 Marks** **Total: 100 Marks**

Scope: Lab Experiments using software like Clementine and Informatica or WeKa Tools

1. Demonstration of preprocessing on some datasets eg. Student.aarf/ labor.aarf/Iris/ loan/ etc
2. Demonstration of Data Visualisation using Weka/ SYSTAT/ R programming language
3. Demonstration of Association Rules extraction on Market basket data using apriori/ FP Algorithms
4. Demonstration of Classification Rule extraction a bench mark dataset using j48/ID3 Algorithm
5. Demonstration of Classification Rule Process on any datasets using Navie Bayes Algorithm
6. Demonstration of Classification Rule Process on any datasets using K-nearest Neighbor classification Algorithm
7. Demonstration of partitional Clustering on any datasets using K-means Algorithm
8. Demonstration of Clustering on any datasets using simple K-mediods algorithm
9. Demonstration of Clustering rules process on any datasets of images using DB Scan algorithm
10. Demonstration of Clustering rules process on any datasets using Birch Algorithm

MTCST 2.8 OBJECT ORIENTED SOFTWARE ENGINEERING LAB

Common for M.Tech (CST, IT)

Practical: 3 Periods /week **Univ-Exam : 3 Hours** **Credits:2**
Sessional Marks: 50 **Univ-Exam-Marks:50** **Total: 100**

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1. The purpose of the Software Engineering Lab course is to familiarize the students with modern software engineering methods and tools, Rational **Products**. The course is realized as a project-like assignment that can, in principle, by a team of three/four students working full time. Typically the assignments have been completed during the semester requiring approximately 60-80 hours from each project team.
2. The goal of the Software Engineering Project is to have a walk through from the requirements, design to implementing and testing. An emphasis is put on proper documentation. Extensive hardware expertise is not necessary, so proportionate attention can be given to the design methodology.
3. Despite its apparent simplicity, the problem allows plenty of alternative solutions and should be a motivating and educating exercise. Demonstration of a properly functioning system and sufficient documentation is proof of a completed assignment
4. Term projects are projects that a group student or might take through from initial specification to implementation. The project deliverables include

Projects

- Documentation including
  - A problem statement
  - A requirements document
- A Requirements Analysis Document.
- A System Requirements Specification.
- A Software Requirements Specification.
- A design document
  - A Software Design Description and a System Design Document.
- A test specification.
- Manuals/guides for
  - Users and associated help frames
  - Programmers
  - Administrators (installation instructions)

- A project plan and schedule setting out milestones, resource usage and estimated costs.
- A quality plan setting out quality assurance procedures
- An implementation.

Reference Books:

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, Pearson Education
2. Visual Modelling with Rational Rose 2002 and UML, Terry Quatrini, Pearson Edusction
3. UML2 Toolkit, Hans-Erik Eriksson, etc; Wiley

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MTCST 2.9 SEMINAR ON ADVANCED TOPICS

Practical: 3 Periods /week **Internal Assessment Marks: 100** **Credits: 2**

Purpose:

To enable a student to be familiar with Communication skills
Student is expected to Learn

a. How to Make a Presentation
I. Verbal
II. Non Verbal
III. LCD based Power Point

b. How to write a report
I. Abstract
II. Body
III. Conclusions
IV. Executive Summary

c. Group Discussion
I. Share the work with a group
II. Modularization of the work
III. Shareware Development

d. Communication
I. Horizontal
II. Vertical

Students will be Given a Topic of Importance and are Expected

A. To Present the Topic Verbally in 45minutes + Question Answering
B. To Present the Topic as a Report in 50 Pages

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III SEMESTER

Common for final year M. Tech (CST, IT, CSTAIR, CSTBI, CSTCN) and 6 year Integrated courses

Code	Name of the subject	Periods/week		Max. Marks		Total Credits
		Theory	Lab	Ext.	Int.	
MTCST3.1	Thesis Work Part 1		Grade		Grade	10

1. **Candidates can do their thesis work within the department or in any industry/research organization for two semesters. In case of thesis done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (CO-Guide) should be from the industry/research organization.**
2. **Thesis part I should be submitted at the end of final year 1st semester and it will be evaluated by a committee consisting of Chairman Board of Studies, Head of the Department and thesis guide.**
3. **Although credits are allotted for the thesis work they will not be taken for the calculation of CGPA.**

VI YEAR II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST4.1	Thesis Work Part 2		Grade		Grade	14	

1. **A publication of a paper on the thesis work in a National/International Conference proceedings with presentation certificate or a paper on the thesis work be communicated to a National/International Journal & accepted for publication for the submission of thesis at the end of final year is mandatory.**
2. **Final Thesis with Part I & Part II should be submitted at the end of final year and it will be evaluated by a committee consisting of Chairman Board of Studies, Head of the Department, External Examiner and thesis guide.**
3. **The candidate has to defend his thesis in a Viva-voce examination to be conducted by the above committee. The committee should submit a report, with signatures of all the members, candidate wise, with grade A-Excellent/ Grade B-Good/Grade C- fair/ Grade D- Reappear.**
4. **The external examiner shall be nominated by the Hon'ble Vice Chancellor as per the norms of the University.**
5. **Although credits are allotted for the thesis work they will not be taken for the calculation of CGPA.**

GUIDELINES FOR PREPARING THE REPORT OF PROJECT WORK

1. ARRANGEMENT OF CONTENTS:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page
2. Bonafide Certificate
3. Abstract
4. Table of Contents
5. List of Tables
6. List of Figures
7. List of Symbols, Abbreviations and Nomenclature
8. Chapters
9. Appendices
10. References

The tables and figures shall be introduced at appropriate places.

2. PAGE DIMENSION AND BINDING SPECIFICATIONS:

The dimension of the project report should be in A4 size. The project report should be bound using flexible cover of the thick white art paper. The cover should be **printed in black letters** and the text for printing should be identical.

3. PREPARATION FORMAT:

3.1.Cover Page & Title Page – A specimen copy of the Cover page & Title page of the project report are given in **Appendix 1.**

3.2 Bonafide Certificate – The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14, as per the format in **Appendix 2.** The certificate shall carry the supervisor's signature and shall be followed by the supervisor's name, academic designation (not any other responsibilities of administrative nature), department and full address of the institution where the supervisor has guided the student. The term **'SUPERVISOR' must** be typed in capital letters between the supervisor's name and academic designation.

3.3 Abstract – Abstract should be one page synopsis of the project report typed one and half line spacing, Font Style Times New Roman and Font Size 12.

3.4 Table of Contents – The table of contents should list all material following it as well as any material which precedes it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents but the page numbers of which are in lower case Roman letters. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents of the project report is given in **Appendix 3.**

3.5 List of Tables – The list should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

3.6 List of Figures – The list should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

3.7 List of Symbols, Abbreviations and Nomenclature – One and a half spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.

3.8 Chapters – The chapters may be broadly divided into 3 parts (i) Introductory chapter, (ii) Chapters developing the main theme of the project work (iii) and Conclusion. The main text will be divided in to several chapters and each chapter may be further divided into several divisions and sub-divisions.

- Each chapter should be given an appropriate title.
- Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.
- Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page, which refers to the material they annotate.

3.9 Appendices –

- Appendices are provided to give supplementary information, which is included in the main text may serve as a distraction and cloud the central theme.
- Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2, etc.
- Appendices, Tables and References appearing in appendices should be numbered and referred to at appropriate places just as in the case of chapters.
- Appendices shall carry the title of the work reported and the same title shall be made in the contents page also.

3.10 List of References –The listing of references should be typed 4 spaces below the heading "REFERENCES" in alphabetical order in single spacing left – justified. The reference material should be listed in the alphabetical order of the first author. The name of the author/authors should be immediately followed by the year and other details .A typical illustrative list given below relates to the citation example quoted above.

REFERENCES:

1. Barnard, R.W. and Kellogg, C. (1980) Applications of Convolution Operators to Problems in Univalent Function Theory, Michigan Mach, J., Vol.27, pp.81–94.

2. Shin, K.G. and Mckay, N.D. (1984) Open Loop Minimum Time Control of Mechanical Manipulations and its Applications, Proc. Amer.Contr.Conf., San Diego, CA, pp. 1231-1236.

4. TYPING INSTRUCTIONS:

The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style Times New Roman and Font size 12.