

AICTE MODEL CURRICULUM  
FOR  
POST GRADUATE DEGREE COURSE  
**M.TECH**  
IN  
**COMPUTER SCIENCE AND TECHNOLOGY**  
[W.E.F. 2019-20]



DEPARTMENT OF  
COMPUTER SCIENCE AND SYSTEMS ENGINEERING  
AU COLLEGE OF ENGINEERING (AUTONOMOUS)  
**ANDHRA UNIVERSITY**  
**VISAKHAPATNAM-530 003**

## M.Tech -Computer Science & Technology

### Course Structure and Scheme of Valuation w.e.f. 2019-20

#### I SEMESTER

Code	Name of the subject	Periods/week		Max.Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST11	Mathematical Foundations of Computer Science	3	-	70	30	100	3
MTCST12	Advanced Data Structures	3	-	70	30	100	3
MTCST13	Elective-I	3	-	70	30	100	3
MTCST14	Elective-II	3	-	70	30	100	3
MTCST15	Research Methodology & IPR	3	-	70	30	100	2
MTCST16	Organizational Behavior (Audit Course)	3	-	70	30	100	0
MTCST17	Advanced Data Structures Lab-		3	50	50	100	2
MTCST18	Elective – II Lab		3	50	50	100	2
<b>Total</b>		<b>18</b>	<b>6</b>	<b>520</b>	<b>280</b>	<b>800</b>	<b>18</b>

**Elective-I: Distributed Operating Systems/Computer Organization & Architecture/Computer Graphics**

**Elective II: Advanced Database Management Systems/Computer Networks//Embedded systems**

#### II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST21	Data Mining & Data Warehousing	3	-	70	30	100	3
MTCST22	Object Oriented Software Engineering	3	-	70	30	100	3
MTCST23	Elective-III	3	-	70	30	100	3
MTCST24	Elective-IV	3	-	70	30	100	3
MTCST25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTCST26	OOSE Lab	-	3	50	50	100	2
MTCST27	Data Mining & Data Warehousing Lab	-	3	50	50	100	2
MTCST28	Mini Project With Seminar	-	3	-	100	100	2
<b>Total</b>		<b>15</b>	<b>9</b>	<b>450</b>	<b>350</b>	<b>800</b>	<b>18</b>

**Elective III: Artificial Intelligence/Cryptography & Network Security/Image Processing**

**Elective IV: Compiler Design/Mobile Computing/Soft Computing**

### III SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST31	Elective-V	3	-	70	30	100	3
MTCST32	Open Elective	3	-	70	30	100	3
MTCST33	Dissertation-I/ Industrial project		-	100	-	100	10
<b>Total</b>		<b>6</b>	<b>-</b>	<b>240</b>	<b>60</b>	<b>300</b>	<b>16</b>

**Elective-V:** Big Data Analytics/Internet of Things/ Machine Learning

**Open Elective:** GPS Applications/Operation Research/4G – 5G Mobile Communication Networks

### IV SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST41	Dissertation - II	-	-	100	-	100	16
<b>Total</b>		<b>-</b>	<b>-</b>	<b>100</b>	<b>-</b>	<b>100</b>	<b>16</b>

# FIRST SEMESTER DETAILED SYLLABUS FOR M.TECH (CST)

## MTCST11 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE Common for M. Tech (CST, IT, AI&R,CN, CS&DA)

**Instruction: 3 Periods/week**  
**Internal: 30 Marks**

**Time: 3 Hours**  
**External: 70 Marks**

**Credits: 3**  
**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.

# MTCST12 ADVANCED DATA STRUCTURES

Common for M. Tech (CST, IT, AI&R, CN, CS&DA)

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70 Marks**

**Credits: 3**  
**Total: 100Marks**

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UNIT- I:Heap Structures Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

UNIT-II:Hashing and Collisions Introduction, Hash Tables, Hash Functions, different Hash Functions:-  
Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

UNIT- III:Search Structures OBST, AVL trees, Red-Black trees, Splay trees, Multiway Search Trees B-trees., 2-3 trees

UNIT-IV:Digital Search Structures Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

UNIT- V:Pattern matching Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String ,Harspool, Rabin Karp

## Textbooks

1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI

## References

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. 3. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Universities Press.

**MTCST13 Elective-I**  
**DISTRIBUTED OPERATING SYSTEMS**  
Common for M.Tech (CST, IT)

**Instruction: 3 Periods/week**  
**Internal: 30 Marks**

**Time: 3 Hours**  
**External: 70 Marks**

**Credits:3**  
**Total: 100 Marks**

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**Unit-1:** Introduction to Distributed Systems, What is a Distributed System?, Hardware concepts, Software concepts, Design issues.

**Unit-2:** Communication in Distributed Systems, Layered Protocols, ATM networks, The Client – server model, Remote Procedure call, Group communication.

**Unit-3-** Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

**Unit-4-** Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real-time Distributed System.

**Unit-5-** Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

**Unit-6:** Distributed Shared Memory, Introduction, What is Shared memory? Consistency models, Page based Distributed Shared memory, Shared – variable Distributed Shared memory, Object based Distributed Shared Memory.

**TEXT BOOK:**

Distributed Operating Systems, Andrew S. Tanenbaum

**Reference Book:**

Advanced Concepts in Operating Systems, Madhav Marathe and Niranjan G. Shivaratna.

**MTCST13 Elective-I**  
**COMPUTER ORGANIZATION AND ARCHITECTURE**  
Common for M.Tech (CST, IT)

**Instruction: 3 Periods/week**  
**Internal: 30 Marks**

**Time: 3 Hours**  
**External: 70 Marks**

**Credits: 3**  
**Total: 100 Marks**

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**1. Register Transfer and Microoperations:**

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 Edition 1985.

**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 Kaufmann (An Imprint of Elsevier).

# MTCST13 Elective-I COMPUTER GRAPHICS

Common for M.Tech (CST, IT)

**Instruction: 3 Periods/week**  
**Internal: 30 Marks**

**Time: 3 Hours**  
**External: 70 Marks**

**Credits: 3**  
**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; Overview of Graphics systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Workstations, Input Devices, Hard Copy Devices, 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, Antialiasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Curve Functions, Parallel Curve Algorithms.
- 3. Two Dimensional Transformations:** Basic 2D Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations.
- 4. Three Dimensional Transformations & Projections:** Translation, Rotation, Scaling, Other Transformations, Composite Transformations, 3D Transformation Functions, Modeling and Coordinate Transformations, Need for projections, Parallel & Perspective projections, General Projection Transformations.
- 5. Viewing Pipeline and Clipping operations :** Viewing Pipeline , Viewing Coordinates & Reference frames, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, , Three Dimensional Viewing, View Volumes, Clipping and its Operations, Types of clipping operations-Point Clipping, Line Clipping, Polygon Clipping, , Curve Clipping, , Text and Exterior Clipping.
- 6. Three Dimensional Concepts and Object representations:** 3D display methods, 3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Superquadrics, Blobby Objects, Spline Representations, Cubic Spline methods, Bézier Curves and Surfaces, B-Spline Curves and Surfaces,
- 7. Color Models and Basics of Computer Animation:** Intuitive color concepts, Basics of RGB Color model, YIQ Color Model, CMY & HSV Color models. Design of animation Sequences, Raster Animations, Key Frame systems: Morphing, A Simple program on Animation.

## **Text Books:**

1. Computer Graphics, Donald Hearn & M. Pauline Baker, Pearson Education, New Delhi.
2. Computer Graphics by Dr. Rajiv Chopra.

## **Reference Books:**

1. Procedural Elements for Computer Graphics, David F. Rogers, Tata McGraw Hill Book Company, New Delhi, 2003
2. Computer Graphics: Principles & Practice in C, J.D. Foley, S.K. Van Dam, F.H. John, Pearson Education, 2004
3. Computer Graphics using OpenGL, Francis S. Hill Jr, Pearson Education, 2004.
4. Computer Vision and Image Processing: A Practical Approach using CVIPtools, S. E. Umbaugh, Prentice Hall, 1998



# **MTCST14 Elective-II**

## **Advanced Database Management Systems**

**Common for M.Tech (CST, IT, CN)**

**Instruction:3 Periods/week**  
**Internal:30Marks**

**Time:3 Hours**  
**External:70Marks**

**Credits:3**  
**Total: 100Marks**

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**UNIT-1: Advanced SQL :** SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features.

**Object-Based Databases and XML:** Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multi set Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Oriented versus Object-Relational, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications.

**UNIT-2: Query Processing and Query Optimization:** Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

**UNIT-3: Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.

**UNIT-4: Database-System Architectures:** Centralized and Client –Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types, Parallel Databases, I/O Parallelism, Inter query Parallelism, Intra query Parallelism, Intra operation Parallelism, Interoperation Parallelism, Design of Parallel Systems.

**UNIT-5: Distributed Databases:** Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases.

**UNIT-6: Advanced Data Types and New Applications:** Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases. Advanced Transaction Processing: Transaction-Processing Monitors, Transactional Workflows, E-Commerce, Main-Memory Databases, Real-Time Transaction Systems, Long-Duration Transactions, Transaction Management in Multi databases.

### **Text Books**

1. Silberchatz, Korth, Sudershan, "Database System Concepts", Tata MC Graw Hills Publishing, , 5th Edition, 2005

### **Reference Books**

1. RamezElmasri&ShamkantNavathe, "Database Management Systems", Pearson Education Asia, 6th Edition, 2010
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, 3rdEdition 2004
3. N.TamerOzsu, Patrick Valduriez, "Principles of Distributed Database Systems", Prentice Hal International Inc., 1999
4. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, R.T.Snodgrass, V.S.Subrahmanian, "Advanced Database Systems", Morgan Kaufman Series, 1997

# MTCST14 ELECTIVE-II COMPUTER NETWORKS

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

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70Marks**

**Credits:3**  
**Total: 100Marks**

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- 1. Introduction to Computer Networks:** Introduction, Network Hardware, Network Software, OSI and TCP/IP Reference Models
- 2. Data Communications:** Transmission Media, Wireless Transmission, Transmission in ISDN, Broad Band ISDN , ATM Networks,
- 3. Design Issues in Data Link Layer:** Data Link Control, Error Detection & Correction, Sliding Window Protocols, IEEE Standards 802.2, 802.3, 802.4,802.5, 802.6, Over view of High Speed LANs.
- 4. Design Issues in Network layer:** Routing Algorithms-Shortest Path routing, Link State routing, Hierarchical routing, Broadcast and Multicast routing algorithms; Congestion Control Algorithms, Network Layer in the Internet: IP Protocol, IP Address.
- 5. Internet Transport Protocols:**Transport Service, Elements of TransportProtocols, TCP and UDP Protocols
- 6. Over View of:** DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols
- 7. Over View of Network Devices:** Repeaters, Bridges, Routers, Gateways,Multiprotocol Routers, Brouters, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers,Firewalls, Proxies.
- 8. Over View ofAdvanced Concepts in Networks:** Cellular Networks, AdhocNetworks, Mobile Adhoc Networks, Sensor Networks, Virtual Private Networks.Delay Tolerant Networks, IPv6

## **Text Book:**

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.

# MTCST14 Elective-II EMBEDDED SYSTEMS

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

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

**Credits:** 3

**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

# MTCST15 RESEARCH METHODOLOGY AND IPR

Common for M.Tech (CST, IT, AI&R, CN, CS&DA)

**Instruction:3Periods/weekTime:3HoursCredits:2**

**Internal:30Marks**

**External:70Marks**

**Total: 100Marks**

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**Unit 1:** Meaning of research problem, Sources of research problem, CriteriaCharacteristics of a good research problem, Errors in selecting a research problem, Scopeand objectives of research problem.Approaches of investigation of solutions for research problem, data collection, analysis,interpretation, Necessary instrumentations

**Unit 2:** Effective literature studies approaches, analysisPlagiarism, Research ethics,

**Unit 3:** Effective technical writing, how to write report, PaperDeveloping a Research Proposal, Format of research proposal, a presentation andassessment by a review committee

**Unit 4:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process ofPatenting and Development: technological research, innovation, patenting, development.International Scenario: International cooperation on Intellectual Property. Procedure forgrants of patents, Patenting under PCT.

**Unit 5:** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.Geographical Indications.

**Unit 6:** New Developments in IPR: Administration of Patent System. New developmentsin IPR; IPR of Biological Systems, Computer Software etc.Traditional knowledge CaseStudies, IPR and IITs.

## References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science& engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 ndEdition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

# MTCST16 Organizational Behavior (Audit Course)

Common for M.Tech (CST, IT, AI&R, CN, CS&DA)

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70Marks**

**Credits:0**  
**Total: 100Marks**

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**UNIT-I: Organizational Behavior:** Concept of Organization - Concept of Organizational Behavior - Nature of Organizational Behavior - Role of Organizational behavior - Disciplines contributing to Organizational Behavior.

**UNIT-II: Motivation:** Definition - Nature of Motivation - Role of Motivation - Theories of Motivation: Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and McGregor's Theory X and Theory Y.

**UNIT –III: Group Dynamics:** Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

**UNIT-IV: Leadership:** Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

**UNIT-V: Communication:** Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication: Downward, Upward and Horizontal communication.

**UNIT-VI: Organizational conflicts:** Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Inter organizational conflict - Conflict management.

**UNIT –VII: Organizational Change:** Nature - Factors in Organizational change -Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

## Text Books.

- 1.L.M.Prasad: Organizational Behavior, Sultan Chand & Sons, New Delhi -110002
- 2.K. Aswathappa: Organizational Behavior, Himalaya Publishing House, New Delhi

## Reference Books.

1. Stephen Robbins: Organizational Behavior, Pearsons Education, New Delhi.

# MTCST17

# ADVANCED DATA STRUCTURES LAB

Common for M.Tech (CST, IT, AI&R, CN, CS&DA)

**Instruction: 3 Periods/week**

**Time: 3 Hours**

**Credits: 2**

**Internal: 50 Marks**

**External: 50 Marks**

**Total: 100 Marks**

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1. Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods:

a) Linear search b) Binary search

2. Write Java programs to implement the following using arrays and linked lists

a) List ADT

3. Write Java programs to implement the following using an array.

a) Stack ADT b) Queue ADT

4. Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).

5. Write a Java program to implement circular queue ADT using an array.

6. Write a Java program that uses both a stack and a queue to test whether the given string is a palindrome or not.

7. Write Java programs to implement the following using a singly linked list.

a) Stack ADT b) Queue ADT

8. Write Java programs to implement the deque (double ended queue) ADT using

a) Array b) Singly linked list c) Doubly linked list.

9. Write a Java program to implement priority queue ADT.

10. Write a Java program to perform the following operations:

a) Construct a binary search tree of elements.

b) Search for a key element in the above binary search tree.

c) Delete an element from the above binary search tree.

11. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.

12. Write a Java program to implement Dijkstra's algorithm for Single source shortest path problem.

13. Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in

a) Preorder b) Inorder c) Postorder.

14. Write Java programs for the implementation of bfs and dfs for a given graph.

15. Write Java programs for implementing the following sorting methods:

a) Bubble sort d) Merge sort g) Binary tree sort

b) Insertion sort e) Heap sort

c) Quick sort f) Radix sort

16. Write a Java program to perform the following operations:

a) Insertion into a B-tree b) Searching in a B-tree

17. Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.

18. Write a Java program that implements KMP algorithm for pattern matching.

#### REFERENCE BOOKS:

1. Data Structures and Algorithms in java, 3rd edition, A.Drozdek, Cengage Learning.

2. Data Structures with Java, J.R.Hubbard, 2nd edition, Schaum's Outlines, TMH.

3. Data Structures and algorithms in Java, 2nd Edition, R.Lafore, Pearson Education.

4. Data Structures using Java, D.S.Malik and P.S. Nair, Cengage Learning.

5. Data structures, Algorithms and Applications in java, 2nd Edition, S.Sahani, UniversitiesPress.

6. Design and Analysis of Algorithms, P.H.Dave and H.B.Dave, Pearson education.

7. Data Structures and java collections frame work, W.J.Collins, McGraw Hill.

8 Java: the complete reference, 7th All editon, Herbert Schildt, TMH

9. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education / Java: How toProgram P.J.Deitel and H.M.Deitel , 8th edition, PHI.

## MTCST18Elective-II Lab

### ADVANCED DATABASE MANAGEMENT SYSTEMS LAB

Common for M.Tech (CST, IT)

**Instruction:3Periods/week**

**Time:3 Hours**

**Credits:2**

**Internal:50Marks**

**External:50 Marks**

**Total: 100Marks**

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#### Experiments

- Basic SQL
  - Intermediate SQL
  - Advanced SQL
  - ER Modeling
  - Database Design and Normalization
  - Accessing Databases from Programs using JDBC
  - Building Web Applications using PHP & MySQL
  - Indexing and Query Processing
  - Query Evaluation Plans
  - Concurrency and Transactions
  - Big Data Analytics using Hadoop

#### Outcome:

- Ability to use databases for building web applications.
- Gaining knowledge about the internals of a database system.

#### References

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6<sup>th</sup> edition, Tata McGraw Hill, 2011
2. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 4<sup>th</sup> Edition, Pearson/Addisionwesley, 2007



**MTCST18 Elective II Lab**  
**COMPUTER NETWORKS LAB**

Common for M.Tech (CST, IT)

**Instruction:3Periods/week**

**Time:3HoursCredits:2**

**Internal:50Marks**

**External:50 Marks**

**Total: 100Marks**

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**Network Programming**

1. Socket Programming
  - a. TCP Sockets
  - b. UDP Sockets
  - c. Applications using Sockets
2. Simulation of Sliding Window Protocol
3. Simulation of Routing Protocols
4. RPC
5. Development of applications such as DNS/ HTTP/ E – mail/ Multi - user Chat

**Web Programming**

1. Design of the Web pages using various features of HTML and DHTML
2. Client server programming using servlets, ASP and JSP on the server side and java script on the client side
3. Web enabling of databases
4. Multimedia effects on web pages design using Flash.

**Reference Books:**

1. Internet and Web Technologies by Raj Kamal, Tata McGraw-Hill
2. Programming the World Wide Web by Robert W. Sebesta, Pearson Education

**MTCST18 Elective II Lab**  
**Embedded Systems LAB**  
Common for M.Tech(CST, IT)

**Instruction:3 Periods/week**

**Time:3HoursCredits:2**

**Internal:50Marks**

**External:50 Marks**

**Total: 100Marks**

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**PART- I:**

1. Simple Assembly Program for  
Addition | Subtraction | Multiplication | Division  
Operating Modes, System Calls and Interrupts, Loops, Branches
2. Write an Assembly programs to configure and control General Purpose Input/Output (GPIO) port pins.
3. Write an Assembly programs to read digital values from external peripherals and execute them with the Target board.
4. Program for reading and writing of a file
5. Program to demonstrate Time delay program using built in Timer / Counter feature on IDEenvironment
6. Program to demonstrates a simple interrupt handler and setting up a timer
7. Program demonstrates setting up interrupt handlers. Press button to generate an interrupt and trace program flow with debug terminal.
8. Program to Interface 8 Bit LED and Switch Interface
9. Program to implement Buzzer Interface on IDE environment
10. Program to Displaying a message in a 2 line x 16 Characters LCD display and verify the result indebug terminal.
11. Program to demonstrate I2C Interface on IDE environment
12. Program to demonstrate I2C Interface – Serial EEPROM
13. Demonstration of Serial communication. Transmission from Kit and reception from PC using
14. Serial Port on IDE environment use debug terminal to trace the program.
15. Generation of PWM Signal
16. Program to demonstrate SD-MMC Card Interface.

**PART- II:**

Write the following programs to understand the use of RTOS with ARM Processor on IDE Environment using ARM Tool chain and Library:

1. Create an application that creates two tasks that wait on a timer whilst the main task loops.
  2. Write an application that creates a task which is scheduled when a button is pressed, which illustrates the use of an event set between an ISR and a task
  3. Write an application that Demonstrates the interruptible ISRs(Requires timer to have higher priority than external interrupt button)
  4. a).Write an application to Test message queues and memory blocks.  
b).Write an application to Test byte queues
  5. Write an application that creates two tasks of the same priority and sets the time slice period to illustrate time slicing.
- Interfacing Programs:
6. Write an application that creates a two task to Blinking two different LEDs at different timings
  7. Write an application that creates a two task displaying two different messages in LCD display intwolines.
  8. Sending messages to mailbox by one task and reading the message from mailbox by another task.
  9. Sending message to PC through serial port by three different tasks on priority Basis.
  10. Basic Audio Processing on IDE environment.

**SECOND SEMESTER  
DETAILED SYLLABUS FOR M.TECH (CST)**

**MTCST21 Data Mining & Data Warehousing**

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3HoursCredits: 3**  
**External:70 Marks**

**Total: 100Marks**

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1. **Introduction to Data Mining:** Motivation and importance of Data Warehousing and Data Mining, Kinds of Data, Kinds of Patterns, Technologies, Data Mining Applications Data Objects and Attributes Types, Statistical Descriptions of Data, Data Visualization, Estimating Data Similarity and Dissimilarity
2. **Data Preprocessing** Pre-processing the Data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation;
3. **Data Warehouse and OLAP Technology:** Basic Concepts of Data warehouse, Data Modeling using Cubes and OLAP, DWH Design and usage, Implementation of Data Warehouse, OLAP servers, Data Generalization withAOI.
4. **Data Cube Technology:** 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-DimensionalOLAPs.
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 EvaluationMethods
6. **Classification:** Basic Concepts, Decision Tree Induction, Bayes Classification, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Classification by Back Propagation, SVM, Lazy Learning, Fuzzy Sets, Rough Sets, Genetic Algorithms, Multiclass Classification, Semi-SupervisedClassification
7. **Cluster Analysis:** Basic Concepts, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Evaluation of ClusteringSolutions

**Text Book:**

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

**References:**

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

# MTCST22 OBJECT ORIENTED SOFTWARE ENGINEERING

Common for M.Tech (CST, IT)

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70 Marks**

**Credits: 3**  
**Total: 100Marks**

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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 Behavioral 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: Simple Chat Instant Messaging System, GPS Based Automobile Navigation System, Waste Management Inspection Tracking System(WMITS), Geographical Information System

**Text Book:**

Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert L. Langanier McGraw-Hill

**References:**

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

## MTCST23 ELECTIVE-III ARTIFICIAL INTELLIGENCE

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70 Marks**

**Credits: 3**  
**Total: 100Marks**

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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-EndsAnalysis.
- 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 usingProlog
- 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 &FuzzySystems.
- 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 Expertsystems.
- 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, HebbianLearning.
- 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, ReactiveSystems

### Text Book:

1. Artificial Intelligence, George F Luger, Pearson EducationPublications
2. Artificial Intelligence, Elaine Rich and Knight, Mcgraw-HillPublications

### References:

1. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI
2. Multi Agent systems- a modern approach to Distributed Artificial intelligence, Weiss.G, MITPress.
3. Artificial Intelligence : A modern Approach, Russell and Norvig, PrinticeHall

# MTCST23 Elective-III Cryptography & Network Security

**Instruction: 3 Periods/week**  
**Internal: 30 Marks**

**Time: 3 Hours**  
**External: 70 Marks**

**Credits: 3**  
**Total: 100 Marks**

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- 1 Overview:** Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, Computer Security Trends, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Practical Application: An Iris Biometric System, Case Study: Security Problems for ATM Systems.
- 2 Access Control:** Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Case Study: RBAC System for a Bank. Database Security: The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security.
- 3 Malicious Software:** Types of Malicious Software (Malware), Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—SPAM E-mail, Trojans, Payload—System Corruption, Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Key loggers, Phishing, Spyware, Payload—Stealth—Backdoors, Root kits, Countermeasures.  
Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack.
- 4 Intrusion Detection:** Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Distributed Adaptive Intrusion Detection, Intrusion Detection Exchange Format, Honeypots, Example System: Snort. Firewalls and Intrusion Prevention Systems: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.
- 5 Buffer Overflow:** Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks, Software Security: Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs, Handling Program Output. Operating System Security: Introduction to Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security.
- 6 Symmetric Encryption and Message Confidentiality:** Symmetric Encryption Principles, Data Encryption Standard, Advanced Encryption Standard, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Symmetric Encryption Devices, Key Distribution. Public-Key Cryptography and Message Authentication: Secure Hash Function, HMAC, The RSA Public-Key Encryption Algorithm, Diffie-Hellman and Other Asymmetric Algorithms.
- 7 Internet Security Protocols and Standards:** Secure E-mail and S/MIME, Domain Keys Identified Mail, Secure Socket Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security. Internet Authentication Applications: Kerberos, X.509, Public-Key Infrastructure, Federated Identity Management. Wireless Network Security: Wireless Security Overview, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

**TextBook:**

1. Computer Security - Principles and Practices (Except the Chapters 13, 14, 15, 16, 17,18, 19),  
2<sup>nd</sup> Edition by William Stallings, Pearson Education, Inc.

**ReferenceBooks:**

1. Cryptography and Network Security by William Stallings, Pearson Education Asia, New Delhi.
2. Network Security Essentials Applications and Standards, by William Stallings, Pearson Education Asia, New Delhi.



# MTCST23 ELECTIVE-III IMAGE PROCESSING

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70 Marks**

**Credits: 3**  
**Total: 100Marks**

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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 HistogramEqualization.
2. **Image Transforms :** A Detail Discussion On Fourier Transform, DFT,FFT, Properties WALSH TransForm , WFT, HADAMARD Transform,DCT
3. **Image Enhancement:**
  - a. Arithmetic and Logical Operations, Pixel or Point Operations, SizeOperations,
  - b. Smoothing Filters-Mean, Median, Mode Filters – ComparativeStudy
  - 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. – ComparativeStudy
  - f. Colour Fundamentals and ColourModels
  - g. ColourImageProcessing. h.
4. **Image Enhancement:** Design of Low Pass, High Pass, EDGE Enhancement, SmoothingFilters 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 CompressionStandards.
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 inSegmentation
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 inI.P
8. **Image , Video & Multimedia Communications:** Multi-scale and multi-orientation representation; Geometry and texture representation; Object based representation; Hierarchical representation; Sparse representation,

## **Text Books:**

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

## **Reference Books:**

1. Fundamentals Of Electronic Image Processing By Arthyr– R – Weeks,Jr.(PHI)
2. Image Processing, Analysis, and Machine Vision by Milan SonkaVaclanHalavac Roger Boyle, VikasPublishingHouse.
3. Digital Image Processing, S. Jayaraman, S. Esakkirajan& T. VeeraKumar, TMH
4. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon, Wiley-Blackwell

## MTCST24 ELECTIVE-IV COMPILER DESIGN

**Instruction:3**Periods/week  
**Internal:30**Marks

**Time:3**Hours  
**External:70** Marks

**Credits: 3**  
**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 OptimizingCompilation.
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 GeneratorLEX.
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 inParsers.
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&TypeConversions.
5. **Code Optimization:** Principal sources of Code Optimization, Loop Optimization, Basic Blocks&FlowGraphs, 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 FromDAG.
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 HandlingRoutines.

- 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, VikasPub.House.
2. Compiler Design, A.A. Pentambekar, Technical Publications
3. Modern Compiler Design, Grune.D, VanReeuwijk K, Bal H.E, Jacobs C J H, Langendoen K Springer,

## MTCST24 ELECTIVE-IV MOBILE COMPUTING

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70 Marks**

**Credits: 3**  
**Total: 100Marks**

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1. **Introduction to Mobile Computing**, Overview of Mobile Technologies, Limitations, Architecture for Mobile Computing, Three-Tier Architecture, Design Considerations for Mobile Computing, Mobile Computing Through Internet, Mobile Devices 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, 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. **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
5. **Communications** Asymmetry, Classification of New Data Delivery Mechanisms, Push-Based Mechanisms, Pull-Based Mechanisms, Hybrid Mechanisms, Selective Tuning (Indexing) Techniques. CDMA& GSM, Wireless Data, 3G Networks and Applications
6. **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, Lothar Merk, Martin S. Nicklous, Thomas Staber, 2<sup>nd</sup> Ed., Springer International Edition.
2. Mobile Communications, J. Schiller, Addison-Wesley, 2003
3. Stojmenovic And Cacute, "Handbook Of Wireless Networks And Mobile Computing", Wiley,

## MTCST24 ELECTIVE-IV SOFT COMPUTING

**Instruction:3Periods/week**

**Time:3Hours**

**Credits:**

**3**

**Internal:30Marks**

**External:70 Marks**

**Total:**

**100Marks**

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### **1. Introduction to Intelligent systems and Soft Computing:**

Intelligent Systems, Knowledge based Systems, Knowledge representation and Processing, Soft Computing

### **2. Fundamentals of Fuzzy logicsystems:**

Evolution of Fuzzy logic, developmental stages and utility in Expert system development, Fuzzy sets, Fuzzy operators, generalized operators, implication, support set and alpha cut, fuzzy resolution, measures of fuzziness fuzzy relations, composition and inference, fuzzy decision making

### **3. Fuzzy logicControl:**

Basics of fuzzy control, Defuzzification, Fuzzification, fuzzy control surface, Fuzzy control architectures, Properties of fuzzy control, robustness and stability

### **4. Fundamentals of Artificial Neuralnetworks:**

Learning and acquisition of knowledge, features of ANN, topologies, learning algorithms, Fundamentals of Connectionist Modeling

### **5. Major classes of Neuralnetworks:**

Multi-layer perceptron, RBF networks, Kohonen's self organising networks, Hopfield networks, Industrial and commercial applications of ANN

### **6. Dynamic Neural networks and theirApplications:**

Basics concepts, dynamica and architecture of Recurrent networks (RNN), training algorithms, Dynamic neural networks for identification and control, Dynamic neural networks for chaos time series prediction, ANN for chaos prediction

### **7. Neuro-fuzzySystems:**

Architectures of neuro-fuzzy systems, cooperative neuro-fuzzy systems, Hybrid neuro-fuzzy systems, construction of neuro-fuzzy systems, structure identification and parameter learning phases

### **8. EvolutionaryComputing:**

Overview of evolutionary computing, Genetic algorithms, and Optimisation, schema theorem, Genetic algorithm operators, Integration of genetic algorithms with neural networks, Integration of GA with fuzzy logic, Population based incremental learning,

### **Text Book:**

1. Soft Computing and Intelligent Systems Design, FakhreddineO.Karray and Clarence De Silva, Pearson Edu

### **Reference Book:**

1. Fuzzy Logic With Engineering Application , Timothy J.Ross, John Wiley & Sons PublishingCompany

2. Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Samir Roy, Ist Edition, Pearson Edu

## MTCST25 ENTREPRENEURSHIP (AUDIT COURSE)

Common for M.Tech (CST, IT, AI&R, CS&DA and CN)

Instruction: 3 Periods/week

Time: 3 Hours

Credits: 0

Internal: 30 Marks

External: 70 Marks

Total: 100 Marks

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### Unit -I

**Basic Concepts of Management:** Management :- Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management.

### Unit-II

**Forms of Business Organizations:** Introduction, Types of Business organizations: **Private Sector-** Individual Ownership , Partnership, Joint stock companies and Co-Operative organizations; **Public sector-** Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

### Unit-III

**Production and operations Management:** Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

### Unit-IV

**Entrepreneurship:** Definition, Characteristics and Skills , Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

### Unit-V

**Entrepreneurial Development and Project Management:** Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

### Text Books:

1. Sharma, S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai ,The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

### Reference Books:

1. Aryasri, A.R., Management Science, McGraw Hill Education (India Private Limited , New Delhi 2014.
2. Sheela, P. , and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur,

**MTCST26 OBJECT ORIENTED SOFTWARE ENGINEERING LAB**  
**common for M.Tech (CST, IT)**

**Instruction: 3 Periods/week**  
**Internal: 50 Marks**

**Time: 3 Hours**  
**External: 50 Marks**

**Credits: 2**  
**Total: 100 Marks**

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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, be done 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 of students 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 Education
3. UML 2 Toolkit, Hans-Erik Eriksson, etc; Wiley

## MTCST27 DATA MINING & DATA WAREHOUSING LAB

**Instruction: 3 Periods/week**

**Time: 3 Hours**

**Credits:**

**2**

**Internal: 50 Marks**

**External: 50 Marks**

**Total:**

**100 Marks**

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**Scope:** Lab Experiments using WeKa Tool and R programming on bench mark datasets.

1. Demonstration of preprocessing on some datasets eg. Student.aarf/ labor.aarf/Iris/ loan/etc
2. Demonstration of Data Visualisation using Weka/ R programming language
3. Demonstration of attribute selection and dimensionality reduction techniques
4. Demonstration of Association Rule extraction on Market basket data using apriori/ FP Algorithms
5. Demonstration of Decision tree construction using j48/ID3 Algorithm and evaluate the model
6. Demonstration of Classification Process using Navie Bayes Algorithm and evaluate the model
7. Demonstration of Classification Process using K-nearest Neighbor classification Algorithm and evaluate the results
8. Demonstration of partitional Clustering using K-means Algorithm and evaluate the results
9. Demonstration of Clustering using simple K-medoids algorithm and evaluate the results
10. Demonstration of Clustering process using DBScan algorithm and evaluate the results.
11. Demonstration of Clustering rules process on any datasets using Birch Algorithm and evaluate the results
12. Demonstration of hierarchical Clustering using agglomerative / divisive approaches and evaluate the results



# DETAILED SYLLABUS FOR M.TECH (CST) THIRD SEMESTER

## MTCST31 ELECTIVE-V BIG DATA ANALYTICS

**Instruction: 3 Periods/week**  
**Internal: 30 Marks**

**Time: 3 Hours**  
**External: 70 Marks**

**Credits: 3**  
**Total: 100 Marks**

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1. Getting Ready to Use R and Hadoop, Installing R, Installing R-Studio, Understanding the nature of R Language, Installing Hadoop, Understanding Hadoop features, Learning the HDFS and Map Reduce architecture, Understanding Hadoop subprojects.
2. Writing Hadoop Map Reduce Programs Understanding the basics of Map Reduce, Introducing Hadoop Map Reduce, Understanding the Hadoop Map Reduce fundamentals, Writing a Hadoop MapReduce example, Learning the different ways to write Hadoop Map Reduce in R.
3. Integrating R and Hadoop Introducing RHIFE, Installing RHIFE, Understanding the architecture of HIPE, Understanding RHIFE samples, Understanding the RHIFE function, Introducing R Hadoop, Understanding the architecture of R Hadoop, Understanding R Hadoop examples, Understanding the R Hadoop function reference
4. Using Hadoop Streaming with R Understanding the basics of Hadoop streaming, Understanding how to run Hadoop streaming with R, Exploring the Hadoop Streaming R package.
5. Learning Data Analytics with R and Hadoop Understanding the data analytics project life cycle, Understanding data analytics problems, Exploring web pages categorization, Computing the frequency of stock market change, Predicting the sale price of blue book for bulldozers—case study.
6. Understanding Big Data Analysis with Machine Learning Introduction to machine learning, Supervised machine-learning algorithms, Unsupervised machine learning algorithm, Recommendation algorithms.
7. Importing and Exporting Data from Various DBs Learning about data files as a database, Understanding MySQL, Understanding Excel, Understanding Mongo DB, Understanding SQLite, Understanding PostgreSQL, Understanding Hive, Understanding HBase.

### **Text Book :**

1. Big Data Analytics with R and Hadoop By Vignesh Prajapati,
2. Big Data Analytics By Venkat Ankam, Packt Publishing Ltd. (Open Source e-book available)

### **Reference Books:**

1. Big Data Analytics Made Easy By Y. Lakshmi Prasad, Notion Press.
2. Big Data Analytics: Disruptive Technologies for Changing the Game, Dr. Arvind Sathi, First Edition October 2012, IBM Corporation
3. Mining of Massive Datasets, Anand Rajarama, Jure Leskovec, Jeffrey D. Ullman. E-book, 2013

## MTCST31 ELECTIVE-V INTERNET OF THINGS

**Instruction:3Periods/week**  
**Internal:30Marks**  
**100Marks**

**Time:3Hours**  
**External:70**

**Credits: 3**  
**MarksTotal:**

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1. Introduction to the internet of things. IoT Architecture: HistoryofIoT,M2M–Machine to Machine, Web of Things, IoT protocols The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN
2. prototyping connected objects. Open-source prototyping platforms.
3. Integrating internet services. XML and JSON. HTTP APIs for accessing popular Internet services (Facebook, Twitter, and others). Practical activities. IoT Application Development: Application Protocols MQTT, REST/HTTP, CoAP, MySQL
4. Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.
5. Ubiquitous computing, applications of IOT, Virtualization of network resources and physical devices inIOT.
6. Internet of Things Standardization M2M Service Layer Standardization OGC Sensor Web forIoT

### TEXT BOOK

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems author . MARINA RUGGIERI H, RIVER PUBLISHERS SERIES IN COMMUNICATIONS

## MTCST31 ELECTIVE-V MACHINE LEARNING

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70 Marks**

**Credits: 3**  
**Total: 100Marks**

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1. **Introduction:** Introduction to Machine Learning, learning task- illustration, Approaches to Machine Learning, Machine Learning algorithms- Theory, Experiment in biology and Psychology.
2. **Concept Learning:** Introduction, Concept Learning Task- Notation, Concept Learning Search, Version spaces, Candidate Elimination Algorithm, Inductive Bias, Biased hypothesis Space, Unbiased Learner, Bias-free Learning, Active queries, Mistake bound/PAC model – basic results. Overview of issues regarding data sources, successcriteria
3. **Decision Tree Learning:** Decision Tree Representation, Basic decision Tree Learning, Inductive bias in Decision tree Learning, Issues in Decision Tree Learning, Minimum Description Length Principle, Occam's razor, Learning with activequeries
4. **Neural Network Learning:** Neural Network Representation, Problems for Neural Network Learning, Perceptions and gradient descent, Multi Layer Network and Back propagation Algorithm, Illustrative Example of Back Propagation Algorithm- Face Recognition, Advanced Topics inANN.
5. **Bayesian Approaches:** Basics of Bayes Theorem and Concept Learning, Expectation Maximization, Minimum Description Length Principle, Navie Bayes Classifier, Bayesian Belief Networks, EM Algorithm, K-Means Algorithm, Hidden Markov Models Instance-Based Techniques; Lazy vs. eager generalization, k nearest neighbor, Locally Weight Representation, Case-basedReasoning
6. **Analytical Learning:** Inductive and Analytical Learning problems, Learning with perfect Domain Theory, Explanation Based Learning, Inductive Bias in EBL, Search Control Knowledge with EBL, Inductive- Analytical Approaches to Learning, Using prior Knowledge for Initialize the Hypothesis, and Altering Search objective, FOCL Algorithm.
7. **Genetic Algorithms:** Representation of Hypothesis as GA., Genetic Operators, Fitness function and Selection, Hypothesis Space search, Genetic Programming, Models of Evolution and Learning, Parallelizing GA, Different search methods for induction

### 1995Text Books:

1. Machine Learning, Tom Mitchell , McGraw Hill,1997
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani & Jerome Friedman, Springer Verlag, 2001

### Reference Books:

1. Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc.,2001
2. Neural Networks for Pattern Recognition, Chris Bishop, Oxford University Press,

## MTCST32 OPEN ELECTIVE: GPS APPLICATIONS

**Instruction:3Periods/week**  
**Internal:30Marks**

**Time:3Hours**  
**External:70 Marks**

**Credits: 3**  
**Total: 100Marks**

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UNIT-1:

Development of NAVSTAR GPS.GPS Satellite configuration- Space segment, Control segment, User segment.

UNIT-2:

GPS working principle, basic equations for finding user position, user position determination with least squares estimator.

UNIT-3:

Other Global Satellite Constellations, GLONASS, GALILEO, Comparison of 3 GNSS (GPS, GALILEO, GLONASS) interms of constellation and services provided.

UNIT-4:

GPS Signal generation, Pseudorandom noise (PRN) code, C/A code , P code, Navigation data, Signal structure of GPS, signal power.

UNIT-5:

Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

UNIT-6:

GPS Error sources, ionospheric effects on GPS signals and its mitigation methods.

UNIT-7:

Satellite based augmentation system-need for GPS augmentation, GPS Aided GEO Augmented System (GAGAN).

### **Textbook:**

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010
2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006.

### **Reference Books:**

1. Scott Gleason and DemozGebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.
2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
3. B.Hoffmann-Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

**MTCST32 OPEN ELECTIVE****OPERATION RESEARCH****Instruction:3Periods/week****Time:3Hours****Credits: 3****Internal:30Marks****External:70 Marks****Total: 100Marks**

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1. Overview of Operations Research, Types of OR Models, Phases of Operations Research – OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis,
2. Standard Form of LPP, Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, Artificial Variables, Big M Method, Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method
3. Transportation Problem as LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogels Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms ,
4. Assignment Problem , Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions Of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-Jobs K Machines Problems, Two-Jobs M-Machine Problems, Crew Scheduling Problems
5. Network Representation of A Project, CPM and PERT, Critical Path Calculations, Time–Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.
6. Replacement Problems-Individual And Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With and Without Shortages, Inventory Problems With Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems
7. Game Theory: Two Person Zero Sum Games , Mixed Strategy Games and Their Algorithms.

**Text Books:**

1. Operations Research, Kanti Swaroop, P.K. Gupta, Man Mohan, Sulthan Chand & Sons Education
2. Publishers Operations Research – An Introduction, Handy A. Taha – Pearson Education.

# MTCST32 OPEN ELECTIVE

## 4G – 5G MOBILE COMMUNICATION NETWORKS

**Instruction: 3 Periods/week**  
**Internal: 30 Marks**

**Time: 3 Hours**  
**External: 70 Marks**

**Credits: 3**  
**Total: 100 Marks**

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### **Unit-1: Introduction**

1G and 2G-voice centric technologies, 3G and 4G-mobile broadband, 5G-beyond mobile broadband-networked society, Spectrum regulation and standardization from 3G to 5G: Overview, ITU-R activities from 3G to 5G, Spectrum for mobile systems and 5G, GPP standardization.

### **Unit-2: Emerging Technologies for 4G**

Multiantenna Technologies: MIMO; Adaptive Multiple Antenna Techniques; Radio Resource Management - QoS Requirements; Software Defined Radio (SDR) Communication Systems - Advantages of SDR - Problems & Applications in SDR Communication Systems; IP Network Issues - Mobility Management - Mobile IP & its Evolution; Mobile Relay Types/Deployment Concepts - Cooperative Mobile Relaying; Other Enabling Technologies; Overview of 4G Research Initiatives and Developments.

### **Unit 3: Multi-gigabit wireless networks**

Next generation (5G) wireless technologies- Upper Gigahertz and Terahertz wireless communications: Millimeter wave networking- Directionality and beam forming- Mobility and signal blockage- IEEE 802.11ad (60 GHz WLAN) MAC and PHY overview: Visible light communication- High-speed networking using LEDs - IEEE 802.15.7 PHY and MAC overview Sensing through visible light- Visible light indoor localization and positioning

### **Unit 4: Indoor localization and RF sensing**

Smartphone localization - WiFi fingerprinting - protocols and challenges - Non-WiFi localization - Device-free sensing with radio frequency - Mining wireless PHY channel state information- Devicefree localization and indoor human tracking - Activity and gesture recognition through RF.

### **Unit 5: Low-power networking**

Backscatter communication - Radio Frequency Identification (RFID) technology overview – Energy harvesting tags and applications- Internet-of-Things (IoT) - IoT protocol overview - CoAP and MQTT - IPv6 networking in low-power PANs (6LoWPAN)

### **Unit 6: Future mobile networks**

Drone networking - Multi-UAV networks, architectures and civilian applications- Communication challenges and protocols for micro UAVs- Connected and autonomous cars - Wireless technologies for Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communications –Automotive surrounding sensing with GHz and THz signals.

### **Unit 7: Instructional Activities**

Survey minimum of four 5G wireless networks for wireless communication and carry out simulation of those networks.

### **Text Books:**

1. 4G: LTE advanced pro and the road to 5G-by Erik Dahlman, Stefan Parkvall and Johan Skold, 3<sup>rd</sup> Edition, Elsevier Publications
2. 5G NR: The Next Generation Wireless Access Technology-by Erik Dahlman, Stefan Parkvall, Elsevier Publications
3. Zhang, Yin, Chen, Min, “Cloud Based 5G Wireless Networks”, Springer, 2016
4. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley 2015.

**References Books:**

1. Young Kyun Kim and Ramjee Prasad, 4G Roadmap and Emerging Communication Technologies, Artech House, 2006.
2. Savo G. Glisic, Advanced Wireless Networks: 4G Technologies, John Wiley & Sons, 2006.
3. Wireless Communications: Principles and Practice, by Theodore S. Rappaport, Prentice Hall.
4. 802.11n: A Survival Guide, by Matthew Gast, O'Reilly Media.
5. 802.11ac: A Survival Guide, by Matthew Gast, O'Reilly Media.
6. Wireless Networking Complete, by Pei Zheng et al., Morgan Kaufmann.

**Hyperlinks:**

1. <https://www.amazon.in/4G-LTE-Advanced-Pro-Road-5G-ebook/dp/B01IUACTDM>
2. <http://ieeexplore.ieee.org/document/7414384/>
3. <https://www.theiet.org/resources/books/telecom/5gwire.cfm?>
4. <http://ieeexplore.ieee.org/document/7794586/>
5. [https://www.researchgate.net/publication/311896317\\_Ultra-reliable\\_communication\\_in\\_a\\_factory\\_environment\\_for\\_5G\\_wireless\\_networks\\_Link\\_level\\_and\\_deployment\\_study](https://www.researchgate.net/publication/311896317_Ultra-reliable_communication_in_a_factory_environment_for_5G_wireless_networks_Link_level_and_deployment_study)
6. <https://www.intechopen.com/books/how-to-link/towards-5g-wireless-networks-a-physicallayer-perspective>

### IVSEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST41	Dissertation - II	-	-	100	-	100	16
<b>Total</b>		-	-	<b>100</b>	-	<b>100</b>	<b>16</b>

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 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 for 100 marks.



# 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 into 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 Math. 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 and chapter headings and subheadings shall be font size 14 and bold.