

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



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

ANDHRA UNIVERSITY: : VISAKHAPATNAM  
**M.Tech. Computer Science and Technology**  
**with Specialization in Computer Networks**

**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
MTCSTCN13	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
MTCSTCN18	Computer Network 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/ Cryptography and Network Security

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

**II-SEMESTER**

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCSTCN21	Mobile-Adhoc Networks	3	-	70	30	100	3
MTCSTCN22	TCP/IP	3	-	70	30	100	3
MTCSTCN23	Elective-III	3	-	70	30	100	3
MTCSTCN24	Elective-IV	3	-	70	30	100	3
MTCST25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTCSTCN26	Wireless Networks Lab	-	3	50	50	100	2
MTCSTCN27	Protocol Development Lab	-	3	50	50	100	2
MTCSTCN28	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: Performance Analysis of Network Architecture/ Network Management Systems/ATM Networks  
 Elective IV: Internet Technologies/Sensor Networks/Network Technologies.

**MTECH (CST with CN)  
III-SEMESTER**

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCSTCN31	Elective-V	3	-	70	30	100	3
MTCSTCN32	Open Elective	3	-	70	30	100	3
MTCSTCN33	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: Internet of Things/ Multimedia Networks/ Virtual Private Networks

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

**MTECH (CST with CN)  
IV-SEMESTER**

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCSTCN41	Dissertation - II	-	-	100	-	100	16
<b>Total</b>		<b>-</b>	<b>-</b>	<b>100</b>	<b>-</b>	<b>100</b>	<b>16</b>

## Detailed Syllabus for M.Tech (CST with CN) First Semester

### MTCST11 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE Common for M. Tech (CST, IT, CN, AIR, CSDA)

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

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

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

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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, CN AIR, CSDA )**

**Instruction: 3 Periods/week**

**Time: 3 Hours**

**Credits: 3**

**Internal: 30 Marks**

**External: 70 Marks**

**Total: 100Marks**

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*Prerequisites 1. A course on “ Data Structures”*

*Objectives 1. Introduces the heap data structures such as leftist trees, binomial heaps, fibonacci and min-max heaps*

*2. Introduces a variety of data structures such as disjoint sets, hash tables, search structures and digital search structures*

*Outcomes*

*1. Ability to select the data structures that efficiently model the information in a problem*

*2. Ability to understand how the choice of data structures impact the performance of programs*

*3. Can Design programs using a variety of data structures, including hash tables, search structures and digital search structures*

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, Sanguthevar Rajasekaran, Universities Press.

## MTCSTCN13 Elective-I DISTRIBUTED OPERATING SYSTEMS

**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, Realtime 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, Makes Singhal and Niranjana G. Shivaratna

**MTCSTCN 13 Elective-I**  
**COMPUTER ORGANIZATION AND ARCHITECTURE**

**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
4. Patterson Morgan Kufmann (An Imprint of Elsevier).

## MTCSTCN 13 ELECTIVE-I: 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 ATMS 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, Honey pots, 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.

## MTCST14 Elective-II COMPUTERNETWORKS

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. 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,Net work 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, 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

### **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 ADVANCED DATABASE MANAGEMENT SYSTEMS

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

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

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

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

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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 Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, “Advanced Database Systems”, Morgan Kaufman Series, 1997

## MTCST14 Elective-II EMBEDDED SYSTEMS

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

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

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

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

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1. **Examples of Embedded Systems** – Typical Hardware – Memory – Microprocessors – Buses – 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:

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

**MTCST15 RESEARCH METHODOLOGY & IPR**  
**Common for M.Tech (CST, IT, CN, AIR, CSDA)**

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

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

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

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**Unit 1:** Meaning of research problem, Sources of research problem, Criteria/Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**Unit 2:** Effective literature studies approaches, analysis/Plagiarism, Research ethics,

**Unit 3:** Effective technical writing, how to write report, Paper/Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**Unit 4:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants 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 developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, 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 nd Edition, "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, CN, AIR, CSDA)**

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

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

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

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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 Mc Gregor'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, CN, AIR, CSDA)

**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
2. implementing the following searching methods:
  - a) Linear search b) Binary search
3. Write Java programs to implement the following using arrays and linked lists
  - a) List ADT
4. Write Java programs to implement the following using an array.
  - a) Stack ADT b) Queue ADT
5. Write a Java program that reads an infix expression and converts the expression to postfix form.
6. (Use stack ADT).

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

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. 13. Write Java programs that use recursive and non-recursive functions to traverse the
14. given binary tree in
  - a) Preorder b) Inorder c) Postorder.
15. 14. Write Java programs for the implementation of bfs and dfs for a given graph.
16. 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
17. 16. Write a Java program to perform the following operations:
  - a) Insertion into a B-tree b) Searching in a B-tree

18. 17. Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.
19. 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 toProgramP.J.Deitel and H.M.Deitel , 8th edition, PHI.



## MTCSTCN18 COMPUTER NETWORKS LAB

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

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

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

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### **a) NetworkProgramming**

1.SocketProgramming

a.TCP Sockets

b.UDPSockets

c.Applications usingSockets

2.Simulation of Sliding WindowProtocol

3.Simulation of RoutingProtocols

4.RPC

5.Development of applications such as DNS/ HTTP/ E – mail/ Multi - userChat

### **b)WebProgramming**

1. Design of the Web pages using various features of HTML andDHTML

2. Client server programming using servlets, ASP and JSP on the server side and java script on the clientside

3. Web enabling ofdatabases

4. Multimedia effects on web pages design usingFlash.

### **Reference Books:**

1. Internet and Web Technologies by Raj Kamal, TataMcGraw-Hill

2. Programming the World Wide Web by Robert W. Sebesta, PearsonEducation

## Detailed Syllabus for M.Tech (CST with CN) Second Semester

### MTCSTCN 21 MOBILE AD-HOC NETWORKS

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

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

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

- 
1. **Introduction:** Introduction to Wireless Networks, Various Generations of Wireless Networks, Virtual Private Networks- Wireless Data Services, Common Channel Signaling, Various Networks for Connecting to the Internet, Blue tooth Technology, Wifi-WiMax- Radio Propagation mechanism , Pathloss Modeling and SignalCoverage
  2. **Wireless Local Area Networks:** Introduction-WLAN topologies-IEEE 802.11 Standards , MAC Protocols,Comparison of 802.11 a,b,g and n Standards, HIPER LAN , ZigBee 802.15.4, Wireless LocalLoop
  3. **Wireless Adhoc Networks:** Basics of Wireless Networks, Infrastructure Versus Infrastructure less Networks – Properties of Wireless, AD hoc Networks, Types of Ad Hoc Networks, Challenges in AD Hoc Networks – Applications of Wireless AD Hoc Networks , Routing Protocols for Ad Hoc Networks: Introduction-Proactive Routing Protocols- Reactive Routing protocols-Hybrid Routing Protocols-QoS Metrics-Energy impact issues inRouting.
  4. **Mobile Communications:** Introduction to cellular concept, Frequency Reuse, Handoff, GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Introduction to mobile computing, novel applications, limitations, andarchitecture.
  5. **Mobile Data Networks:** Location/mobility management, Mobile IP, Dynamic routing protocols, Location-based protocols, Emerging topics: sensor networking, Data-Oriented CDPD network, GPRS and higher data rates, Short messaging service inGSM.
  6. **Mobile Ad Hoc Networks (MANETs):** Overview, Properties of A MANET, Spectrum of MANET Applications, Routing and Various RoutingAlgorithms.
  7. **Other Wireless Technologies:** Introduction, IEEE 802.15.4 and Zigbee, General Architecture, Physical Layer, MAC layer, Zigbee, WiMAX and IEEE 802.16, Layers and Architecture, Physical Layer, OFDM Physicallayer.

8. **Security in Ad Hoc Networks: Introduction-** Security Attacks, Intrusion Detection System, Intrusion Prevention system, Intrusion Response system, Wired Equivalent Privacy( WEP) -A Security Protocol for Wireless Local Area Networks (WLANs), Security inMANETs.

**Text Books:**

1. Principles of Wireless Networks , KavethPahlavan, K. Prasanth Krishnamurthy, Pearson Publications, Asia,2002
2. Mobile Cellular Communications, G.Sasibhusan Rao, PearsonPublications.

References:

1. Guide to Wireless Ad Hoc Networks: Series: Computer Communications and Networks, Misra, Sudip; Woungang, Isaac; Misra, Subhas Chandra, 2009, Springer

## MTCSTCN22 TCP/IP

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

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

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

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- 1. Review Of Important Networking Concepts:** Networking and architectures of TCP/IP and OSI reference models
- 2.** Address Resolution Protocol (ARP) and RARP, IP Protocol, IP addresses, Over view of ICMP, PING and Trace route, BOOTP and DHCP, IP Forwarding, Congestion Control in the NW layer
- 3. Dynamic Routing Protocols:** RIP,OSPF
- 4. Transport Protocols:** TCP and UDP- Connection Management, Flow Control and Congestion Control
- 5.** LAN Switching, NAT, DHCP
- 6.** Domain Name System, IP Multicasting, SNMP, IPV6, MPLS, MOBILE IP,TCP/IP SECURITY
- 7.** Introduction to FINGER Protocol, WHOIS Protocol
- 8.** Other Protocols: WAIS, GOPHER, VERONICA, TCPDUMP,

### **TEXT BOOKS:**

1. Computer Networks, Andrews S Tanenbaum,, Edition 5, PHI
2. TCP/IP illustrated, Volume 1: The Protocols, W. Richard Stevens, W. Richard Stevens, Pearson Education Asia, 2002
3. TCP/IP Tutorial and Technical Overview, A.Rodriguez, J. Gatrell, J. Karas, R.Peschke,IBMRedbook(Available on net forfree)

### **REFERENCE BOOKS:**

1. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4thEdition) by Douglas E. Comer ,Pearson EducationAsia,2000
2. Internetworking with TCP/IP, Vol. III: Client-Server Programming and Applications, Linux/Posix Sockets Version, Douglas E. Comer, David L. Stevens, Michael Evangelista , Pearson EducationAsia,2000

**MTCSTCN23 Elective-III**  
**PERFORMANCE ANALYSIS OF NETWORK ARCHITECTURES**

**Instruction: 3 Periods/week**

**Time: 3 Hours**

**Credits: 3**

**Internal: 30 Marks**

**External: 70 Marks**

**Total: 100 Marks**

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1. Introduction: Term Definitions, Parallel System Architecture, Distributed System Architecture, Network Architecture
2. Characteristics of Network Architectures :Switching Techniques, Traffic Patterns , Wired Network Architectures, Wireless Network Architectures , Network-on-Chip Architectures
3. Performance Evaluation: Numerical Simulation , Markov Chains , Petri Nets
4. Model Engineering: Model Development , Complexity Reduction , Automatic Model Generation
5. Application: Cellular Network, USAIA Framework, Petri Net Model , Model Engineering and Performance
6. Application: Multistage Interconnection Network: Simulation: Petri Nets ,
7. Simulation: MINSimulate . Mathematical Model: Complexity Reduction

Text Book:

Performance analysis of network architectures, Tutschand Dietmar, Springer 2006

## MTCSTCN23 Elective-III NETWORK MANAGEMENT SYSTEMS

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

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

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

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1. Data Communication and Network management overview, Review of computer network technologies
2. Basic foundations: Standards, Models, and language
3. SNMPv1N/W management: organization and information models, SNMPv1N/W management: Communication and Functional models
4. SNMP management: SNMPv2, SNMP management: SNMPv3, SNMP management: RMON (Remote Monitoring)
5. Broadband N/W management: ATM N/W, Access N/W,
6. Telecommunication N/W management:
7. N/W management tools and systems
8. N/W management applications, Web based management

### TEXTBOOK:

1. Network Management: Principles and Practice, Mani Subramanian, Georgia Institute of Technology, Pearson Education Asia, 2000
2. Network Management Fundamentals, Alexander Clemn CISI Press 2007

## MTCSTCN23 Elective-III ATM NETWORKS

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

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

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

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1. Transfer Modes:  
Overview of ATM, Introduction, Circuit switching, Routing, virtual circuit Switching, Comparison of transfer modes. Motivation for ATM, Basic properties.
2. ATM Reference Model:  
Core aspects, ATM Networks, Architecture and interfaces, Internetworking, Applications, BISDN and ATM, ATM Standardization.
3. ATM Physical Layer:  
TC sub layer, PMD sub layer, DS1interface, DS3interface, E1Interface, E3interface, SONET/SDH based interface.
4. ATM Layer and AAL:  
ATM Layer and AAL, ATM cell header at UNI and NNI, ATM layer function, AAL1, AAL2, AAL3/4.
5. ATM traffic and traffic management:  
ATM traffic and traffic management. Traffic parameters, Service parameters, QOS Parameters, Service categories, Traffic management, Traffic contact management.
6. ATM Switching:  
Introduction, Component, Performance, Measurements, Switching issues, Shared Memory Architecture, Shared medium architecture, Space division architecture, Switching in ATM.
7. ATM Addressing, Signaling and Routing, :  
AISA format, Group addressing, ATM signal protocol stack, SAAL, Routing, PNNI Protocol,PNNIhierarchy,PNNItopology,ATMNetworkManagementandSecurity

Text Book

RainerHandel,Huber,“ATMNetwork”,AdisonWesley

## MTCSTCN24 ELECTIVE-IV INTERNET TECHNOLOGIES

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

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

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

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- 1. Introduction to HTML :** Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The HyperText Transfer Protocol, The Web Programmer's Toolbox.,  
**Introduction to HTML :** Origins and Evolution of HTML, Standard HTML Document Structure, Basic Text Formatting, Images, Hypertext Links, Lists, Tables, Frames, Forms.  
**Cascading Style Sheets:** Introduction, Levels of Style Sheets, Style Specification Formats, Style Classes, Properties and Property Values, Colors.
- 2. The Basics of JavaScript:** Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions. Screen Output, Control Statements, Object Creation and Modification, Arrays. Functions, Constructors, Pattern Matching, Errors in Scripts.  
**JavaScript and HTML Documents:** The JavaScript Execution Environment, The Document Object Model, Element Access in JavaScript, Introduction to Events and Event Handling, Events, Attributes, and Tags, Using the load Event, Event Handlers for Button Events, Checking Form Input, The navigator Object, EventPropagation.
- 3. Dynamic Documents with JavaScript:** Browser Support for Dynamic Documents, Element Positioning, Moving Elements. Element Visibility, Dynamic Colors and Fonts, Dynamic Content, Stacking Elements. Locating the Mouse Cursor, Dragging and Dropping Elements, Slow Movements of Elements.
- 4. Introduction to XML:** Introduction, The Syntax of XML, XML Document Structure, Data Type Definitions, Namespaces, Displaying Raw XML Documents, Displaying XML Documents with CSS. XML Transformations and Style Sheets, Schemas.



5. **Introduction to Perl** : Origins and Uses of Perl, Scalars and Their Operations, Assignment Statements and Simple Input and Output, Control Statements, Fundamentals of Arrays, Hashes, References, Functions, Pattern Matching using Regular Expressions, File Input and Output. Using Perl for CGI Programming : The Common Gateway Interface, CGI Linkage, The CGI.pm Module, Form Handling, A Survey Example, Cookies, Animation using CGI.
6. **Servers and Servlets** : Web Server Operation, General Server Characteristics, Apache under UNIX, Overview of Servlets, Servlet Details, Storing Information on Clients.
7. **Introduction to PHP** : Origins and Uses of PHP, Overview of PHP, General Syntactic Characteristics, Primitives, Operations, and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching, Form Handling, Files, Cookies, Session Tracking.
8. **Database Access through the Web**: Relational Databases, The Structured Query Language, Architectures for Database Access, Using MySQL, Database Access with Perl, Database Access with PHP, Database Access with JDBC.

**TEXT BOOK:**

1. **Programming the World Wide Web By Robert W. Sebesta, Pearson Education, 2005**
2. **Internet Technologies, Anne Mary Bradley, Heinemann Publications 2002**

## MTCSTCN 24 ELECTIVE-IV SENSOR NETWORKS

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

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

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

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1. **Introduction:** The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for Wireless Sensor Networks (WSNs), Sensor networks vs Enabling Technologies for WSNs, **Single node architecture:** Hardware components, Energy consumption of sensor nodes, Some examples of sensor nodes, Operating systems and execution environments
2. **Network architecture:** Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs,
3. **Physical layer and transceiver design considerations in WSNs:**  
**MAC Protocols:** Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol, How about IEEE 802.11 and Bluetooth
4. **Link layer protocols:** Fundamentals: tasks and requirements, Error control, Framing, Link management
5. **Naming and addressing:** Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses, Content-based and geographic addressing
6. **Routing protocols:** The many faces of forwarding and routing, Energy-efficient unicast, Broadcast and multicast, Geographic routing.
7. **Data-centric and content-based networking :** Introduction, Data-centric routing, Data aggregation, Data-centric storage
8. **Transport layer and Quality of Service:** The transport layer and QoS in wireless sensor networks, Coverage and deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control

### TEXT BOOK:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005
2. Network Management Fundamentals, Alexander Clemm CISCIPress 2007

## MTCSTCN24 ELECTIVE-IV NETWORKTECHNOLOGIES

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

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

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

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1. **Layer 3 Switching:** Layer 3 switching approaches, Layering aspects, Relieving Network Congestion, Comparing Routers and switches, Concepts of label switching and its techniques.
2. **Frame relay WAN protocol:** Protocol architecture, Frame relay virtual circuits, Data flow in Frame relay, Frame relay network implementation.
3. **Fast Ethernets:** Gigabit Ethernet, Alternative to high speed transmission, Fiber today UIP tomorrow, Quality of service on Ethernet.
4. **ISDN:** ISDN definition, working principles, internet accessing, ISDN standards, ISDN evolution. **ATM:** Working operations, multicasting in ATMs, ATM signaling and addressing.
5. **Voice Technologies:** SS7, VoIP, Current and future telephony trends.
6. **Future trends in IP technology:** Introduction to SONET and its architecture, IP-Over-SONET,
7. Backbone architecture, Tunneling with Virtual Private Networks.

**TEXT BOOK:** Network Administration by Steve Wisniewski, Pearson Education Asia, 2001

**REFERENCE BOOK:** Upgrading and repairing Networks by Scott

Mueller, 5<sup>th</sup> Edition, Pearson Education Asia, 2005

## MTCST25 ENTREPRENEURSHIP (AUDIT COURSE)

(common for M.Tech-CST, IT, AI, CN, CSDA)

**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,

## MTCSTCN26 WIRELESS NETWORKS LAB.

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

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

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

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Lab.1: Wireless LAN set-up for Ad-hoc/Infrastructure Mode

Installing and Configuring WLAN Components with Minimum of Three minimally Configured IBM Compatible PCs with Wireless Network Interface Cards (NICs)

Lab.2: Wireless LAN set-up for Access Point/Bridge Mode

Installing and Configuring WLAN Components with Minimum of Three minimally Configured IBM Compatible PCs with Wireless NICs & One Access Point

Lab.3: Experiments based on Wireless Security for Ad-hoc/Infrastructure Mode WLAN

With Minimum of Three minimally Configured IBM Compatible PCs with Wireless NICs

Lab.4: Experiments based on Wireless Security for Access Point/Bridge Mode WLAN

With Minimum of Three minimally Configured IBM Compatible PCs with Wireless NICs and One Access Point Lab.5:

Integration of Ad-hoc mode WLAN with existing Network.

Lab.6: Integration of Access-Point mode WLAN with existing Network.

Lab.7: Experiment on tuning of output power to increase or decrease the Bandwidth in Ad-hoc mode WLAN

Lab.8: Experiment on tuning of output power to increase or decrease the Bandwidth in Access-Point mode WLAN

Lab.9: Point to point Wireless Connectivity for outdoor application with Two Wireless Bridges and relevant accessories

Lab.10: Experiments based on Bluetooth Technology with Bluetooth Training system

## MTCSTCN27 PROTOCOL DEVELOPMENT LAB

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

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

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

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1. Physical Layer-RS-232 communication, Serial, Canonical, Non-Canonical
  - a. Demonstration of serial communication and to achieve it by enabling or disabling flags.
  - b. Change baud rate, parity bits, stop bits and repeat 1.
  - c. To setup canonical processing using the interface by enabling or disabling flags.
  - d. To explore c\_iflag and explore them.
  - e. To setup Non canonical processing using the interface by enabling or disabling flags.
  - f. To explore c\_cflag and explore them.
  
2. Data Link Layer: Error and Flow control, Stop and wait, Sliding window
  - a. Content Error control mechanism.
  - b. Flow integrity error control mechanism
  
3. Sliding Window
  - a. Content error control mechanism using selective retransmission
  - b. Content error control mechanism using Go-back N.
  
- 4 Network Layer–To study the concept of Network Layer
  - a. Error and flow with the ICMP:
  - b. PING Program: The ping program is used to test, measure and manage a network.
  
5. Transport Layer – To study TCP connection oriented and UDP connectionless protocol.
  - a. TCP Server and client.
  - b. UDP Server and Client.
  
- 5 Applications Layer - Hyper Text Transfer Protocol (HTTP) Operation

## Detailed Syllabus for M.Tech (CST with CN) Third Semester

### MTCSTCN31 ELECTIVE-VI INTERNET OF THINGS

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

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

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

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- 1) Introduction to the internet of things, IoT Architecture: History of IoT, 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
2. Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.
3. Ubiquitous computing, applications of IOT, Virtualization of network resources and physical devices in IOT.
4. Internet of Things Standardization M2M Service Layer Standardization OGC Sensor Web for IoT

#### **TEXT BOOK**

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Marina Ruggieri H, River Publishers Series In Communications

## MTCSTCN31 ELECTIVE-V MULTI MEDIA NETWORKS

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

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

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

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1. INTRODUCTION TO MULTIMEDIA: Basics of multimedia data types; Basics of multimedia compression technologies; JPEG, MPEG, Multimedia communications
2. MULTIMEDIA INFORMATION REPRESENTATION: Introduction to Information Theory, information of a source, average information of a discrete memory less source, source coding for memory less sources; Multimedia compression – text, image, audio, video (Standards: JPEG/JPEG-2000, G.723, MPEG-4/H.264L)
3. STANDARDS FOR MULTIMEDIA COMMUNICATIONS: Issues in Multimedia Transmissions and protocols; audio and video streams; Packet video in the Network environment;
4. Transport protocols – An Overview of TCP/IP; overview of UDP/IP; RTP and RTCP, RTSP; voice over IP, multicast, video conferencing, anycast, service redirection, QoS; Error resilience.
5. An overview of Circuit-switched networks, Enterprise Networks , Broadband ATM Networks
6. Entertainment Networks and High-Speed Modems, Application Support Functions
7. Digital Multimedia Broadcasting: Standards, Moving from DVB-T to DVB-H, T=DMB Multimedia broadcasting for Portable Devices

### TEXT BOOK :

Fred Halsall , Multimedia Communications: Applications, Networks, Protocols and Standards, Addison Wesley, 2001

### REFERENCE BOOK:

Multimedia Networking: From Theory to Practice Jenq-Neng Hwang Cambridge University Press, 2009



## MTCSTCN31 Elective-VVIRTUAL PRIVATE NETWORK

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

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

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

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**1. Introduction and Basics VPN Technologies**

Introduction, Security Risks of the Internet , VPNs and Internet Security Issues, VPN Solutions, A Note on IP Address and Domain Name Conventions, Firewall Deployment, Encryption and Authentication , VPN Protocols, Methodologies for Compromising VPNs, Patents and Legal Ramifications

**2. Implementing Layer 2 Connections**

General WAN, RAS, and VPN Concepts, VPN Versus WAN, VPN Versus RAS, Differences Between PPTP, L2F, and L2TP, How PPTP Works, Features of PPTP

**3. Configuring and Testing Layer 2 Connections**

Installing and Configuring PPTP on a Windows NT RAS Server, Configuring PPTP for Dial-up Networking on a Windows NT Client, Configuring PPTP for Dial-up Networking on a , Windows 95 or 98 Client, Enabling PPTP on Remote Access Switches , Making the Calls , Troubleshooting Problems, Using PPTP with Other Security Measures

**4. Implementing the AltaVista Tunnel98**

Advantages of the AltaVista Tunnel System, AltaVista Tunnel Limitations , working of AltaVista Tunnel Works, VPNs and AltaVista , Installing the AltaVista Tunnel, Configuring the AltaVista Tunnel Extranet and Telecommuter Server, Configuring the AltaVista Telecommuter Client, Troubleshooting Problems

**5. Creating a VPN with the Unix SecureShell**

The SSH Software, Building and Installing SSH , SSH Components , Creating a VPN with PPP and SSH, Troubleshooting Problems , A Performance Evaluation

**6. The Cisco PIX Firewall**

The Cisco PIX Firewall, The PIX in Action , Configuring the PIX as a Gateway, Configuring the Other VPN Capabilities

**7. Managing and Maintaining VPN and its Scenario**

Choosing an ISP, Solving VPN Problems , Delivering Quality of Service , Security Suggestions , Keeping Yourself Up-to-Date, A VPN Scenario: The Topology , Central Office Large Branch Office, Small Branch Offices, Remote Access Users

**Text Book:**

Virtual Private Networks, Charlie Scott, Paul Wolfe and Mike Erwin , O'Reilly Publisher, Second Edition January 1999

## MTCSTCN32 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**

Multi antenna 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- Device free 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>

## MTCSTCN32 OPEN ELECTIVE: OPERATION RESEARCH

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

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

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

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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. Operations Research–An Introduction, Handy A Taha–Pearson Education.

## MTCSTCN32 OPEN ELECTIVE: GPS APPLICATIONS

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

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

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

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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) in terms 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 Geocentric 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 Demoz Gebre-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.

**M.TECH CST with spl. COMPUTER NETWORKS**  
**Fourth Semester**

**MTCSTCN41 Dissertation-II**

**IVSEMESTER**

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Code	Name of the subject	Periods/week			Total Credits	
		Max.Marks	Theory	LabExt Int.		
MTCSTCN41	Dissertation - II	-	100	-	100	16
	-					
		<b>Total</b>	<b>100</b>	<b>-</b>	<b>100</b>	<b>16</b>

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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.

## GENERAL 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.