Appendix " R " Item No. 36

**AICTE MODEL CURRICULUM**

**COMPUTER SCIENCE AND SYSTEMS ENGINEERING**

**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 3

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

Total 18 6 520 280 800 18

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

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

**IISEMESTER**

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

Total 15 9 450 350 800 18

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

Elective IV: Compiler Design/Mobile Computing/Soft Computing

**IIISEMESTER**

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

Total 6 - 240 60 300 16

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

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

**IVSEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTCST41 Dissertation - II - 100 - 100 16

Total - - 100 - 100 16

**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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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 theirapplications.

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 FreeGrammars.

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

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

*Text books:*

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

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

*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 (ThomsonNrools/Cole)

4. Cryptanalysis of number theoretic Cyphers, Samuel S. WagstaffJr.Champan& Hall/CRC Press2003.

5. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes –Ousley, Keith StrassbergTataMcGraw-Hill.

**MTCST12 ADVANCED DATA STRUCTURES**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

Unit-2: Communication in Distributed Systems, Lay red Protocols, ATM networks, TheClient – sever model, Remote Procedure call, Group communication.

Unit-3- Synchronization in Distributed System, Clock Synchronization, MutualExclusion, Election algorithms, Atomic transactions, Deadlocks in DistributedSystems.

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 – variableDistributed Shared memory, Object based Distributed Shared Memory.

*TEXT BOOK:*

Distributed Operating Systems, Andrew S. Tanenbanm

*Reference Book:*

Advanced Concepts in Operating Systems, Makes Singhal and NiranjanG.Shivaratna.

**MTCST13 Elective-I**

**COMPUTER ORGANIZATIONAND ARCHITECTURE**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 andDesign: 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 programmedControl: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

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

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

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

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

*Text Book:*

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd.Third Edition, Sept. 2008.

2. Computer Architecture and Parallel Processing, Kai Hwang and Faye A. Briggs, McGraw Hill, International Edition1985.

*Reference Book:*

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd.Eastern Economy Edition, Sixth Edition,2003.

2. Computer System Architecture?, John. P.Hayes.

3. Computer Architecture Aquantitative approach 3rd edition JohnL. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier).

**MTCST13 Elective-I COMPUTER GRAPHICS**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Work stations, Input Devices, Hard Copy Devices, Interactive Input Methods, Window sand Icons,Virtual Reality Environments, Graphics Software.

2. Output primitives :Points and Lines, , Line and Curve Attributes, Color and Gray scalelevels, Antialiasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primi tives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, CurveFunctions, Parallel Curve Algorithms.

3. Two Dimensional Transformations: Basic 2DTransformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, AffineTransformations.

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, LineClipping, PolygonClipping, Curve Clipping,Text and Exterior Clipping.

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

7. Color Models and Basics of Computer Animation: Intuitive color concepts, Basics of RGB Colormodel,

YIQ Color Model, CMY & HSV Colormodels.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 Feiner, AV an Dam F.H John Pearson Education, 2004

3. Computer Graphics using Open GL,Franscis SHill 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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100

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. Ramez Elmasri & Shamkant Navathe, ?Database Management Systems?, Pearson Education Asia, 6th Edition, 2010

2. Raghu Ramakrishnan, Johannes Gehrke, ?Database Management Systems?, McGraw Hill, 3rd Edition 2004

3. N.Tamer Ozsu, 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 COMPUTER NETWORKS**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100

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.

**MTCST14Elective-II EMBEDDEDSYSTEMS**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 – InterruptLatency.

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 – Semaphorevariants.

5. Message Queues – Mailboxes – Pipes – Timer Functions – Events – Memory Management – Interrupt Routines in RTOSEnvironment.

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

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

8. Testing on your Host Machine – Instruction Set Simulators – Laboratory Tools used forDebugging.

*Text Book:*

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

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

*Reference Book:*

EmbeddedSystems:Architecture,ProgrammingandDesign –RajKamal,TataMcGraw- Hill Education, 2008

**MTCST15 RESEARCH METHODOLOGY AND IPR**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 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 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 : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 STRUCTURESLAB**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

1. Write Java programs that use both recursive and non-recursive functions forimplementing 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 : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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?, 6th edition, Tata McGraw Hill, 2011

2. RamezElmasri, Shamkant B. Navathe, ?Fundamentals of Database Systems?, 4th Edition, Pearson/Addisionwesley, 2007

**MTCST18 Elective II Lab**

**COMPUTER NETWORKS LAB**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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 scripton 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/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

PART- I:

1. Simple Assembly Program for a Addition | Subtraction | Multiplication | Division b Operating Modes, System Calls and Interrupts, c 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, whichillustrates 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 : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Margarett 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 : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 DeploymentDiagrams.

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-MortemAnalysis.

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. CASESTUDY: Simple Chat Instant MessagingSystem, GPS Based Automobile NavigationSystem, Waste Management Inspection Tracking System(WMITS), Geographical InformationSystem

*Text Book:*

Object-Oriented Software Engineering Practical software developmentusing UML and Java by Timothy C. Lethbridge& Robert, LanganiereMcgraw-Hill

*References:*

1. 1.Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson EducationAsia.

2. Software Engineering: A Practitioner's Approach, Roger SPressman.

3. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A. Sykes, Addison-WesleyProfessional.

**MTCST23 ELECTIVE-III ARTIFICIAL INTELLIGENCE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 using Prolog

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

4. Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Model and Temporal Logics; Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic: Crisp Sets ,Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences &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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1 Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, ComputerSecurity Trends, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random andPseudorandom 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 ATMSystems.

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 forDatabase Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, CloudSecurity.

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—Stealthing—Backdoors, Root kits, Counter measures. Denial -of -Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of- Service Attacks, Application-Based Band width 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 IntrusionDetection, Distributed Adaptive Intrusion Detection, Intrusion Detection ExchangeFormat, Honeypots, Example System: Snort. Firewalls and Intrusion Prevention Systems:The Need for Fire walls, Fire wall Characteristics, Types of Firewalls, Fire wall Basing,Fire wall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.

5 Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Forms of Over flow 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: SecureHash 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, DomainKeys 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 WirelessLAN Security.

*Text Book:*

1. Computer Security - Principles and Practices (Except the Chapters 13, 14, 15, 16, 17,18, 19), 2nd 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, NewDelhi.

**MTCST23 ELECTIVE-III IMAGE PROCESSING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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. ImageEnhancement: 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, Prewi tt Filter, Contrast Based Edge Enhancement Techniques– Comparative Study e. Low Pass Filters, High Pass Filters, Sharpening Filters. – Comparative Study f. Colour Fundamentals and ColourModels g. ColourImage Processing.  
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4. Image Enhancement: Design of Low Pass, High Pass, EDGE Enhancement, SmootheningFilters 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 in Segmentation

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

8. Image, Video & Multimedia Communications: Multi -scale and multi-orientation representation; Geometry and texture representation; Object based representation; Hierarchical representation; Sparse representation,

*Text Books:*

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

*Reference Books:*

1. Fundamentals Of Electronic Image Processing By Arthyr– R – Weeks, Jr.(PHI)

2. Image Processing, Analysis, and Machine Vision by Milan SonkaVaclanHalavac Roger Boyle, Vikas Publishing House.

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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 in Parsers.

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

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

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

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

2. Compiler Design, A.A. Pentambekar,Technical Publications

3. Modern Compiler Design, Grune.D, Van Reeuwijk K, Bal H.E, Jacobs C J H, Langendoen KSpringer,

**MTCST24 ELECTIVE-IV MOBILE COMPUTING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Devises and Mobile-Enabled Applications.

2. Introduction To Wireless Networking, Various Generations of Wireless Networks,

Wireless LANs, Advantages and Disadvantages of WLANs, Fixed Network Transmission

Hierarchy, Traffic Routing in Wireless Networks, WAN Link Connection Technologies, CellularNetworks.

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, GottapuSasibhushanaRao, Pearson Education, First Edition, 2013.

*Reference Books:*

1. Princiles Of Computing, UweHansmann, Lother Merk, Martin S.Nicklous, Thomas Staber, 2nd Ed., Springer International Edition.

2. Mobile Communications, J.Schiller, Addison-Wesley, 2003

3. Stojmenovic And Cacute, ?Handbook Of Wireless Networks And Mobile Computing?, Wiley,

**MTCST24 ELECTIVE-IV SOFT COMPUTING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Publishing Company

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/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 ENGINEERINGLAB**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

1. The purpose of the Software Engineering Lab course is to familiarize the students with modern software engineering methods and tools, Rational Products. The course is realized as a project-like assignment that can, in principle, by a team of three/four students working full time. Typically the assignments have been completed during the semester requiring approximately 60-80 hours from each projectteam.

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 designmethodology.

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 completedassignment

4. Term projects are projects that a group student or might take through from initial specification to implementation. The project deliverablesinclude Projects

? Documentationincluding

o A problemstatement

o A requirementsdocument

? A Requirements AnalysisDocument.

? A System RequirementsSpecification.

? A Software RequirementsSpecification.

? A designdocument

o A Software Design Description and a System DesignDocument.

? A testspecification.

? Manuals/guidesfor

o Users and associated helpframes

o Programmers

o Administrators (installationinstructions)

? A project plan and schedule setting out milestones, resource usage and estimatedcosts.

? A quality plan setting out quality assuranceprocedures

? Animplementation.

*Reference Books:*

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, PearsonEducation

2. Visual Modelling with Rational Rose 2002 and UML,Terry Quatrini, Pearson Edusction

3. UML2 Toolkit, Hans -Erik Eriksson, etc;Wiley

**MTCST27 DATA MINING & DATA WAREHOUSINGLAB**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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/ FPAlgorithms

5. Demonstration of Decision tree construction using j48/ID3 Algorithm and evaluate themodel

6. Demonstration of Classification Process using Navie Bayes Algorithm and evaluate themodel

7. Demonstration of Classification Process using K-nearest Neighbor classification Algorithm and evaluate theresults

8. Demonstration of partitional Clustering using K-means Algorithm and evaluate theresults

9. Demonstration of Clustering using simple K-mediods algorithm and evaluate theresults

10. Demonstration of Clustering process using DBScan algorithm and evaluate there sults.

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 theresults

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

**MTCST31 ELECTIVE-V BIG DATA ANALYTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Getting Ready to Use R and Hadoop, Installing R, Installing R-Studio, Understanding the nature of R L anguage, 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, Introduc ing Hadoop Map Reduce, Understanding the Hadoop Map Reduce fundamenta ls, Writing a Hadoop Map Reduce example, Learning the different ways to write Hadoop Map Reduce in R.

3. Integrating Rand Hadoop Introducing RHIPE, Insta lling RHIPE, Understanding the archite cture of HIPE, Understanding RHIPE sample s, Understanding the RHIPE function, Introducing RHadoop, Understanding the a rchitecture of RH adoop,Understanding RH adoopexamples,Unde rstanding the RH adoop function reference

4. UsingHadoopStreamingwithRUnderstandingthebasic sofHadoopstre aming, 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 analytic s problems, Exploring web pages categoriza tion, 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 Datafrom Various DBs Learning about data files as database, Understanding MySQL, Understanding Excel,  
Understanding Mongo DB, Understanding SQLite, Understanding Postgre SQL, Understanding Hive, Understanding HBase.

*Text Book :*

1. Big Data Analytic s with R and Hadoop By Vignesh Prajapati,

2. Big Data Analytics ByV enkat 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, An and Rajarama, Jure Leskovec, Jeffrey D.Ullman. E-book, 2013

**MTCST31 ELECTIVE-V INTERNET OF THINGS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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 : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 1995

*Text 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 0. 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 : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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-Wellenh of, GPS theory and practice, 5th Edition, Springer 2001.

**MTCST32 OPEN ELECTIVE OPERATION RESEARCH**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Overview of Operations Research, Types of OR Models, Phases of Operations Research– OR Techniques, Introductiont o Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis,

2. Standard Form of LPP, Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, Arficial 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, Degeneracyin 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.

*TextBooks:*

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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit-1: Introduction : 1G and2G-voice centric technologies, 3G and 4G-mobile broadband, 5G-beyond mobile broadband-netwroked 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 andsignal 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 – Energyharvesting tags and applications - Internet-of-Things (IoT) - IoT protocol overview - Co AP 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, 3rd 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

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

Total - - 100 - 100 16

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 &TitlePage

2. Bonafide Certificate

3. Abstract

4. Table ofContents

5. List ofTables

6. List of Figures

7. List of Symbols, Abbreviations andNomenclature

8. Chapters

9. Appendices

10. References

The tables and figures shall be introduced at appropriate places.

*2. PAGE DIMENSION AND BINDINGSPECIFICATIONS:*

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. PREPARATIONFORMAT:*

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 academicdesignation.

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 Size12.

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 Appendix3.

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 thishead.

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 thishead.

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

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

? Each chapter should be given an appropriatetitle. ? Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they arecited.

? 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 theyannotate.

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 centraltheme.

? 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 pagealso.

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 quotedabove.

*REFERENCES:*

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

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

*4. TYPING INSTRUCTIONS:*

The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style Times New Roman and Font size 12 and chapter headings and subheadings shall be font size 14 and bold.

**COMPUTER SCIENCE AND SYSTEMS ENGINEERING**

**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

Total 18 6 520 280 800 18

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

Total 15 9 450 350 800 18

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

Total 6 - 240 60 300 16

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

Total - - 100 - 100 16

**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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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 TuringMachines,

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 (ThomsonNrools/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 TataMcGraw-Hill.

**MTCST12 ADVANCED DATA STRUCTURES**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press.

**MTCSTCN13 Elective-I DISTRIBUTED OPERATING SYSTEMS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

Unit-2: Communication in Distributed Systems, Lay red Protocols, ATM networks, TheClient – sever model, Remote Procedure call, Group communication.

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

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, DistributedFile 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 – variableDistributed Shared memory, Object based Distributed Shared Memory.

*TEXT BOOK:*

Distributed Operating Systems, Andrew S. Tanenbanm

*Reference Book:*

Advanced Concepts in Operating Systems, Makes Singhal and Niranjan G.Shivaratna

**MTCSTCN 13 Elective-I**

**COMPUTER ORGANIZATIONAND ARCHITECTURE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 andDesign: 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 programmedControl: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

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

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

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

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

*Text Book:*

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd.,Third Edition, Sept. 2008.

2. Computer Architecture and Parallel Processing, Kai Hwang and Faye A. Briggs, McGraw Hill, International Edition1985.

*Reference Book:*

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.

2. Computer System Architecture\_ John. P.Hayes.

3.Computer Architecture Aquantitative approach 3rd edition JohnL.Hennessy & David

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

**MTCSTCN 13 ELECTIVE-I: CRYPTOGRAPHY & NETWORK SECURITY**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 ATMSystems.

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—Stealthing—Backdoors, Root kits, Countermeasures. Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Band width Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to aDenial-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 WirelessLAN Security.

*Text Book:*

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

*Reference Books:*

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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Transport Protocols, 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 of Advanced Concepts in Networks: Cellular Networks, Adhoc Networks, 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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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. Ramez Elmasri & Shamkant Navathe, ?Database Management Systems?, Pearson Education Asia, 6th Edition, 2010

2. Raghu Ramakrishnan, Johannes Gehrke, ?Database Management Systems?, McGraw Hill, 3rd Edition 2004

3. N.Tamer Ozsu, 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 EMBEDDEDSYSTEMS**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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 – Semaphorevariants.

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 – SavingPower.

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 Micro controller 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, RajKamal, Tata McGraw-Hill Education, 2008

**MTCST15 RESEARCH METHODOLOGY & IPR**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics 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, 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 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 developments in 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, CN, AIR, CSDA)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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, Universities Press.

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 to Program P.J.Deitel and H.M. Deitel, 8th edition, PHI.

**MTCSTCN18 COMPUTER NETWORKS LAB**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

a) Network Programming

1. SocketProgramming a. TCP Sockets b. UDPSockets 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 b) Web Programming

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 of databases

4. Multimedia effects on web pages design usingFlash.

*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

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

**MTCSTCN 21 MOBILE AD-HOCNETWORKS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 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 Signal Coverage

2. Wireless Local Area Networks: Introduction-WLAN topologies-IEEE 802.11 Standards, MAC Protocols,Comparision of 802.11 a,b,g and n Standards, HIPER LAN, ZigBee 802.15.4, Wireless Local Loop

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 in Routing.

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, Pearson Publications.

*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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 iIllustrated, 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, IBM Redbook (Available on net forfree)

*REFERENCE BOOKS:*

1. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4thEdition) by Douglas E. Comer, Pearson Education Asia,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 Education Asia, 2000

**MTCSTCN23 Elective-III**

**PERFORMANCE ANALYSIS OF NETWORKARCHITECURES**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Data Communication and Network management overview, Review of computer networks 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. Broadb and N/W management: ATMN/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, GeorgiaInstitute of Technology, Pearson Education Asia, 2000

2. Network Management Fundumentals, Alexander Clemn CISI Press 2007

**MTCSTCN23 Elective-III ATM NETWORKS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, ATM Network Management and Security

*Text Book*

Rainer Handel, Huber,? ATM Network?, Adison Wesley

**MTCSTCN24 ELECTIVE-IV INTERNET TECHNOLOGIES**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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. Java Script and HTML Documents: The Java Script Execution Environment, The Document Object Model, Element Access in Java Script, 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, Event Propagation.

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 usingCGI.

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, SessionTracking.

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 SENSORNETWORKS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 executionenvironments

2. Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs,

3. Physical layer and transceiver design considerations inWSNs: 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, Errorcontrol, Framing, Linkmanagement

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, Geographicrouting.

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 ratecontrol

*TEXT BOOK:*

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005

2. Network Management Fundamentals, Alexender Clemn CISCI Press 2007

**MTCSTCN24 ELECTIVE-IV NETWORKTECHNOLOGIES**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Layer 3 Switching: Layer 3 switching approaches, Layering aspects, Relieving Network Congestion, Comparing Routers and switches, Concepts of label switching and itstechniques.

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, Qualityof service onEthernet.

4. ISDN: ISDN definition, working principles, internet accessing, ISDN standards, ISDN evolution. ATM: Working operations, multicasting in ATMs, ATM signaling andaddressing.

5. Voice Technologies: SS7, VoIP, Current and future telephonytrends.

6. Future trends in IP technology: Introduction to SONET and its architecture, IP-Over-SONET,

7. Backbone architecture, Tunneling with Virtual PrivateNetworks.

*TEXT BOOK:*

Network Administration by Steve Wisniewski, Pearson Education Asia, 2001

*REFERENCE BOOK:*

Upgrading and repairing Networks by Scott Mueller, 5th Edition, Pearson Education Asia, 2005

**MTCST25 ENTREPRENEURSHIP (AUDIT COURSE)**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Entre preneurs, 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/weekTime: 3 HoursCredits : 3

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

Lab.1: Wireless LAN set-up for Ad-hoc/Infrastructure Mode Installing and Configuring WLAN Components with Minimum of Threeminimally 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 Threeminimally 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-Pont mode WLAN with existing Network.

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

Lab.8: Experiment on tuning of output power to increase or decrease the Band width in Access- Pont 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/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

1. Physical Layer-RS-232 communication, Serial, Canonical, Non-Canonicala. Demonstration of serial communication and to achieveit by enabling ordisabling flags. b. Change baud rate, parity bits, stops bits and repeat expt1. c. To setup canonical processing using the in terface by enabling ordisabling 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. Contenter rorcontrol mechanism using selective retransmission b. Content error control mechanis musing Go-backN.

4 Network Layer–To study the concept of Network Layer. a. Error and flow with the ICMP: b. PING Program: The ping programisused to test, measure and manage a network.

5. Transport Layer – To study TCP connection oriented and UDP connection less protocol. a. TCP Server andclient. 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 NTERNET OF THINGS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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) Proto typing connected objects. Open-source proto typing 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 inIOT.

4. 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, Marina Ruggieri H, River Publishers Series In Communications

**MTCSTCN31 ELECTIVE-V MULTI MEDIA NETWORKS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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; Packetvideoin 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, any cast, service redirection, QoS; Error resilience.

5. An over view 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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Tunnel 98 : 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 Alta Vista Telecommuter Client, Troubleshooting Problems

5. Creating a VPN with the Unix Secure Shell : The SSH Software, Building and Installing SSH, SSH Components , Creating a VPN with PPP and SSH, Trouble shooting Problems, A Performance Evaluation

6. The Cisco PIXFirewall : 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 January1999

**MTCSTCN32 Open Elective:  
4G-5G MOBILE COMMUNICATION NETWORKS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit-1: Introduction : 1G and 2G-voice centric technologies, 3G and 4G-mobile broadband, 5G-beyond mobile roadband-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 andsignal 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, 3rd 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 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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, UnrestrictedV ariables, 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 SimplexMethod

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-JobsK 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 & SystemFailure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With andWithout 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.

*TextBooks:*

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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 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**

**IV SEMESTER**

Code Name of the subject

Periods/week Max.Marks Total Credits

Theory LabExt Int.

MTCSTCN41 Dissertation - II - 100 - 100 16

Total 100 - 100 16

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 BINDINGSPECIFICATIONS: 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. PREPARATIONFORMAT: 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 Size12.

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 Appendix3.

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 thishead.

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 thishead.

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

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

\* Each chapter should be given an appropriatetitle.

\* Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they arecited.

\* 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 theyannotate.

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 centraltheme.

\* 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 pagealso.

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 quotedabove.

*REFERENCES:*

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

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

4. TYPING INSTRUCTIONS: The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style Times New Roman and Font size 12 and chapter headings and subheadings shall be font size 14 and bold.

**M.Tech Computer Science &Technology**

**Specialization in Artificial Intelligence & Robotics**

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

MTCSTAIR13 Elective-I 3 - 70 30 100 3

MTCSTAIR14 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

MTCSTAIR18 Artificial Intelligence Lab 3 50 50 100 2

Total 18 6 520 280 800 18

Elective-I: Introduction to Robotics/ Distributed Operating Systems/ Computer Organization & Architecture

Elective II: Artificial Intelligence/ Embedded Systems/ Human Computer Interaction

**II SEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTCSTAIR21 Machine Learning 3 - 70 30 100 3

MTCSTAIR22 Advanced Robotics 3 - 70 30 100 3

MTCSTAIR23 Elective-III 3 - 70 30 100 3

MTCSTAIR24 Elective-IV 3 - 70 30 100 3

MTCST25 Entrepreneurship (Audit Course) 3 - 70 30 100 0

MTCSTAIR26 Machine Learning Lab - 3 50 50 100 2

MTCSTAIR27 Robotics Lab - 3 50 50 100 2

MTCSTAIR28 Mini Project With Seminar - 3 - 100 100 2

Total 15 9 450 350 800 18

Elective III: Image Processing / Expert Systems/ Computer Vision

Elective IV: Pattern Recognition/ Soft Computing/ Cryptography& Network Security.

**III SEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTCSTAIR31 Elective-V 3 - 70 30 100 3

MTCSTAIR32 Open Elective 3 - 70 30 100 3

MTCSTAIR33 Dissertation-I / Industrial project - 100 - 100 10

Total 6 - 240 60 300 16

Elective V : Sensor Networks/Natural Language Processing/Deep Learning

Open Elective :Business Analytics/Operations Research/Cost Management of Engineering Projects

IVSEMESTER

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTCSTAIR41 Dissertation - II - - 100 - 100 16

Total - - 100 - 100 16

**FIRST SEMESTER**

**DETAILED SYLLABUS FOR M.TECH (CST Spl. AI&R)**

**MTCST11 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 & un decidable 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 (ThomsonNrools/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 StrassbergTata McGraw-Hill.

**MTCST12 ADVANCED DATA STRUCTURES**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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.

**MTCSTAIR13 Elective-I**

**INTRODUCTION TO ROBOTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction to Robotics: Classification of Robots, History of Robotics, Advantages and Disadvantages of Robots, Robot Components, Robot Degrees of Freedom, Robot Joints, Robot Coordinates, Robot Reference Frames, Programming Modes, Robot Characteristics, Robot Workspace, Robot Languages, RobotApplications

2. Kinematics of Robots: Position Analysis, Robots as Mechanisms, Conventions, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics of Robots, Forward and Inverse Kinematic Equations: Position, Forward and Inverse Kinematic Equations, Forward and Inverse Kinematic Equations: Position and Orientation, Denavit-Hartenberg Representation of Forward Kinematic Equations of Robots, The Inverse Kinematic Solution of Robots, Inverse Kinematic Programming of Robots, Degeneracy and Dexterity, The Fundamental Problem with the Denavit-Hartenberg Representation

3. Trajectory Planning Introduction, Path versus Trajectory, Joint-Space versus Cartesian-Space Descriptions, Basics of Trajectory Planning, Joint-Space Trajectory Planning, Cartesian-Space Trajectories, Continuous Trajectory Recording.

4. Robot End Effectors Types, Mechanical Grippers and Other types, Tools as End Effectors, The Robot/End Effector Interface, Considerations in Gripper Selection andDesign

5. Actuators and Drive Systems:Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic Actuators, Pneumatic Devices, Electric Motors, Microprocessor Control of Electric Motors, Magnetostrictive Actuators, Shape-Memory Type Metals, Electro-active Polymer Actuators (EAP), Speed Reduction, OtherSystems

*Text Books:*

1. Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia, 2001.

*Reference Books:*

1. R.K.Mittal and I J Nagrath, Robotics and Control, TMH,2003.

2. Computational Intelligence, Davis Poole, Alan Mackwath, Randy Coehel, Oxford University Press1998.

**MTCSTAIR13 Elective-I**

**DISTRIBUTED OPERATING SYSTEMS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

Unit-2: Communication in Distributed Systems, Lay red Protocols, ATM networks, The Client – sever model, Remote Procedure call, Group communication.

Unit-3- Synchronization in Distributed System, Clock Synchronization, MutualExclusion, 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, DistributedFile 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 – variableDistributed Shared memory, Object based Distributed Shared Memory.

*TEXT BOOK:*

Distributed Operating Systems, Andrew S. Tanenbanm

*Reference Book:*

Advanced Concepts in Operating Systems, Makes Singhal and Niranjan G.Shivaratna.

**MTCSTAIR13 Elective-I**

**COMPUTER ORGANIZATION & ARCHITECTURE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

5. Input/outputOrganization: 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:*

a. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd.,Third Edition, Sept. 2008. b. Computer Architecture and Parallel Processing, Kai Hwang and Faye A. Briggs,McGraw Hill, InternationalEdition1985.

*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 Aquantitative approach 3rd edition John L.Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier).

**MTCSTAIR14Elective-II**

**ARTIFICIAL INTELLIGENCE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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

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

**MTCSTAIR14 Elective-II**

**EMBEDDEDSYSTEMS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, Semaphorevariants.

5. Message Queues: Mailboxes, Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in RTOSEnvironment.

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, RajKamal, Tata McGraw- Hill Education, 2008

**MTCSTAIR14 Elective-II**

**HUMAN COMPUTER INTERACTION**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

UNIT I: Introduction: Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession Managing Design Processes: Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories

UNIT II: Menu Selection, Form Fill-In and Dialog Boxes: Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data entry with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays

UNIT III: Command and Natural Languages: Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays- Small and large

UNIT IV: Quality of Service: Introduction, Models of Response-Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences Balancing Function and Fashion: Introduction, Error Messages, Nonanthropomorphic Design, Display Design, Web Page Design, Window Design, Color

UNIT V: User Documentation and Online Help: Introduction, Online Vs Paper Documentation, Reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process

UNIT VI: Information Search: Introduction, Searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces Information Visualization: Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization

*Text Books:*

1. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson

2. The Essential guide to user interface design, 2/e, Wilbert O Galitz, Wiley DreamaTech.

*Reference Books:*

1. Human Computer, Interaction Dan R.Olsan, Cengage, 2010.

2. Designing the user interface. 4/e, Ben Shneidermann, PEA.

**MTCST15 RESEARCH METHODOLOGY AND IPR**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit 1: Meaning of research problem, Sources of research problem, CriteriaCharacteristics 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 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 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 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 : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

UNIT-I: Organizational Behavior: Concept of Organization - Concept of OrganizationalBehavior - Nature of Organizational Behavior - Role of Organizationalbehavior - Disciplines contributing to OrganizationalBehavior.

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, Interorganizational 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 STRUCTURESLAB**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

1. Write Java programs that use both recursive and non-recursive functions forimplementing 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) Inorderc) 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 b) Merge sort c) Binary tree sort d) Insertion sort e) Heap sort f) Quick sort g) 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 costspanning 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, Universities Press.

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.

**MTCSTAIR18 ARTIFICIAL INTELLIGENCE LAB**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

1. Implementation of DFS for water jug problem using LISP/PROLOG

2. Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java

3. Implementation of TSP using heuristic approach usingJava/LISP/Prolog

4. Implementation of Simulated Annealing Algorithm using LISP/PROLOG

5. Implementation of Hill-climbing to solve 8- PuzzleProblem

6. Implementation of Towers of Honoi Problem using LISP/PROLOG

7. Implementation of A\* Algorithm using LISP/PROLOG

8. Implementation of Hill Climbing Algorithm using LISP/PROLOG

9. Implementation Expert System with forward chaining using JESS/CLIPS

10. Implementation Expert System with backward chaining usingRVD/PROLOG

**Detailed Syllabus for M.Tech(CST spl. AI&R) Second Semester**

**MTCSTAIR21 MACHINE LEARNING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, FOCLAlgorithm.

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 forinduction

*Text 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:*

3. Pattern Classification, Richard 0. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc., 2001

4. Neural Networks for Pattern Recognition, Chris Bishop, Oxford University Press,1995

**MTCSTAIR22 ADVANCED ROBOTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. CONTROL SYSTEMS ANDCOMPONENTS: Basic Control Systems   
Concepts and Models, Controllers, Control System Analysis, Robot Activation and Feedback Components, Power Transmission Systems, Robot Joint Control Design.

2. SENSORS: Sensor Characteristics, Sensor Utilization, Position Sensors, Velocity Sensors, Acceleration Sensors, Force and Pressure Sensors, Torque Sensors, Microswitches, Visible Light and Infrared Sensors, Touch and Tactile Sensors, Proximity Sensors, Range Finders, Sniff Sensors, Taste Sensors,

3. IMAGE PROCESSING AND ANALYSIS WITH VISION SYSTEMS: Basic Concepts, Fourier Transform and Frequency Content of a Signal, Frequency Content of an Image; Noise, Edges , Resolution and Quantization, Sampling Theorem, Image-Processing Techniques, Histogram of Images, Thresholding, Spatial Domain Operations: Convolution Mask, Connectivity, Noise Reduction, Edge Detection, Sharpening an Image, Hough Transform, Segmentation, Segmentation by, Region Growing and Region Splitting, Binary Morphology Operations, Gray Morphology Operations, Erosion, Dilation, Object Recognition by Features, Depth Measurement with Vision Systems, Scene Analysis versusMapping

4. ROBOTPROGRAMMING Programming methods, Robot program as path in space,Motion Interpolation, WAIT, SIGNAL DELAY Commands, Branching.

5. ROBOTLANGUAGES The Textual Robot languages, Generations of Robot programming languages, Robot language Structures, Constants, Variables, and other data Objects, Motion Commands, program Control and Subroutines

6. ROBOT APPLICATIONS IN MANUFCATURING: Material Transfer And Machine Loading/ Unloading, An Approach for ImplementingRobotics

7. FUTURE APPLICATIONS: Characteristics of Future Robot Tasks, Future manufacturing Applications, Hazardous and Inaccessible NonmanufacturingEnvironments

*TEXT BOOK:*

1. Mikell P. Groover , Mitchell Weiss , Roger N. Nagel , Nicholas G. Odrey Industrial Robotics: Technology, Programming, and Applications , 1st edition, McGraw-Hill International Edition, 1986

2. Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia,2001.

*REFERENCE BOOK:*

K.S.Fu, R.C Gonzalez, C.S.G.Lee , ROBOTICS , Control, Sensing , Vision and Intelligence , 1st edition, McGraw-Hill International Edition, 1987

**MTCSTAIR23 Elective-III**

**IMAGE PROCESSING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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.ImageTransforms : A Detail Discussion On Fourier Transform, DFT,FFT, Properties WALSH TransForm , WFT, HADAMARD Transform,DCT

3.ImageEnhancement: 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) ColourImage Processing.

4.Image Enhancement: Design of Low Pass, High Pass, EDGE Enhancement, Smoothening Filters in Frequency Domain. Butter Worth Filter, HomomorphicFilters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, DomainandSpatialDomain.

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 , PruningExtensionstoGray– Scale Images Application of Morphology in I.P

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

*Text Book:*

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

*ReferenceBooks:*

2. Fundamentals Of Electronic Image Processing By Arthyr– R – Weeks,Jr.(PHI)

3. Image Processing, Analysis, And Machine Vision By Milan SonkaVaclanHalavacRogerBoyle, VikasPublishingHouse.

4. Digital Image Processing, S. Jayaraman, S. Esakkirajan& T. VeeraKumar,TMH

**MTCSTAIR23 Elective-III**

**EXPERT SYSTEMS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction: Introduction to Expert System, Definitions, Importance of Expert System, Charactestic features of Expert System, Applications of Expert System, Different ategories of Expert Systems, Rule Based System Archicture, Nural Network Archicture

2. Knowledge Representions: Components of a Knowledge in Expert system,OAV Triplets, Sementic Networks, FramsRepresention via Logic Statements, Production Systems, Clause, Properties Rule properties, Rule Conversions, Multiple Conclusions,Nural Networks via Rule Based System

3. Knowledge Acqusition:Introduction Knowledge Acqusition and domain Expert, Selection of the domain, Selection of the Knowledge Engineers, Selection of the Expert, Meetings and Plans, Orgnization of Meetings,Documentation, Multiple domain Experts, Knowledge Acqisition -An Example, Knowledge Acquisition using Rule induction, Generating Rules from Trees, ID3 algorithm for RuleGeneration

4. Design of Expert System:Introduction,Selecting the appropriate Probblem,Stateges in the Developing Expert System, Errors in Development stages, Software Engineering and Expert Systems,The Expert System Life Cycle, Expert System Design Examples- Certainty factors,Decission tress

5. Inference Engine: Inference Engine, Insight of Inference Engine, Search Strategies, Forward Chaining Algorithm,Algorithms for forward Chaining- Baseline Version, Backword Chaining Algorithm, Algorithms for Back word Chaining-Baseline Version, Mixed Modes of Chaining, Work sheets for Forward and Back wordChaining

6. Reasoning Under Uncertainity: Uncertainty,Types of Error,Error and Induction,ClassicProbabulity,TemporalReasioning and MorcovChines,TMS, Fuzzy Logic and Natural Languages computations, Probabilistic Reasioning, probabilistic Networks,BayesianNetworks.Use of Probabilty and Fuzzy logic in Expert System, Rule Induction by MachineLearning

7. Software Tools and Architectures: Overview of Expert System Tools, Expert System Shells,Multiple Paradigm Environments,Absract architectures, Potential Implementation Problems, Selecting a Software Tool, Implentation Mechanism of tools, Black Board Architecture, Reasoning under uncertainityandTruthMaintanceSystems Case-study :A case-study on Financial planning Expert System, Sale Expert system, DENDRAL andMYCIN

*Text Books:*

1. Expert System principals and Programming-Giarratano.Rilev.2003

2. Introducion to Expert SystemsV-JamesP.Iginizo.Mc.Graw-Hill.inc

3. Introduction to Expert Systems Peter Jackson, Addison Wesley PublishingCompany

*References:*

1. Introduction to artificial Intelligence & Expert System- PanW.patterson.PHI

2. A Comprehensive Guide to AI and Expert systems, R.I.Levine D.E. Drang, BarryEdelson

**MTCSTAIR23 Elective-III**

**COMPUTER VISION**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. FUNDAMENTALS OF IMAGE PROCESSING: Image Acquisition, Definitions of Pixel, Gray Value, Sampling, Quantization, Histogram, Image Sliding, Image Stretching. Distance and Connectivity. Image Smoothening Operations - Mean, Median, Mode Filters. Edge Enhancement Filters - Directional Filters, Laplacian, Sobel, and Robert. Definition of Image Compression - Run Length Encoding Method, Contour Encoding Method. Definition of Segmentation - Pixel based method ofsegmentation.

2. MORPHOLOGICAL OPERAT IONS: Definition of Thresholding, A few techniques of thresholding. Importance of Binary Images. Erosion, Dilation, Opening, Closing, HIT -or -MISS Transformation, Thinning, Thickening, Skeletons, Pruning, Con vex hull. Extensions to Gray - Scale Images.Applications of Gray - Scale Morphology. Applications of Morphological Operations in PatternAnalysis.

3. SHAPE REPRESENTATION AND DESCRIPTIONS (Part - 1): Region Identification, Algorithms for Region Identification, Shape Representation and Description - Chain Codes, Geometric Border Representation - Boundary Length, Curvature, Bending Energy, Signature, Chord Distribution, Fourier Transforms of Boundaries, Boundary Description using Segment Sequences, B -Spline Representation, Shapeinvariants.

4. SHAPE REPRESENTATION AND DESCRIPTION (Part - 2): Region - Based Methods - Area - Algorithms for Calculation of Area. Euler?s Number, Projections, Eccentricity, Elongatedness, Rectangularity, Direction, Compactness. Detailed Discussion on - Moments. Convex hull, Algorithms related to convex hull. Graph Representation - Algorithm for Skeleton, Algorithm for Graph Construction. Definitions of Region Decomposition, Region Neighborhood Graphs, ShapeClasses.

5. OBJECT RECOGNITION: Knowledge Representation, Statistical Pattern Recognition, - Classification Principles, Classifier Setting, and Classifier Learning. Syntactic Pattern Recognition Grammars, and Languages, Syntactic Analysis, Syntactic Classifier.Recognitionas Graph Matching - Isomorphism, Related Algorithms. Similarity ofGraphs.

6. CLUSTER ANALYSIS: Definition, Hierarchical Clustering, - Agglomerative Clustering Algorithms, Single - Linkage Algorithm, Complete Linkage Algorithm, Average - Linkage Algorithm, Ward?sMethod. Partitional Clustering - Definition, Forgy?sAlgorithm, K - MeansAlgorithm, Isodata Algorithm. Applications in Pattern Analysis.

7. ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC IN PATTERN ANALYSIS: Introduction to ANN, Architecture of ANN, Activation Functions,Training of ANN Supervised, Unsupervised, Reinforced, McCulloch - Pitts Model, HEBBNET, ADELINE, and Application of ANN in Pattern Analysis. Definition and Brief Discussion about Fuzzy Logic, Fuzzy Sets.Application in PatternAnalysis.

*Text Books :*

1. Pattern Recognition and Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost ,PHI

2. Image Processing, Analysis and Machine Vision, Milan Sonka, Vaclav Hlavac, VIKAS

*References:*

Introduction to Artificial Neural Networks, S.N. Sivanandam, M. Paul Raj , VIKAS

**MTCSTAIR24Elective-IV   
PatternRecognition**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction: Overview of Pattern Recognition- Relations of PR with other Systems, PR Applications, Different Approaches to Pattern Recognition- Statistical Approach to PR, Syntactic Approach to PR, Neural Approach to PR, Examples of PR Approaches. Other Approaches toPR.

2. Structure of PR System: Abstract Representation of PR Mappings, Structure of PR System, Patterns and Feature s, Feature Extraction Examples, Object Description and Classification, Figure Recognition, Numerical Results and Analysis. Feature Vector and Feature Space, training and Learning in PRSystem.

3. Statistical Pattern Recognition: Introduction, Gaussian Case and Class Dependency, Discriminate Function, Examples, ClassifierPerformance,

4. Training: Parametric Estimation and Supervised Learning, Maximum Likely Hood Estimation, Bayesian Parameter Estimation Approach , Parzen Windows, Direct Classification Using Training set., Unsupervised Learning and Clustering, Clustering for Unsupervised Learning and Classification

5. Syntactic Pattern Recognition: Overview of Syntactic Pattern Recognition, Grammar Based Approaches and Applications, Examples of String Generation as Pattern Description, 2-D line Drawing Description Grammar, Character Description using PDL, Object Description using Projected Cylinder Models, Block World Description Models, Heuristic Generation of Grammars,

6. Recognition of Syntactic Description: Recognition by Matching, Recognition by Parsing, CYK Parsing Algorithm, Augmented Transition Nets in Parsing, Graph Based structure representation, Structured Strategy to Compare AttributedGraphs.

7. Neural Pattern Recognition: Introduction to Neural Networks,, Neural Network Structure for PR Applications, Physical Neural Networks, ANN Model, NN Based PR Association, Matrix Approaches andExamples

8. Feed Forward Neural Networks : Training by Back Propagation, Hope field Approach to Neural Computing, Other related Neural Approaches andExtensions

*Text Book:*

1. Pattern Recognition- Statistical, Structural and Neural Approaches, Rober.J. Shelkoff, John Wiley & Sons, NY1992,ISBN0-471-52974-5

*Reference Book:*

1. Neural Networks for pattern recognition, Christopher M.Bishop Oxford UniversityPress.

2. Pattern Classification, Richard O.Duda ,Wiley IndiaEdition

**MTCSTAIR24 Elective-IV**

**SOFT COMPUTING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

**MTCSTAIR 24 Elective IV**

**Cryptography & Network Security**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1 Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, ComputerSecurity Trends, Computer Security Strategy. Cryptographic Tools: Confidentiality wi t h Symmetric Encryption, Message Authentication and Hash Functions,Public-Key Encryption, Digital Signatures and Key Management, Random andPseudorandom Numbers, Practical Application: Encryption of Stored Data. User Authentication:Means of Authentication, Password-Based Authentication, Token-BasedAuthentication, Biometric Authentication, Remote User Authentication, Security Issues forUser Authentication, Practical Application: An Iris Biometric System, Case Study:Security Problems for ATMSystems.

2 Access Control: Access Control Principles, Subjects, Objects, and AccessRights, Discretionary Access Control, Example: UNIX File Access Control, Role-BasedAccess Control, Case Study: RBAC System for a Bank. Database Security: The Need forDatabase Security, Database Management Systems, Relational Databases, DatabaseAccess Control, Inference, Statistical Databases, Database Encryption, CloudSecurity.

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—Stealthing—Backdoors, Root kits,Countermeasures. Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks,Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector andAmplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to aDenial-of-Service Attack.

4 Intrusion Detection: Intruders, Intrusion Detection, Host-Based IntrusionDetection, Distributed Host-Based Intrusion Detection, Network-Based IntrusionDetection, Distributed Adaptive Intrusion Detection, Intrusion Detection ExchangeFormat, Honeypots, Example System: Snort. Firewalls and Intrusion Prevention Systems:The Needfor Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: UnifiedThreatManagementProducts.

5 Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Formsof Overflow Attacks, Software Security: Software Security Issues, Handling ProgramInput, Writing Safe Program Code, Interacting with the Operating System and OtherPrograms,Handling Program Output. Operating System Security: Introduction to OperatingSystem Security, System Security Planning, Operating Systems Hardening, ApplicationSecurity, Security Maintenance, Linux/Unix Security, Windows Security, VirtualizationSecurity.

6 Symmetric Encryption and Message Confidentiality: Symmetric EncryptionPrinciples, Data Encryption Standard, Advanced Encryption Standard, Stream Ciphers andRC4, Cipher Block Modes of Operation, Location of Symmetric Encryption Devices,Key Distribution. Public-Key Cryptography and Message Authentication: SecureHash Function, HMAC, The RSA Public-Key Encryption Algorithm, Diffie-Hellman andOtherAsymmetricAlgorithms.

7 Internet Security Protocols and Standards: Secure E-mail and S/MIME, DomainKeys 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), 2nd Edition by William Stallings, Pearson Education,Inc.

*Reference Books:*

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.

**MTCST25 ENTREPRENEURSHIP (Audit Course)**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit -I Basic Concepts of Management:- Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management. ( Eight Periods)

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.( Eight periods)

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. (Ten periods)

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. (Six periods )

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. (Eight periods)

*Text Books:*

(1 )Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.

(2) VasantDesai, 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 JagadeswaraRao, K., Entrepreneurship, Shree Publishing House, Guntur,

**MTCSTAIR26 MACHINE LEARNING Lab**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

1. The programs can be implemented in either JAVA or Python.

2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.

3. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Lab Experiments: 1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

**MTCSTAIR27 ROBOTICS LAB**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

This Lab is intended to get familiarized with mechanical, electrical, and electronics structures of different types of robots for monitoring, controlling and developing applications like pick and place, swapping, e.t.c., by either stand alone controller in the robot structure or interfacing toPC.

1. Programming a simple Robot on Wheels.

2. Programming a Walking Robot.

3. Experiments based on Bipedal Robot.

4. Experiments based on Humanoid Robot-ROOBONOVA.

5. Pick and Place Application Programming with 4 DOF Robot Arm by Interfacing to PC.

6. Swap Application Programming with 4 DOF Robot Arm by Interfacing to PC.

7. Pick and Place Application Programming with 5 DOF Robot Arm by Interfacing to PC.

8. Swap Application Programming with 5 DOF Robot Arm by Interfacing to PC.

9. Pick and Place Application Programming with 6 DOF Robot Arm by Interfacing to PC.

10. Swap Application Programming with 6 DOF Robot Arm by Interfacing to PC.

REQUIRED MATERIALS : Mechanical Tools with Tool Box,, IBM Compatible PCs-; 10 No, Interface Cables for Robot Structures.; Robot Platform. Walking Robot structure with Controller.BRAT Kit for Bipedal Robot. Simple HumanoidRobot-ROBONOVA-I.5 DOF Robot Arm withAccessories. 6 DOF Robot Arm withAccessories.

**Detailed Syllabus for M.Tech (CST spl. AI&R) Third Semester**

**MTCSTAIR31 Elective-V**

**SENSOR NETWORKS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, Errorcontrol, 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 ratecontrol

*TEXT BOOK:*

*References*

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005

2. Network Management Fundamentals, Alexender Clemn CISCIPress 2007

**MTCSTAIR31ELECTIVE-V**

**NATURAL LANGUAGE PROCESSING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction: Introduction to Natural Language Processing, Linguistic Background, Phases in Natural Language understanding, Spoken Language input and output Technologies, Written text input, Mathematical Methods, Statistical Modeling and Classification, Finite State Methods,

2. Grammars for Natural Language Processing, Parsing, Semantic and Logic Form, Ambiguity Resolution, SemanticInterpretation

3. Information Retrieval Architecture: Indexing, Storage, Compression Techniques, Retrieval Approaches,Evaluation,

4. Search Engines: Commercial Search Engine features, Comparison, Performance Measures, Document Processing, NLP Based Information Retrieval, InformationExtraction.

5. Text Mining: Categorization, Extraction Based Categorization, Clustering, Hierarchical Clustering, Document Clustering andRouting,

6. Finding and Organizing Answers from Text Search, Use of Categories and Clusters for Organizing Retrieval Results, Text Categorization and Efficient Summarization Using Lexical Chains, PatternExtraction

7. Generic Issues:Multilinguality, Multilingual Information Retrieval and Speech Processing, Multimodality, Text and Images, Modality Integration, Transmission and Storages, Speech coding, Evaluation of Systems, Human Factors and Acceptability

8. Applications: Machine Translation, transfer Metaphor, Interlingua and statistical Approaches, Discourse Processing, Dialog and Conversational agents, Natural Language Generation, Surface Realization and DiscoursePlanning

*Text Books:*

1. Speech and Language processing, Daniel Jurafsky and JamesH Martin, 2000, PrinticeHall

2. Foundations of Statistical Natural Language Processing, ChristopherD Manning HinrichSchutze, MITPress,1999

*References:*

1. Survey of the State of the art in Human Language Technology, Ron Cole, J. Martin, et.al, Cambridge UniversityPress

2. Survey of Text Mining, Clustering, Classifications and Retrieval, Michael W. Berry, Springer Verog,2003

3. Natural language understanding, James Allen, Benjaman/Cumings Publishing Co.

4. Information Storageand Retrieval systems, Gerald JKowalski and MarkT Maybury, Kulwer AcademicPublishers,2000

5. Natural Language Information retrieval, Tomek Strzalkowski, KulwerAcademic Publishers,1999

**MTCSAIR31 ELECTIVE-V**

**DEEP LEARNING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Machine Learning Basics: Learning Algorithms, Capacity, Overfitting, and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised and Unsupervised Learning algorithms, Stochastic Gradient Descent, Building a ML algorithm, Challenges and Motivation to Deep learning

2. Deep forward Networks: Learning XOR, Gradient -based Learning, Hidden Units, Architecture Design, Back-propagation and other Differentiation algorithms

3.Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as constrained Optimization, Regularization and under -constrained problems, dataset Augmentation, Noise robustness, semi-supervised learning, multitask learning, Early stopping, parameter tying and setting, sparse presentations, bagging and other ensemble methods, dropout, adversarial training, tangent distance, prop and manifold tangent classifier

4.Optimization for Training Deep Models: Difference between learning and pure optimization, Challenges in NN optimization, Basic algorithms, parameter Initialization strategies, Algorithms with adaptive learning rates, approximate second order methods, Optimization strategies and meta algorithms

5.Convolutional Networks: Convolution operation, Motivation, pooling, convolution and pooling as an infinitely strong prior, variants of basic convolution function, structured outputs, data types, efficient convolution algorithms, random or unsupervisedfeatures

6. Sequence Modeling: Recurrent and recursive nets: Unfolding computational graphs, recurrent neural networks, bidirectional RNNs, Encoder-decoder Sequece-to-sequence Architectures, Deep recurrent networks, recursive neural networks, challenge of long-term dependencies, echo state networks, leaky units and other strategies for multiple time scales, Long Short -term Memory (LSTM) and other gated RNNs

7. Practical methodology and applications: Performance metrics, default baseline models, determining whether to gather more data, selecting hyperparameters, debugging strategies, multi-digit number recognition, large scale deep learning, applications in computer vision and NLP

*Text Book:*

1. "Deep Learning", Ian Goodfellow, YoshuaBengio and Aaron Courville, published by MIT Press,UK, 2017 Series

2. Deep Learning with Keras: The Textbook by Antonio Gulli and Sujit Pal, Packt Publishing Ltd, Birmingham, UK, April 2017

*Reference Book:*

1. Deep Learning with TensorFlow, The Textbook by Giancarlo Zaccone, Md. Rezaul Karim, and Ahmed Menshawy, Packt Publishing Ltd, Birmingham, UK, April 2017.

**MTCSAIR32 OPEN ELECTIVE**

**BUSINESS ANALYTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit I: Business Analytics and Optimization: Introduction to Business Analytics and Optimization, Challenges - Volume, Variety (Diversity),and speed of Data Creation (and needed decisions), Approaches to help maximize profitabilityand returns, Business Analytics Capabilities, Enterprise Analytics Capabilities, BusinessAnalytics Technologies, Predictive Analytics, Prescriptive Analytics, A fact-based decisionmaking culture, A strong data infrastructure, The Right Analytical Tools, Analytics Workforce,Knowledge Requirements, Business Analyst, Data Scientist, Where to put the analytics team,IBM Business Analytics Maturity Model, Optimization, Key BAO Concepts, The need for BAOnow, Essential Capabilities In BAO, BAO Capabilities: Business Performance Management,Predictive Analysis and Mining, Value of BAO to Business Organization, Impact of BAO ondiverse industries, Advantages to implementing BAO solutions, BAO Capabilities: Real-timeAnalytics: Data In Motion, BAO support for decision-making, High level architecture of BAO,Importance of reference architecture, BAO reference architecture, BAO reference architecture toBAO architects, IBM Technology Portfolio for BAO.

Unit II: Data Warehouse: Decision Support, Three-Tier Decision Support Systems, Exploring and Analyzing Data, What isa data warehouse? Data warehouse architecture choices, Enterprise data warehouse, Independentdata mart architecture, Dependent data mart architecture, Data Warehouse, Data warehouseusage, Multidimensional Data, Conceptual Modeling of Data Warehouses, The ?Classic? StarSchema, The ?Snowflake? Schema, The ?Fact Constellation? Schema, Data Warehouse DesignProcess, Single-Layer Architecture, Two-Layer Architecture, Three-Tier Data WarehouseArchitecture, Data Warehouse Development, Multi-Tiered Architecture, Information pyramid,BI reporting tool architectures, Types of BI users, Multidimensional analysis techniques, DataAnalysis and OLAP, OLAP Server Architectures, Data Cube, Discovery-Driven Data Cubes,OLTP vs. OLAP, Business Query, Dashboards and Scorecards Development, Metadata Model,Automated Tasks and Events, Mobile BI, Disconnected BI, Collaborative BI, Real-timeMonitoring, Software Development Kit (SDK), Setting up data for BI, Making BI easy toconsume.

Unit III: Business Intelligence : Definitions of Business Intelligence, Sample BI Architecture, Things are getting more complex,BI Components and Architecture, Scope and fit of BI solutions within existing infrastructure,High Level BI Process, Functional Areas of BI Tool, A single or a few applications, Benefits ofBI, Maximize Value from BI Systems, Strategy and Business Intelligence, BusinessTransformation Projects, Business Role of BI (TWDI), ASUG Business Intelligence MaturityModel, Why Act? BI Effectiveness Scorecard, BI Value Scorecard, Five key areas of strategy,Planning a BI Project, Pre-Engagement Activities, Engagement Activities and process, BIDesign and Development, Business Environment, Project Tasks: Task 1- Knowledge CaptureGoals - Discuss Business Objectives & Prior Learning, Interview key stakeholders, ProjectPlanning, Task 2 - Consolidate Findings - Create logical design, Task 3 - Map the CustomerSituation - Current Environment, Business/Functional Requirements Sample Diagram, LogicalBI Diagram, Task 4 -Methodology & Approach, Task 5 - Standards & Governance, Task 6 -Sections, Milestones and Tasks, Task 7 – Proof of Concept (POC), Task 8 – Table Creation,Task 9 – OLAP Creation, Task 10 –Final Deliverables, Risk management and mitigation, Costjustification and measuring success.

Unit IV: Data Mining : Data Mining, Evolution of Data Mining, Knowledge-Based System,Data Mining Process, Phases of Data Mining Process, KDD Process Model, CRISP - DM,CRISP-DM - Elaborate view, Data Mining – On what kinds of Data? DM Tasks andComponents of DM methods, Data mining operations, Data mining techniques, Industryexamples of application of DM, Challenges of Data Mining, Why Machine should ?Learn??What is Machine Learning? Growth of Machine Learning, Machine Learning types,Unsupervised learning, Reinforcement Learning.

Unit V: Big Data Analytics : Big Data, Intrinsic Property of Data, A Growing Interconnected andInstrumental World, Need for Big Data, Characteristics of Big Data, Structure of Big Data andneed for standards, Big Data Analytics Adoption, Benefits & Barrier of Big Data Analytics,Trends for Big Data Analytics, Commoditization of Hardware Enabling New Analytics, the 5Key Big Data Use Cases, More Ways – Wide Ranging Analytics and Techniques, Big DataPlatform and Application Frameworks, A Big Data Platform Manifesto, Use Cases for a BigData Platform.

*Books:*

Introduction to Business Analytics (IBM ICE Publication)

**MTCSAIR32 OPEN ELECTIVE**

**OPERATIONS RESEARCH**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

UNIT I: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

UNIT II:Standard Form of LPP, Basic Feasible Solutions , Unrestricted Variables, Simplex Algorithm , Artificial Variables, Big M Me th od , Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method

UNIT III: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

UNIT IV: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

UNITV: Network Representation of A Project, CPM and PERT , Critical Path Calculations, Time – Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

UNIT VI: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

UNIT VII: Game Theory : Two Person Zero Sum Games , Mixed Strategy Games and Their Algorithms.

*TextBooks:*

1. Operations Research, KantiSwaroop, P.K. Gupta, Man Mohan, Sulthan Chand & Sons Education

2. OperationsResearch–AnIntroduction, HandyATaha–Pearson Education.

**MTCSAIR32 OPEN ELECTIVE**

**COST MANAGEMENT OF ENGINEERING PROJECTS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit 1: Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit 2 : Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit 3 : Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decisionmakingproblems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

Unit 4 : Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

*References:*

1. Charles T. Horngren, Srikant M. Datar, Cost Accounting A Managerial Emphasis, Pearson, 13th Edition, 2009.

2. Ahmed Riahi- Belkaoui., Advanced Management Accounting, Greenwood Publication Group, 2001.

3. Robert S Kaplan Anthony A. Alkinson, Management Accounting, Prentice Hall, 4th Edition, 2003.

4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher, 1998.

5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd., 2015.

**IVSEMESTER**

Code Name of the subject Periods/week/max.marks

Theory Ext Int total Credits

MTCSTAIR41 Dissertation-II - 100 - 100 16

Total 100 - 100 16

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 BINDINGSPECIFICATIONS: 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. PREPARATIONFORMAT: 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 Size12.

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 Appendix3.

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 thishead.

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 thishead.

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

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

\* Each chapter should be given an appropriatetitle.

\* Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they arecited.

\* 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 theyannotate.

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 centraltheme.

\* 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 pagealso.

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 quotedabove.

*REFERENCES:*

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

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

4. TYPING INSTRUCTIONS: The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style Times New Roman and Font size 12 and chapter headings and subheadings shall be font size 14 and bold.

**M.TECH. INFORMATIONTECHNOLOGY**

**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

Total 18 6 520 280 800 18

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

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

**IISEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTIT21 Web Systems & Technologies 3 - 70 30 100 3

MTCST22 Object Oriented Software Engineering 3 - 70 30 100 3

MTIT23 Elective-III 3 - 70 30 100 3

MTIT24 Elective-IV 3 - 70 30 100 3

MTCST25 Entrepreneurship (Audit Course) 3 - 70 30 100 0

MTCST26 OOSE Lab - 3 50 50 100 2

MTIT27 Web Programming Lab - 3 50 50 100 2

MTIT28 Mini Project With Seminar - 3 - 100 100 2

Total 15 9 450 350 800 18

Elective III: Cryptography & Network Security/Geo-Informatics/ Artificial Intelligence

Elective IV: Big Data Analytics/Mobile Computing/Soft Computing

**III SEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTIT31 Elective-V 3 - 70 30 100 3

MTIT32 Open Elective 3 - 70 30 100 3

MTIT33 Dissertation-I / Industrial project - 100 - 100 10

Total 6 - 240 60 300 16

Elective V: Business Intelligence/Internet of Things/ E-Commerce

Open Elective: GPS Applications/Operation Research/Bio-Informatics

**IVSEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTIT41 Dissertation - II - - 100 - 100 16

Total - - 100 - 100 16

**FIRST SEMESTER**

**DETAILED SYLLABUS FOR M.TECH (IT)**

**MTCST11 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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 theirapplications.

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 FreeGrammars.

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 CorrespondenceProblems

*Text books:*

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

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 (ThomsonNrools/Cole)

4. Cryptanalysis of number theoretic Cyphers, Samuel S. WagstaffJr.Champan& Hall/CRC Press2003.

5. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes –Ousley, Keith StrassbergTataMcGraw-Hill.

**MTCST12 ADVANCED DATA STRUCTURES**

**COMMON FOR M.TECH (CST, IT, AI&R, CN, CS&DA)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Heap Structures Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

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

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

4. Digital Search Structures Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

5. 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/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

2. Communication in Distributed Systems, Lay red Protocols, ATM networks, TheClient – sever model, Remote Procedure call, Group communication.

3. Synchronization in Distributed System, Clock Synchronization, MutualExclusion, Election algorithms, Atomic transactions, Deadlocks in DistributedSystems.

4. Process and processors in Distributed System threads, System Models,Processors allocation, Scheduling in Distributed System, Fault tolerance, Realtime Distributed System.

5. Distributed File Systems, Distributed File System Design, DistributedFile System implementation, Trends in Distributed File System.

6. Distributed Shared Memory, Introduction, What is Shared memory?,Consistency models, Page based Distributed Shared memory, Shared – variableDistributed Shared memory, Object based Distributed Shared Memory.

*TEXT BOOK:*

1. Distributed Operating Systems, Andrew S. Tanenbanm

*Reference Book:*

1. Advanced Concepts in Operating Systems, Makes Singhal and NiranjanG.Shivaratna.

**MTCST13 ELECTIVE-I**

**COMPUTER ORGANIZATIONAND ARCHITECTURE**

**COMMON FOR M.TECH (CST, IT)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 andDesign: 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/outputOrganization: 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, InternationalEdition1985.

*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 Aquantitative approach 3rd edition John L.Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier).

**MTCST13 ELECTIVE-I COMPUTER GRAPHICS**

**COMMON FOR M.TECH (CST, IT)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction: Computer Graphics and their applications: Computer Aided Design, Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Over view of Graphics systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Work stations, 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 scalelevels, 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 2DTransformations, 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, Super Quadrics, 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 Colormodel,

YIQ Color Model, CMY & HSV Colormodels. Desig nofanimation 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 & Practicein C, J.D.Foley, S.KFeiner, AVan Dam F.H John Pearson Education, 2004

3. Computer Graphic susing Open GL, Franscis S Hill Jr, Pearson Education, 2004.

4. Computer Vision and Image Processing: A Practical Approach using CVI Ptools, S. E.Umbaugh, Prentice Hall,1998

**MTCST 14 ELECTIVE-II**

**ADVANCED DATABASEMANAGEMENT SYSTEMS**

**COMMON FOR M.TECH (CST, IT, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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.

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.

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.

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.

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.

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, 3rd Edition 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 COMPUTER NETWORKS**

**COMMON FOR M.TECH (CST, IT, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 Transport Protocols, 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, Adhoc Networks, Mobile Adhoc Networks, Sensor Networks, Virtual Private Networks. Delay Tolerant Networks, IPv6

*Text Book:*

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

*References:*

1. Data Communications and Networking ,Behrouz A Forouzan , Tata McGraw-Hill Co Ltd, Second Edition,

2. Computer networks, Mayank Dave, CENGAGE.

3. Computer networks, A System Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier.

4. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.

5. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

**MTCST14 ELECTIVE-II EMBEDDEDSYSTEMS**

**COMMON FOR M.TECH (CST, IT & CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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 – InterruptLatency.

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

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

5. Message Queues – Mailboxes – Pipes – Timer Functions – Events – Memory Management – Interrupt Routines in RTOSEnvironment.

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

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

8. Testing on your Host Machine – Instruction Set Simulators – Laboratory Tools used forDebugging.

*Text Book:*

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

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

*Reference Book:*

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

**MTCST15 RESEARCH METHODOLOGY& IPR**

**COMMON FOR M. TECH (CST, IT, AI&R, CN, CS&DA)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Meaning of research problem, Sources of research problem, Criteria Characteristics 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

2. Effective literature studies approaches, analysis Plagiarism, Research ethics

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

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.

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

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 : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Organizationa lBehavior: Concept of Organization - Concept of Organizational Behavior - Nature of OrganizationalBehavior- Role of Organizationalbehavior - Disciplines contributing to OrganizationalBehavior.

2. 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.

3. Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

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

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

6. Organizational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganisational conflict - Conflict management.

7. Organizational Change: Nature - Factors inOrganizational 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, CSDA)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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 shortestpath problem.

13. Write Java programs that use recursive and non-recursive functions to traverse thegiven binary tree in a) Preorder b) Inorder c) Postorder.

14. Write Java programs for the implementation of Breadth First Search and Depth First Search for a given graph.

15. Write Java programs for implementing the following sorting methods: a) Bubble sort (b) Insertion sort (c) Quick sort (d) Merge sort (e) Heap sort f) Radix sort g) Binary tree 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. 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.

**MTCST18 ELECTIVE-II LAB**

**ADVANCED DATABASE MANAGEMENT SYSTEMS LAB**

**COMMON FOR M. TECH (CST, IT)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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?, 6th edition, Tata McGraw Hill, 2011

2. RamezElmasri, Shamkant B. Navathe, ?Fundamentals of Database Systems?, 4thEdition, Pearson/Addisionwesley, 2007

**MTCST18 ELECTIVE-II LAB COMPUTER NETWORKS LAB**

**COMMON FOR M. TECH (CST, IT)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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 scripton 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/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

PART- I: 1. Simple Assembly Program forAddition | Subtraction | Multiplication | Division

2. Operating Modes, System Calls and Interrupts, Loops, Branches

3. Write an Assembly programs to configure and control General Purpose Input/Output (GPIO) portpins.

4. Write an Assembly programs to read digital values from external peripherals and execute them with the Target board.

5. Program for reading and writing of a file

6. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment

7. Program to demonstrates a simple interrupt handler and setting up a timer

8. Program demonstrates setting up interrupt handlers. Press button to generate an interrupt and trace program flow with debug terminal.

9. Program to Interface 8 Bit LED and Switch Interface

10. Program to implement Buzzer Interface on IDE environment

11. Program to Displaying a message in a 2 line x 16 Characters LCD display and verify the result indebug terminal.

12. Program to demonstrate I2C Interface on IDE environment

13. Program to demonstrate I2C Interface – Serial EEPROM

14. Demonstration of Serial communication. Transmission from Kit and reception from PC using

15. Serial Port on IDE environment use debug terminal to trace the program.

16. Generation of PWM Signal

17. 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 intwo lines.

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 (IT)**

**MTIT21 WEB SYSTEMS & TECHNOLOGIES**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction:

HistoryoftheInternetandworldwidewebandHTML,BasicInternet Protocols-HTTP, SMTP,Pop3, Mime, IMAP, Introduction to scripting Languages -Java Scripts,ObjectbasedScriptingforthewebstructures,functions,arraysandObjects, DynamicHTMLwithJavaScript

2. DynamicHTML: Introductionto Objectreferences, DynamicStyle,Dynamic Position, Frames, Navigators, Event Models, On Check, On load, Mouse operations, Adding Shaddows, Creating Images, Creating Gradients, Creating Motion with Blur, Data binding,Sorting Tabledata, Bindingo fImages And Table.

3. IntroductiontoPHPProgramming: Introduction, Database Access with PHP, PHP Interpreters, Security Issues, File Handlingwith PHP, Working with HTML and DHTML, PHP UserAuthentication

4. Java Beans: Introduction toJava Beans,Advantages ofJavaBeans,BDK; Introspection, Using Bound properties, Bean InfoInterface, Constrained properties; Persistence, Customizes, Java Beans API, Introduction to EJB‘s.

5. Multimedia: AudioandVideoSpeech,SynthesisandRecognition,E-BusinessModels, Online Payments andSecurity, Web Servers, Client and Server side Scripting, AccessingWebservers,ApacheWebServer.

6. Database,ASPandXML: RDBMSModels,Overviewof SQL,ASP-WorkingofASP, objects, Session Tracking and Cookies, ADO, Accessing Data Base with ASP, Server side Active, XComponents, Web resources, XML-Documentty pedefinition, XMLSchemas, Document Object model, Presenting XML,Using XML Processors:D OMand SAX, Syntax of AJAX, Application Development using XM Land AJAX

7. ServletsandJSP: Introduction to Servelets: Servlet Overview Architecture, HTTP package, Handling Http Request & Responses, Using Cookies -Session Tracking, Security Issues, Multitier architecture, JSP Overview, JSP Processing. JSP Application Design with MVC Setting Up and JSPEnvironment:

8. JSP Application Development : Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing,Displaying ValuesUsingan Expression to Setan Attribute, Declaring Variables and Methods Erro rHandling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages, Sharing Session and Application Data– Memory Usage Considerations

*TEXT BOOKS :*

1. WebProgramming, building internet applications, 2/e, Chris Bates, Wiley Dreamtech

2. The complete Reference Java 2,5/e, Patrick Naughton, Herbert Schildt.TMH

3. Programming world wide web-Sebesta, PEA

*REFERENCE BOOKS :*

1. Internet,WorldWideWeb,Howtoprogram,Dietel,Nieto,PHI/PEA

2. Jakarta Struts Cook book,Bill Siggelkow,SPDO‘Reilly

3. WebTehnologies,2/e,Godbole,kahate,TMH,202,

4. An Introduction to web Design,Programming,Wang,Thomson

5. Web Applications Technologies Concepts-Knuckles, John Wiley

**MTCST22 OBJECT ORIENTED SOFTWARE ENGINEERING**

**COMMON FOR M. TECH (CST, IT)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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

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

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-MortemAnalysis.

7. Software Project Management: Introduction To Software Project Management, Activities Of Software Project Management, Structure Of Project Plan,SoftwareEngineering Teams, Software Cost Estimation, Project Scheduling, Tracking And Monitoring.

CASESTUDY 1. Simple Chat Instant MessagingSystem

2. GPS Based Automobile NavigationSystem

3. Waste Management Inspection Tracking System(WMITS)

4. Geographical InformationSystem

*Text Book:*

1. Object-Oriented Software Engineering Practical software developmentusing UML and Java by Timothy C. Lethbridge& Robert, LanganiereMcgraw-Hill

*References:*

1. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson EducationAsia.

2. Software Engineering: A Practitioner's Approach, Roger SPressman.

3. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A. Sykes, Addison-WesleyProfessional.

**MTIT23 ELECTIVE-III**

**CRYPTOGRAPHY& NETWORK SECURITY**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1 Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, ComputerSecurity Trends, Computer Security Strategy. Cryptographic Tools: Confidentiality wi t h Symmetric Encryption, Message Authentication and Hash Functions,Public-Key Encryption, Digital Signatures and Key Management, Random andPseudorandom Numbers, Practical Application: Encryption of Stored Data. User Authentication:Means of Authentication, Password-Based Authentication, Token-BasedAuthentication, Biometric Authentication, Remote User Authentication, Security Issues forUser Authentication, Practical Application: An Iris Biometric System, Case Study:Security Problems for ATMSystems.

2 Access Control: Access Control Principles, Subjects, Objects, and AccessRights, Discretionary Access Control, Example: UNIX File Access Control, Role-BasedAccess Control, Case Study: RBAC System for a Bank. Database Security: The Need forDatabase Security, Database Management Systems, Relational Databases, DatabaseAccess Control, Inference, Statistical Databases, Database Encryption, CloudSecurity.

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—Stealthing—Backdoors, Root kits,Countermeasures. Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks,Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector andAmplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to aDenial-of-Service Attack.

4 Intrusion Detection: Intruders, Intrusion Detection, Host-Based IntrusionDetection, Distributed Host-Based Intrusion Detection, Network-Based IntrusionDetection, Distributed Adaptive Intrusion Detection, Intrusion Detection ExchangeFormat, Honeypots, Example System: Snort. Firewalls and Intrusion Prevention Systems:The

Need for Firewalls, FirewallCharacteristics, Types of Firewalls, Fire wall Basing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.

5 Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Formsof Overflow Attacks, Software Security: Software Security Issues, Handling ProgramInput, Writing Safe Program Code, Interacting with the Operating System and OtherPrograms,Handling Program Output. Operating System Security: Introduction to OperatingSystem Security, System Security Planning, Operating Systems Hardening, ApplicationSecurity, Security Maintenance, Linux/Unix Security, Windows Security, VirtualizationSecurity.

6 Symmetric Encryption and Message Confidentiality: Symmetric EncryptionPrinciples, Data Encryption Standard, Advanced Encryption Standard, Stream Ciphers andRC4, Cipher Block Modes of Operation, Location of Symmetric Encryption Devices,Key Distribution. Public-Key Cryptography and Message Authentication: SecureHash Function, HMAC, TheRSA Public-Key Encryption Algorithm, Diffie-Hellman andOtherAsymmetricAlgorithms.

7 Internet Security Protocols and Standards: Secure E-mail and S/MIME, Domain Keys Identifie Mail, Secure SocketLayer (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 WirelessLAN Security.

*TextBook:*

1. Computer Security - Principles and Practices (Except the Chapters 13, 14, 15, 16, 17,18, 19), 2ndEdition 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, NewDelhi.

**MTIT23 ELECTIVE-III**

**GEO - INFORMATICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction: Definition of GIS and Related Terminology-Evolution of GIS-Components of GIS- Approaches to study of GIS Maps and GIS: Map Scale- Classes of maps-The mapping Process- Plane coordinate systems and Transformations- Geographic Coordinate System of Earth- Map Projection- Establishing a spatial framework for mapping Locations on Earth- Geo-referencing- Acquisition of Spatial Data for the terrain- Topographic Mapping-Attribute Data for Thematic Mapping

2. Digital Representation of Geographic Data: Technical Issues Pertaining to Digital Representation of Geographic Data-Database creation and management-Raster Geographic and Vector data representation-Object oriented Geographic Data representation-Relationship between Data representation and Data Analysis in GIS Data Quality and Data Standards: Concepts and Definitions of Data Quality-Components of Geographic Data Quality-Assessment of Data Quality- Managing Spatial Data Errors-Geographic Data Standards- Geographic Data Standards And GISDevelopment

3. Raster and Vector-Based GIS Data Processing: Acquiring and Handling Raster Data Processing Cartographic Modeling- Characteristics of Vector- Based GIS Data Processing Vector Data Input Functions Non-topological GIS Analysis Functions Feature-Based Topological Functions Layer-Based Topological Functions Vector-Based Output Functions ApplicationProgramming

4. Visualization of Geographic Information and Generation: Cartography in the Context of GIS-Human-Computer Interaction and GIS- Visualization of Geographic Information Principles of Cartographic Design in GIS-Generation of InformationProducts

5. Remote Sensing and GIS Integration: Principles of Electromagnetic Remote Sensing System Classifications-Imaging Characteristics of Remote Sensing Systems-Extraction of Metric Information from Remotely Sensed Images-Extraction of Thematic Information from Remotely Sensed Images- Integration of Remote Sensing andGIS

6. Digital Terrain Modeling: Definitions and Terminology Approaches to Digital Terrain-Data Sampling- Acquisition of Digital Terrain Data-Data Processing, Analysis, and Visualization- Applications of Digital TerrainModels.

7. Spatial Analysis and Modeling: Descriptive Statistics-Spatial Auto Correlation- Quadratic Counts and Nearest- Neighbor Analysis-Trend Surface Analysis-Gravity Models-Network Analysis-GISModeling

8. GIS Implementation and Project Management: Software Engineering as Applied to GIS-GIS Project Planning-Systems Analysis and User Requirements-Geographic Database Design Methodology-GIS Application Software Design Methodology-Systems Implementation and Technology Rollout-Systems Maintenance and Technical Support, GIS Issues and Prospects: Issues of Implementing GIS-The Trend of GIS-Development Frontiers ofGIS Research.

*Text Book:*

Concepts and Techniques of Geographic Information Systems, by C. P. Lo & Albert K. W. Yeung, Prentice Hall of India Ltd

*Reference Books:*

1) An Introduction to Geographical Information Systems, by Ian Heywood, Sarah Cornelium& Steve Carver, PearsonEducation

2) Introduction to Geographic Information Systems, by Kang-rsungChang, Tata McGraw Hill Publishing CompanyLimited

**MTIT23Elective-III**

**ARTIFICIAL INTELLIGENCE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

*ext 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

**MTIT24 Elective-IV**

**BIG DATA ANALYTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Getting Ready to Use R and Hadoop, Installing R, Installing R-Studio, Understanding the nature of R L anguage, 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 Rand Hadoop Introducing RHIPE, Installing RHIPE, Understanding thearchitecture of HIPE, Understanding RHIPE samples, Understanding the RHIPE function, Introducing RH adoop, Understanding the architecture of RHadoop, Understanding RH adoop examples, Understanding the RH adoopfunction reference

4. Using Hadoop Streaming with R Understanding the basics of Hadoopstreaming, 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 Introductionto 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 data base, Under standing MySQL, Understanding Excel, Understanding Mongo DB, Understanding SQLite, Understanding Postgre SQL, Understanding Hive, Understanding HBase.

*Text Book :*

1.Big Data Analytics with R and Hadoop By Vignesh Prajapati, Packt Publishing Ltd. (OpenSourcee-book available)

Reference Books:

1. Big Data Analytics By Venkat Ankam, Packt PublishingLtd.

2. Big Data Analytics Made Easy By Y.Lakshmi Prasad, NotionPress.

**MTIT24 Elective-IV**

**MOBILE COMPUTING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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

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

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

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

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

*Text Books:*

1. Mobile Computing - Technology Applications And Service Creation, Asoke K Talukder and RoopaR.Yavagal, TMH2006.

2. Mobile Cellular Communication, GottapuSasibhushanaRao,, Pearson Education, First Edition, 2013.

*Reference Books:*

1. Principles Of Computing, UweHansmann, LotherMerk, Martin S.Nicklous, Thomas Staber, 2ndEd., Springer International Edition.

2. Mobile Communications, J.Schiller, Addison-Wesley,2003

3. Stojmenovic And Cacute, ?Handbook Of Wireless Networks And Mobile Computing?,

**Wiley, MTIT24 Elective-IV**

**SOFT COMPUTING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, CN, CS&DA)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit -I : Basic Concepts of Management:Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management. ( Eight Periods)

Unit-II : Forms of Business Organizations: Introduction, Types of Businessorganizations: 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.( Eight periods)

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. (Ten periods)

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. (Six periods )

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. (Eight periods)

*Text Books:*

1. Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, KhannaPublishers, Delhi, 2000.

2. VasantDesai, 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 JagadeswaraRao, K., Entrepreneurship, Shree Publishing House, Guntur,

**MTIT27 WEB PROGRAMMINGLAB**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Identifying well known ports on a Remote System :By trying to listen to the various well known ports by opening client connections. If the exception does not occur then the remote port is active else the remote port is inactive.

2. Writing a Chat application: i). One-One: By opening socket connection and displaying what is written by one party to the other.

ii). Many-Many (Broad cast): Each client opens a socket connection to the chat server and writes tothesocket. Whatever is written by one party can be seen by all other parties.

3. Data retrieval from a Remote database: At the remote database a server listens for client connections. This server accepts SQL queries from the client, executes it on the database and sends the response to theclient.

4. MailClient: POP Client: Gives the server name,user name and password retrieve the mails and allow manipulation of mail box using POPcommands. SMTP Client:Gives the server name, send e-mail to the recipient using SMTPcommands-

5. Simulation of Telnet: Provide a user interface to contact well-known ports, so that client-serverinteraction can be seen by theuser..

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

7. Client server programming using servlets, ASP and JSP on the server side and java script on the client side

8. Web enabling ofdatabases

9. Multimedia effects on web pages design usingFlash.

*References*

1. Java Network Programming, Harol, OriellyPublications

2. An Introduction to Computer Networking, Kenneth C. Mansfield JrandJames L. Antonakos, Pearson EducationAsia

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

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

**MTCST26 OBJECT ORIENTED SOFTWARE ENGINEERINGLAB**

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

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. The purpose of the Software Engineering Lab course is to familiarize the students with modern software engineering methods and tools, Rational Products. The course is realized as a project-like assignment that can, in principle, by a team of three/four students working full time. Typically the assignments have been completed during the semester requiring approximately 60-80 hours from each projectteam.

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 designmethodology.

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 completedassignment

4. Term projects are projects that a group student or might take through from initial specification to implementation. The project deliverablesinclude Projects

\* Documentationincluding

\* A problemstatement

\* A requirementsdocument

\* A Requirements AnalysisDocument.

\* A System RequirementsSpecification.

\* A Software RequirementsSpecification.

\* A designdocument

\* A Software Design Description and a System DesignDocument.

\* A testspecification.

\* Manuals/guidesfor

\* Users and associated helpframes

\* Programmers

\* Administrators (installationinstructions)

\* A project plan and schedule setting out milestones, resource usage and estimatedcosts.

\* A quality plan setting out quality assuranceprocedures

\* Animplementation.

*Reference Books:*

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, PearsonEducation

2. Visual Modelling with Rational Rose 2002 and UML, Terry Quatrini, Pearson Edusction

3. UML2 Toolkit, Hans -Erik Eriksson, etc;Wiley

**Detailed Syllabus for M.Tech (IT) Third Semester**

**MTIT31 ELECTIVE-V BUSINESS INTELLIGENCE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

UNIT-I Introduction to Business Intelligence Types of digital data; Introduction to OLTP, OLAP and Data Mining; BI Definitions & Concepts; Business Applications of BI; BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities

UNIT-II Basics of Data Integration (Extraction Transformation Loading); Concepts of data integration; Need and advantages of using data integration; Introduction to common data integration approaches; Introduction to data quality, data profiling concepts and applications, Introduction to SSIS Architecture, Introduction to ETL using SSIS;

UNIT-III Data Warehouse and OLAP Technology – Definition, A Multidimensional Data Model, Concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema; Data Warehouse Architecture. Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling; Introduction to business metrics and KPIs; Introduction to enterprise reporting; Concepts of dashboards, balanced scorecards; Applications of Data mining and Case studies of BI

UNIT- IV Data Mining—On What Kind of Data? Data Mining Functionalities—What Kinds of Patterns Can Be Mined? Mining Association rules: Basic concepts, frequent item set mining methods. Definitions of classification, prediction and clustering;

UNIT-V Classification and Prediction - Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Prediction, Cluster Analysis - Types of Data in Cluster Analysis, Hierarchical Methods.

*TEXT BOOKS :*

1. R N Prasad and SeemaAcharya ?Fundamentals of Business Analytics?, Wiley-India, 2011Jiawei Han and MichelineKamber, ?Data Mining: Concepts and Techniques?, Morgan

2. Kaufmann Publishers, 2000 (ISBN: 1-55860-489-8). David Loshin, ?Business Intelligence -The Savvy Manager's Guide?, Morgan Kaufmann Publishers.

**MTIT31 ELECTIVE-VINTERNET OF THINGS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. 1.Introductiontotheinternetofthings.IoTArchitecture:HistoryofIoT,M2M–MachinetoMachine,WebofThings,IoT protocols The Architecture The Layering concepts,IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

2. Prototyping connected objects. Open-source prototypingplatforms.

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. Ubiquitouscomputing,applications of IOT,Virtualization of network resources and physical devices inIOT.

6. Internet of Things Standardisation 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

**MTIT31 Elective-V E-COMMERCE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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

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

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

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

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

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

*Text Books:*

Frontiers of Electronic Commerce, Kalakata and Whinston, Pearson.

*References*

1. E-Commerce fundamentals and Applications, Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, JohnWiley.

2. E-Commerce, S.Jaiswal,Galgotia.

3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.MichaelChang.

4. E-Commerce - Business, Technology and Society, Kenneth C.Taudon, Carol GuyericoTraver.

**MTIT32 OPEN ELECTIVE: GPS APPLICATIONS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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.

**MTIT32 OPEN ELECTIVE: OPERATION RESEARCH**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Overview of Operations Research, Types ofOR Models, Phases of Operations Research–

OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis,

2. Standard Formof LPP, Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, ArtificialVariables, Big M Method, Two Phase Simplex Method, Degeneracy,Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems AndTheirRelations, Dual Simplex Method

3. Transportation Problem as LPP, Initial Solutions, North West Corner Rule,LowestCost Method, VogelsApproximation Method, Optimum Solutions of TPP, Degeneracyin Transportation, Transportation Algorithms ,

4. Assignment Problem , Assignment Problem as LPP, Hungarian Method, Travelling SalesmanProblem, Solutions Of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-JobsK-MachinesProblems,Two-JobsM-MachineProblems,CrewSchedulingProblems

5. Network Representation of A Project, CPM and PERT, Critical Path Calculations, Time–Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis inNetworkScheduling.

6. Replacement Problems-Individual And Group Replacement Policy, Reliability & SystemFailure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With andWithout 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.

*TextBooks:*

1. Operations Research, KantiSwaroop, P.K. Gupta, Man Mohan, Sulthan Chand & Sons Education

2. PublishersOperationsResearch–AnIntroduction,HandyATahaPearson Education.

**MTIT32 OPEN ELECTIVE: BIO-INFORMATICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

Unit-1 Basic Biology: What is life? The unity and the diversity of living things. Prokaryotes and Eukaryotes, Yeast and People, Evolutionary time and relatedness, Living parts: Tissues, cells, compartments and organelles, Central dogma of molecular biology, Concept of DNA, RNA, Protein and metabolic pathway. What is Bioinformatics? Recent challenges in Bioinformatics.

Unit2 Biological databases: Their needs and challenges. Example of different biological databases – sequence, structure, function, micro-array, pathway, etc.

Unit-3 Sequence Analysis: Theory and Tools: -Pairwise alignment – Different local and global search alignment, Heuristic searches (like BLAST) applicable to search against database, Multiple alignment algorithms, Whole genome comparison.

Unit4 Walk through the genome: Prediction of regulatory motifs, Operon, Gene, splices site, etc.

Unit-5 Markov models: Hidden Markov models – The evaluation, decoding and estimation problem and the algorithms. Application in sequence analysis.

Unit-6 Molecular phylogeny: maximum Parsimony, distance Matrix and maximum likelihood methods. Concepts of adaptive evolution.

Unit-7 Application of graph theory in Biology: Biochemical Pathway, Protein-protein interaction network, Regulatory network and their analysis.

*Text Books:*

1. Bioinformatics: David Mount

2. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic acids, R. Durbin, S.R. Eddy, A. Krogh and G. Mitchison.

**IVSEMESTER**

Code Name of the subject Periods/week/max.marks

Theory Ext Int total Credits

MTIT41 Dissertation-II - 100 - 100 16

Total 100 - 100 16

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 BINDINGSPECIFICATIONS: 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. PREPARATIONFORMAT: 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 Size12.

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 Appendix3.

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 thishead.

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 thishead.

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

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

? Each chapter should be given an appropriatetitle.

? Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they arecited.

? 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 theyannotate.

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 centraltheme.

? 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 pagealso.

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 quotedabove.

*REFERENCES:*

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

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

4. TYPING INSTRUCTIONS: The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style Times New Roman and Font size 12 and chapter headings and subheadings shall be font size 14 and bold.

**CYBER SECURITY & DATA ANALYTICS**

**COMPUTER SCIENCE AND SYSTEMS ENGINEERING**

M.Tech Computer Science & Technology

With spl. in Cyber Security and Data Analytics

Course Structure and Scheme of Valuation w.e.f. 2019-2020

**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

MTCSDA13 Elective-I 3 - 70 30 100 3

MTCSDA14 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

MTCSDA18 Elective – II Lab - 3 50 50 100 2

Total 18 6 520 280 800 18

Elective-I: Data Warehousing & Descriptive Mining/ Principles of Data & System Security/Social Network Analysis

Elective II: Statistical Foundations of Analytics/Recommender Systems/Web Security

**II SEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTCSDA21 Malware Analysis 3 - 70 30 100 3

MTCSDA22 Bigdata Analytics 3 - 70 30 100 3

MTCSDA23 Elective-III 3 - 70 30 100 3

MTCSDA24 Elective-IV 3 - 70 30 100 3

MTCST25 Entrepreneurship (Audit Course) 3 - 70 30 100 0

MTCSDA26 Data Analytics Lab - 3 50 50 100 2

MTCSDA27 Cyber Security Lab - 3 50 50 100 2

MTCSDA28 Mini Project With Seminar - 3 - 100 100 2

Total 15 9 450 350 800 18

Elective III: Security in cloud computing/ Wireless Network Security / Incident Response & Cyber Forensics

Elective IV: Data Science/Soft computing/Machine Learning/Predictive Analytics

**M.Tech(CS&DA) III SEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTCSDA31 Elective-V 3 - 70 30 100 3

MTCSDS32 Open Elective 3 - 70 30 100 3

MTCSDA33 Dissertation-I / Industrial project - 100 - 100 10

Total 6 - 240 60 300 16

Elective-V: Deep Learning /IOT and its Security/ Network Security through Data Analytics /Intelligent Information Retrieval

Open Elective: GPS Applications/ Operations Research / Cost Management of Engineering Projects

**IV SEMESTER**

Code Name of the subject Periods/week Max.Marks Total Credits

Theory Lab Ext. Int.

MTCSDA41 Dissertation - II - - 100 - 100 16

Total - - 100 - 100 16

**FIRST SEMESTER**

**M.TECH CST WITH SPL. IN CYBER SECURITY AND DATA ANALYTICS**

**MTCST11 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**

**(common with M.Tech-CST, IT, AI&R, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, Primarily 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 andtheir 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 MachinesUniversal 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. Discrete Mathematical structures with application to Computer Science – J.P. Tremblay and R. Manohar.

3. 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. Introduction to Theory of Computation – Michael Sipser (Thomson Nrools/Cole)

3. Cryptanalysis of number theoretic Cyphers, Samuel S. WagstaffJr.Champan& Hall/CRC Press 2003

4. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes –Ousley, Keith Strassberg Tata McGraw-Hill.

**MTCST12 ADVANCED DATA STRUCTURES**

**(common with M.Tech-CST, IT, AI&R, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

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

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

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

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

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

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

*Text Book:*

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

2. Data Structures, Algorithms and Applications in C++, Sarta jSahni, McGraw-Hill International Edition

*Reference Books:*

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

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

**MTCSDA13 Elective-I**

**DATA WAREHOUSING & DESCRIPTIVE MINING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. INTRODUCTION TO DATA MINING: Kinds of data, Data mining functionalities, Technologies, Issues in Data Mining, Data Objects & Attribute types, Statistical Description of data, Measuring Data Similarity &Dissimilarity.

DATA PREPROCESSING: Overview, Data Cleaning, Data integration, Data Reduction, Data Transformation & Discretization.

2. DATAWAREHOUSINNG & OLAP: Basic Concepts, Data Warehouse Modeling, Data Warehouse Design & Usage, Data Warehouse Implementation, Data Generalization by Attribute Oriented Induction.

3. DATA CUBE TECHNOLOGY: Preliminary Concepts, Cube Materialization for Full cube, Iceberg Cube, Closed Cube and Cube Shell, General strategies for cube computation, Data Cube Computation Methods- Multiway array aggregation, BUC for Iceberg cubes, Star-Cubing using a dynamic star tree structure, Processing Advanced Kinds of Queries by Exploring Cube Technology.

4. MINING FREQUENT PATTERNS, ASSOCIATIONS, & CORRELATIONS: Basic Concepts, Frequent Itemset Mining Methods, A priori algorithm, generating association rules, improving efficiency of a priori, pattern-growth approach for mining frequent itemsets, mining frequent itemsets from vertical data format, mining closed and Maximal patterns.

5. ADVANCE PATTERN MINING: Pattern Evaluation Methods, strong rules are not necessarily interesting, association analysis with correlation analysis, comparison of pattern evaluation measures, Mining Multilevel Associations, Mining in Multi-Dimensional Space, Mining quantitative ARs, Mining rare patterns and negative patterns, Constraint -Based Frequent Pattern Mining, Mining High-Dimensional Data & Colossal Patterns

6. CLUSTER ANALYSIS: Cluster Analysis, Partitioning Methods-K-means, K-Medoids, Hierarchical Methods-Agglomerative versus divisive clustering , distance measures, BIRCH, Chameleon, Probabilistic algorithms, Density- Based Methods-DBSCAN, OPTICS.

7. ADVANCE CLUSTER ANALYSIS: Grid-Based Methods-STING, CLIQUE, Evaluation of Clustering, Probabilistic Model-Based Clustering, Fuzzy clusters, Expectation-maximization algorithm, Clustering High-Dimensional Data- problems, challenges, Methodologies, subspace clustering, Methods, Biclustering, Dimensionality reduction methods and spectral clustering.

*Text Book:*

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

2. Data Mining Techniques, A.K.Pujari, University Press Data mining concepts by Tan, Steinbech, and Vipin Kumar - Pearson Edu publishers

*References:*

1. Data Mining –Introductory and Advanced by Margarett Dunham -- Pearson Education publishers

2. Data Warehousing for Real –world by Sam Annahory-- Pearson Education publishers

**MTCSDA13 ELECTIVE-I**

**PRINCIPLES OF DATA & SYSTEM SECURITY**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Concepts of Security : Confidentiality, Containment, isolation, Privacy, Anonymity, psuedo- anonymity etc., Policy specification, User authentication, Session management, multi-level security, multi-lateral security

2. Security Mechanisms : Protection, Confinement, Isolation, Virtual machines, Non-interference Dealing with legacy code, Sandboxes, Separability, , Data caging

3. Access Control : Mandatory Access Control, Discrete Access Control, Principles of Least Privilege, Distributed Access Control, Role based Access, Attribute Based Access, Key Management, SPKI/SDSI Security Models for Information Systems Bell la Padua, Biba, Clark-Wilson, Lattice Model, Chinese Wall Model

4. Information Flow Models : Distributed Information Control, Secure OS based on IFC, Conference management systems like EasyChair, HotCrp…OS Security: Principles, Case studies of Operating Systems, secure OS like SELINUX Information Flow Models Distributed Information Control (DIFC), Conference management systems EasyChair, HotCrp, certification of programs Run-Time Monitoring Security Automata, Edit Automata, Shallow Automata

5. Information Risk Management: Concepts like Risk Acceptance, Risk Avoidance, Risk Avoidance, Risk Mitigation, Risk Handling Strategies and Risk Assessment Special Topics: Mobile phone security, Android Security, Cloud security, Security of Internet of Things (IoT)

*Text Books and Resources:*

1. Cryptography and Data Security, Dorothy Denning, Addison Wesley

2. Principles of Information Systems Security: text and cases Dhillon, Gurpreet. Wiley, 2007.

3. Introduction to Computer Security, Matt Bishop, Pearson Education Publishers

4. Information Risk Management: A Practitioner's Guide; David Sutton BCS Learning & Development Limited,2014

5. Security Engineering – Ross Anderson (2n Edition) –Papers/ chapters

**MTCSDA13 ELECTIVE-I**

**SOCIAL NETWORK ANALYSIS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction: Analyzing social web, tools used, Basics of network structure, representing social networks, different network structures and properties, describing nodes and edges with centrality, describing networks, degree distribution, density, connectivity, centralization

2. Network Visualization: graph layout grid layout, visualizating network features, scale issues Tie strength: measuring tie strength, tie strength and network structure, tie strength and network propagation

3. Trust: defining trust, naunces of trust, Measuring trust, trust in social media, inferring trust, network-based inference, similarity based trust inference Understanding Structure through user attributes and behavior: Analyzing attributes and behavior, analyzing content, identifying user roles

4. Building Networks: Modeling networks, Sampling methods, egocentric network analysis Entity Resolution and Link Prediction: Link prediction, Entity resolution, Incorporating network data, case study for link prediction and entity resolution

5. Propagation in Networks: Epidemic models, Threshold models, firefighter problem, stochastic models, applications of epidemic models to social media Community-Maintained Resources: Supporting technologies for community- maintained resources, Wikies, message boards, repositories, user motivations

6. Location-based Social Interaction: Location technology, mobile location sharing, location-based social media analysis, privacy and location -based social media Social Information Filtering: Social sharing and social filtering, automated recommender systems, case study of trusty based movie recommendations

7. Social Media in Public Sector: Analyzing public-sector social media, case studies of congressional use of twitter, predicting elections and astroturfing Privacy: Privacy policies and settings, aggregation and data mining, deanonymization, inferring data, data ownership and maintaining privacy online, respecting privacy in social media analysis

*Text Book:*

1. "Analyzing the Social Web", Jennifer Golbeck Morgan Kaufmann publishers

2. Social Network Data Analytics, Aggarwal, Charu C., Springer Edition

**MTCSDA14 ELECTIVE-II**

**STATISTICAL FOUNDATIONS OF ANALYTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Probability : Sample Space and Events, Probability, Independent events, Conditional probability, Bayes' theorem. Random variables, Distribution and Probability functions, Univariate distributions, Multivariate distributions. Expectation, Properties of Expectation, Variance and covariance, Expectation and variance of important random variables, Conditional expectation, Moment generating functions.

2. Statistical Inference : Parametric and Non Parametric Models, Fundamental concepts in inference, ( Point estimation, Interval estimation, Hypothesis testing) ,Parametric Inference, Methods of moments, Maximum Likelihood, The Delta Method, Multi-parameter Models, Hypothesis testing, Null and alternative hypothesis, test statistics, Type I and Type II Error, Level of significance, ANOVA, Test for goodness of fit, Non- parametric tests.

3. Bayesian Inference: The Bayesian Philosophy , The Bayesian Method, Functions of Parameters, Simulation, Large Sample Properties of Bayes? Procedures, Priors( Flats, Improper, and Noninformative), Multi parameter Problems, Bayesian Testing

4. Statistical Decision Theory: Comparing Risk Functions, Bayes Estimators, Minimax, Maximum Likelihood, Minimax, and Bayes, Admissibility, Stein?s Paradox.

5. Statistical Learning Supervised Learning: Linear Regression (simple), Least squares and maximum likelihood, Multiple regression, Logistic regression, Linear Discriminant Analysis, QR decomposition, Regularization and alternative regression methods(Ridge, Lasso). Unsupervised Learning: Principal Component Analysis, SVD, Tensor decomposition - Sparse linear algebra, Cluster methods.

*Text books*

1. All of Statistics: A Concise Course in Statistical Inference, Larry Wasserman, Published by Springer New York, ISBN: 978-1-4419-2322-6.

2. Statistical Methods Paperback – 2012 by S. P. Gupta

*Reference Books:*

1. The Elements of Statistical Learning - Data Mining, Inference and Prediction - 2nd Edition, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer Series in Statistics.

2. Statistical Data Analytics: Foundations for Data Mining, Informatics, and Knowledge Discovery, Walter W. Piegorsch, Wiley Publications, ISBN: 978-1-118-61965-0.

**MTCSDA14 Elective-II**

**RECOMMENDER SYSTEMS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Collabarative recommendations: User-based nearest neighbor recommendation, Item -based nearest neighbor recommendation, About ratings, Model-based and Preprocessing-based approaches, Recent practical approaches and Systems.

2. Content- based recommendation: Content representation and content similarity, Similarity-based retrieval, Other text classification methods.

3. Knowledge-based recommendation: Introduction ,Knowledge representation and reasoning, Interacting with constraint--based recommenders, Interacting with case-based recommenders, Example applications.

4. Hybrid recommendation approaches: Opportunities for hybridization ,Monolithic hybridization design, Parallelized hybridization design, Pipelined hybridization design.

5. Evaluating recommender systems: Introduction ,General properties of evaluation research, Popular evaluation designs, Evaluation on historical datasets, Alternate evaluation designs.

6. Attacks on collaborative recommender systems: A first example, Attack dimensions , Attack types, Evaluation of effectiveness and countermeasures, Counter measures, Privacy aspects - distributed collaborative filtering.

7. Online consumer decision making: Introduction , Context effects, Primacy/recency effects, Further effects, Personality and social psychology. Recommender systems and the next-generation web: Trust aware recommender systems, Folksonomies and more, Ontological filtering, Extracting semantics from the web.

*Prescribed Book:*

1. Recommender Systems: An Introduction by Dietmar Jannach, Markus Zanker, Alexander Felfernig, Gerhard Friedrich, CAMBRIDGE UNIVERSITY PRESS.

2. Recommender Systems: The Textbook by Charu C. Aggarwal, Springer Publications.

**MTCSDA14 ELECTIVE-II**

**WEB SECURITY**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Web security model : Browser security model including same-origin policy, Client-server trust boundaries, e.g., cannotrely on secure execution in the client

2. Session management, authentication: Single sign-on, HTTPS and certificates, Application vulnerabilities and defenses- SQL injection, XSS, CSRF

3. Client-side security : Cookies security policy, HTTP security extensions, e.g. HSTS, Plugins, extensions, and webapps, Web user tracking

4. Server-side security tools: E.g. Web Application Firewalls (WAFs) and fuzzers, Major Browser Attacks

*Text Book:*

1. Bryan and Vincent, “Web Application Security, A Beginners Guide”, McGraw-Hill, 2011

2. Web Security Basics, by Shweta Bhasin

**MTCST15 RESEARCH METHODOLOGY & IPR**

**(common with M.Tech-CST, IT, AI&R, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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

2. Effective literature studies approaches, analysis Plagiarism, Research ethics

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

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.

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

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 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 with M.Tech-CST, IT, AI&R, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Organizational Behavior: Concept of Organization - Concept of Organizational Behavior - Nature of Organizational Behavior- Role of Organizational behavior - Disciplines contributing to Organizational Behavior.

2. 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.

3. Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

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

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

6. Organizational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganisational conflict - Conflict management.

7. 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 with M.Tech-CST, IT, AI&R, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

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 Breadth First Search and Depth First Search for a given graph.

15. Write Java programs for implementing the following sorting methods: a) Bubble sort (b) Insertion sort (c) Quick sort (d) Merge sort (e) Heap sort f) Radix sort g) Binary tree 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, Universities Press.

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. 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 to Program P.J.Deitel and H.M.Deitel , 8th edition, PHI.

**MTCSDA18 ELECTIVE-II LAB: RECOMMENDER SYSTEMS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

Goal: To understand Recommender process and build Recommendation Engine Dataset: MovieLens 100k Implementation of following list of experiments with R programming

1. Loading the dataset; Loading the dataset in R; Characteristics of the dataset; Loading the dataset using package recommender lab in R

2. Estimating similarity; Similarity between user-user and item-item; User defined function for similarity estimation.;Similarity estimation using built in functions

3. Data analysis; Rating distribution; Count number of ratings available for each movie.; Visualizing average movie ratings; Count number of ratings given by each user; Visualizing average user ratings;Top-N movies list

4. Generation of train set and test set from dataset

5. Building User based Collaborative Filtering Engine; Generation of Top-N Movie List; Evaluating the recommender Engine

6. Building Item-based Collaborative Filtering Engine; Generation of Top-N Movie List; Evaluating the recommender Engine

7. Building Content based recommender Engine

8. Dimensionality reduction using Principal Components Analysis (PCA); PCA based recommender Engine; Rating prediction using the Top-K principal components

9. Dimensionality reduction using Singular Value Decomposition (SVD); SVD based recommender Engine; Characterize users and items using SVD; Rating prediction using SVD; Regularized SVD

10. Attacks in Recommender System; Detecting shilling profiles by clustering user profiles

**MTCSDA18 ELECTIVE-II LAB: WEB SECURITY**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

LAB Exercises: Cycle 1:

1. Learn about SQL injection attacks, XSS, XSRF and Security issues of web browsers in detail.

2. Visit OWASP and learn more about web based vulnerabilities.

3. Learn about Metaspoilt frame work and any scanning tools(Nmapetc).

Cycle 2:

1. Using Nmap scan all Live ports in a network and identify them.

2. Load Kali Linux using VMWare and using metaspoilt try to establish a session/connection between your system and any other system in the network.

3. Find ways to exploit the SQL injection vulnerabilities, demonstrate the damage that can be achieved by the attack, and master the techniques that can help defend against such type of attacks.

**SECOND SEMESTER**

**M.TECH- CST WITH SPL. IN CYBER SECURITY AND DATA A NALYTICS**

**MTCSDA21 MALWARE ANALYSIS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. INTRODUCTION: Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.

2. STATIC ANALYSIS: X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine.

3. DYNAMIC ANALYSIS: Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark.

4. Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

5. Malware Detection Techniques: Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences.

6. Intro to Kernel – Kernel basics, Windows Kernel API, Windows Drivers, Kernel Debugging - Rootkit Techniques- Hooking, Patching, Kernel Object Manipulation, Rootkit Anti-forensics

*TEXT BOOK:*

1. Michael Sikorski and Andrew Honig, “ Practical Malware Analysis”, No Starch Press, 2012

2. Learning Malware Analysis: Explore the Concepts, Tools, and Techniques to Analyze and Investigate Windows Malware by Monnappa K A

*REFERENCES*

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel”, Addison-Wesley, 2005

2. Hacking exposed™ malware & rootkits: malware & rootkits security secrets & Solutions by Michael Davis, Sean Bodmer, Aaron Lemasters, McGraw-Hill, ISBN: 978-0-07-159119-5, 2010

**MTCSDA22 BIG DATA ANALYTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Getting Ready to Use R and Hadoop Installing R, Installing RStudio , Understanding the features of R language, Installing Hadoop, Understanding Hadoop features, Learning the HDFS and MapReduce architecture, Understanding Hadoop subprojects.

2. Writing Hadoop MapReduce Programs Understanding the basics of MapReduce, Introducing Hadoop MapReduce, Understanding the Hadoop MapReduce fundamentals, Writing a Hadoop

MapReduce example, Learning the different ways to write Hadoop MapReduce in R . 3. Integrating R and Hadoop Introducing RHIPE, Installing RHIPE, Understanding thearchitecture of RHIPE, Understanding RHIPE samples, Understanding the RHIPE function, Introducing RHadoop, Understanding the architecture of RHadoop, Understanding RHadoop examples, Understanding the RHadoop 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 thefrequency 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 database , Understanding MySQL, Understanding Excel, Understanding MongoDB, Understanding SQLite, Understanding PostgreSQL, Understanding Hive, Understanding HBase .

*Text Book :*

1. Big Data Analytics with R and Hadoop By VigneshPrajapati, Packt Publishing Ltd.(Open Source e-book available)

*Reference Books:*

1. Big Data Analytics By Venkat Ankam, Packt Publishing Ltd.

2. Big Data Analytics Made Easy By Y. Lakshmi Prasad, Notion Press.

3. Big Data Analytics: Disruptive Technologies for Changing the Game, Dr. ArvindSathi,, First Edition October 2012, IBM Corporation

4. Mining of Massive Datasets, Anand Rajarama, Jure Leskovec, Jeffrey D. Ullman.E-book, 2013

**MTCSDA23 ELECTIVE-III SECURITY IN CLOUD COMPUTING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. INTRODUCTION : Mind the Gap, The Evolution of Cloud Computing

2. WHAT IS CLOUD COMPUTING: Cloud Computing Defined ,The SPI Framework for Cloud Computing ,The Traditional Software Model ,The Cloud Services Delivery Model ,Cloud Deployment Models ,Key Driversto Adopting the Cloud ,The Impact of Cloud Computing on Users ,Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

3. INFRASTRUCTURE SECURITY: Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level

4. DATA SECURITY AND STORAGE: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security

5. IDENTITY AND ACCESS MANAGEMENT: Trust Boundaries and IAM, need of IAM, IAM Challenges, IAM Definitions ,IAM Architecture and Practice , Getting Ready for the Cloud, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management ,Cloud Service Provider IAM Practice

6. SECURITY MANAGEMENT IN THE CLOUD : Security Management Standards, Security Management in the Cloud , Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management

*Text Book:*

1. Cloud Security and Privacy, by Tim Mather, Subra Kumaraswamy, and ShahedLatif , Publishedby O?Reilly Media, Inc.

*Reference Book:*

1. Cloud Security: A Comprehensive Guide to Secure Cloud Computing , Ronald L. Krutz, RusselDean Vines ,John Wiley & Sons, 31-Aug-2010

2. Cloud Computing Security: Foundations and Challenges , John R. Vacca CRC Press, 19-Sep- 2016

**MTCSDA23 ELECTIVE-III WIRELESS NETWORK SECURITY**

1. Overview of Wireless LAN physical components, Wireless LAN topologies and technologies - 802.11 a/b/g/n/ac Features

2. Understanding, Building and Configuring Wireless Networks, Configure and install wireless adapters, access points, bridges and antennas

3. Security Features of 802.11,WirelessWEP, WPA1 and WPA2, PSK Authentication, TKIP Encryption and AES-CCMP Encryption, Enterprise Wireless Security, IEEE.11, Enterprise Wireless Security Devices (Thin Access Point) Wireless VLANs

4. Security threats and vulnerabilities in Wireless networks, Vulnerabilities of IEEE.11 Security, MAC Address Filtering Weaknesses

5. hacking Personal Wireless Security, WEP, WPA1 and WPA2 ,Caffe Latte Attack Basics, Caffe Latte Attack Demo ,KoreksChopchop Attack, Fragmentation And HirteAttack, Cracking PEAP Hotspot Attacks, Hacking Isolated Clients

*References:*

1. 802.11 Wireless Networks: The Definitive Guide by Matthew Gast, O'Reilly Media

2. BackTrack 5 Wireless Penetration Testing Beginner's Guide by Vivek Ramachandran

3. Next Generation Wireless LANs: 802.11n and 802.11ac by Eldad Perahia and Robert Stacey, Cambridge University Press

4. Controller-Based Wireless LAN Fundamentals: An end-to-end reference guide to design, deploy, manage, and secure 802.11 wireless networks by Jeff Smith, Jake Woodhams, Robert Marg, Cisco press

5. Hacking Exposed Wireless, Third Edition: Wireless Security Secrets & Solutions by Joshua Wright , Johnny Cache, McGraw Hill

**MTCSDA23 ELECTIVE-III**

**INCIDENT RESPONSE & CYBER FORENSICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Real World Incidents, IR Management Handbook, Pre-incident preparation, forensic fundamentals, Wireshark fundamentals, capturing packets

2. Getting the investigation started, developing Leads, Discovering Scope

3. Live Data Collection, Forensic Duplication, Network Evidence: device data, packets data, Evidence acquisition and collection, Enterprise services

4. Analysis Methodology, Investigating Applications, Analysis of Network evidence, system memory, system storage - forensic imaging

5. Investigating Windows systems

6. Malware handling, static and dynamic analysis, incident tracking and writing reports, Remediation plans with case study.

7. Threat intelligence: Overview, methodology, direction, sources, platforms, usage.

*References*

1. Incident Response & Computer Forensics, Kevin Mandia, Mathew Pepe, Jason Luttgens , Third Edition, Oreilly 2014

2. Digital Forensics and Incidence Response, Gerard Johansen, Packt Publishing, 2017

3. Wireshark for Security Professionals, Jessy Bullock and Jeff T. parker, First Edition, Wiley

**MTCSDA24 ELECTIVE-IV DATA SCIENCE**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. INTRODUCTION TO DATA SCIENCE : Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL.

2. MODELING METHODS : Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.

3. INTRODUCTION TO R: Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.

4. MAP REDUCE :Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing HadoopMap Reduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting- Reducing phase execution.

5. DELIVERING RESULTS: Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph - using graphics parameters. Case studies.

*REFERENCES*

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.

2. Jure Leskovec, AnandRajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014.

3. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley &Sons, Inc., 2012.

4. W. N. Venables, D. M. Smith and the R Core Team, “An Introduction to R”, 2013.

5. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, AbhijitDasgupta, “Practical DataScienceCookbook”, Packt Publishing Ltd., 2014.

6. Nathan Yau, “Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics”, Wiley, 2011.

7. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”,Wiley, ISBN: 9788126551071, 2015.

8. http://www.johndcook.com/R\_language\_for\_programmers.html

9. http://bigdatauniversity.com/

10. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction

**MTCSDA24 ELECTIVE-IV SOFT COMPUTING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction to Intelligent systems and Soft Computing: Intelligent Systems, Knowledge based Systems, Knowledge representation and Processing, Soft Computing

2. Fundamentals of Fuzzy logic systems: 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 logic Control: Basics of fuzzy control, Defuzzification, Fuzzification, fuzzy control surface, Fuzzy control architectures, Properties of fuzzy control, robustness and stability

4. Fundamentals of Artificial Neural networks: Learning and acquisition of knowledge, features of ANN, topologies, learning algorithms, Fundamentals of Connectionist Modeling

5. Major classes of Neural networks: Multi-layer perceptron, RBF networks, Kohonen's self organising networks, Hopfield networks, Industrial and commercial applications of ANN

6. Neuro-fuzzy Systems: Architectures of neuro-fuzzy systems, cooperative neuro-fuzzy systems, Hybrid neuro-fuzzy systems, construction of neuro-fuzzy systems, structure identification and parameter learning phases

7. Evolutionary Computing: 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

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

*Reference Book:*

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

**MTCSDA24 ELECTIVE-IV MACHINE LEARNING**

1. Introduction to Machine Learning, Applications of Machine learning, Supervisory Learning: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms

2. Bayesian Decision Theory: Classification, losses and risks, discriminant functions, utility theory, value of information, Bayesian networks, Influence diagrams, Association rules, Parametric Methods: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures

3. Multivariate methods: Multivariate data, parameter estimation, missing value imputation, univariate normal distribution and classification, discrete features, regression, Dimensionality Reduction: Subset selection, PCA, Factor Analysis, multi-dimensional scaling, LDA

4. Clustering: Mixture densities, K-means clustering, Expectation Maximization algorithm, mixtures of Latent Variable Models, Supervised learning after clustering, Hierarchical clustering, choosing number of clusters

5. Non-parametric methods: Non-parametric methods density estimation, generalisation to multivariate data, nonparametric classification, condensed nearest neighbors, non-parametricregression: smoothing models, choosing smoothing parameters

6. Decision trees and Linear Discrimination: Univariate classification and regression trees, ruleextraction from trees, Multivariate trees, Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic discrimination for binary and multi-class problems, discrimination by regression, Support vector machines, optimal separating hyperplane, kernel functions for non-separable spaces, SVM for regression.

7. Hidden Markov Models: Discrete Markov processes, Hidden Markov Models, Three basic problems of HMM, Evaluation problem, finding the state sequence, Learning model parameters, continuous observations, Model selectioninHMMAssessing and comparing classification Algorithms: Cross-validation and resampling methods, measuring error, interval estimation,hypothesis testing, assessing performance of a classifier, comparing two classification algorithms, comparing multiple classification algorithms based on variance

*Text Book:*

Introduction to Machine Learning by Ethem Alpaydin, Prentice-Hall of India, 2006

*Reference books:*

1. Machine Learning, Tom Mitchell , McGraw Hill, 1997

2. Pattern Classification, Richard 0. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc., 2001

**MTCSDA24 ELECTIVE-IV PREDICTIVE ANALYTICS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. CLASSIFICATION:BASIC CONCEPTS : Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to improve Classification Accuracy.

2. CLASSIFICATION:ADVANCED CONCEPTS:- Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners, Other Classification Methods, Accuracy and Error Measures.

3. MINING STREAM, TIME- SERIES, AND SEQUENCE DATA: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases.

4. GRAPH MINING: Introduction, Methods for Mining Frequent Subgraphs, Mining Variant and Constrained Substructure Patterns, Applications.

5. SPATIAL DATA MINING: Spatial Data Cube Construction and Spatial OLAP, Mining Spatial Association and Co-location Patterns, Spatial Clustering Methods, Spatial Classification and Spatial Trend Analysis, Mining Raster Databases.

6. MULTIMEDIA DATA MINING: Similarity Search in Multimedia Data, Multidimensional Analysis of Multimedia Data, Classification and Prediction Analysis of Multimedia Data, Mining Associations in Multimedia Data, Audio and Video Data Mining.

7. TEXT MINING: Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Text Mining Approaches.

8. MINING THE WORLD WIDE WEB: Mining the Web Page Layout Structure, Mining the Web's Link Structure to Identify Authoritative Web Pages, Mining Multimedia Data on the Web, Automatic Classification of Web Documents, Web Usage Mining.

*Text Book:*

1. Data Mining- Concepts and Techniques by JiaweiHan, and Micheline Kamber–Morgan Kaufmann publishers –--2nd edition

*Reference Book:*

1. Data Mining: Introductory and Advanced by Margerett Dunham, Pearson Education

**MTCST25 ENTREPRENEURSHIP (AUDIT COURSE)**

**(common with M.Tech-CST, IT, AI&R, CN)**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 0

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. 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;

2. 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.

3. 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.

4. 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.

5. 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, KhannaPublishers, Delhi, 2000.

2. VasantDesai ,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 JagadeswaraRao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

**MTCSDA26 DATA ANALYTICS LAB**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

Module-I: R language scripts for Demonstration of Logistic regression and evaluation of the Model development using Weka for predictive analytics including classification, forcasting, etc. R language scripts for development of models for predictive analytics and performance evaluation

Module-II: Experiments on Bigdata handling in Hadoop eco system

**MTCSDA27 CYBER SECURITY LAB**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 50 Marks External : 50 MarksTotal : 100 Marks

Module-1: The students will be exposed to different types of attack scenarios and hacking tools with respect to security. Open source tools will be used for the implementation of the lab experiments

Module-II : The students will be exposed to different case studies of cyber-attacks and using open source Cyber Forensic tools they will examine the case.

**THIRD SEMESTER**

**M.TECH CST WITH SPL. IN CYBER SECURITY AND DATA ANALYTICS**

**MTCSDA31 ELECTIVE-V DEEP LEARNING**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Machine Learning Basics: Learning Algorithms, Capacity, Overfitting, and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised and Unsupervised Learning algorithms, Stochastic Gradient Descent, Building a ML algorithm, Challenges and Motivation to Deep learning

2. Deep forward Networks: Learning XOR, Gradient -based Learning, Hidden Units, Architecture Design, Back-propagation and other Differentiation algorithms

3. Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as constrained Optimization, Regularization and under -constrained problems, dataset Augmentation, Noise robustness, semi-supervised learning, multitask learning, Early stopping, parameter tying and setting, sparse presentations, bagging and other ensemble methods, dropout, adversarial training, tangent distance, prop and manifold tangent classifier

4. Optimization for Training Deep Models: Difference between learning and pure optimization, Challenges in NN optimization, Basic algorithms, parameter Initialization strategies, Algorithms with adaptive learning rates, approximate second order methods, Optimization strategies and meta algorithms

5. Convolutional Networks: Convolution operation, Motivation, pooling, convolution and pooling as an infinitely strong prior, variants of basic convolution function, structured outputs, datatypes, efficient convolution algorithms, random or unsupervised features

6. Sequence Modeling: Recurrent and recursive nets: Unfolding computational graphs, recurrent neural networks, bidirectional RNNs, Encoder-decoder Sequence-to-sequence Architectures, Deep recurrent networks, recursive neural networks, challenge of long-term dependencies, echo state networks, leaky units and other strategies for multiple time scales, Long Short -term Memory (LSTM) and other gated RNNs

7. Practical methodology and applications: Performance metrics, default baseline models, determining whether to gather more data, selecting hyperparameters, debugging strategies, multi-digit number recognition, large scale deep learning, applications in computer vision and NLP

*Text Book:*

1. "Deep Learning", Ian Goodfellow, YoshuaBengio and Aaron Courville, published by MIT Press,UK, 2017 Series

2. Deep Learning with Keras: The Textbook by Antonio Gulli and Sujit Pal, PacktPublishing Ltd, Birmingham, UK, April 2017

*Reference Book:*

1. Deep Learning with TensorFlow, The Textbook by Giancarlo Zaccone, Md. Rezaul

Karim, and Ahmed Menshawy, Packt Publishing Ltd, Birmingham, UK, April 2017.

**MTCSDA31 ELECTIVE-V IOT AND ITS SECURITY**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction of IoT Domains of IoT, M2M vsIoT,M2M to IoT; M2M to IoT - A Market Perspective; M2M to IoT - An Architectural Overview; M2M and IoT-Technology Fundamentals, Management of IoT

2. IoT Communication Protocols: NFC, RFID, Zigbee; MIPI, M-PHY; UniPro, SPMI, SPI, M-PCIe; Wired vs. Wireless communication, GSM, CDMA, LTE, GPRS, small cell; Vulnerabilities and Risks associated with Protocols

3. IoT Platforms: Hardware, SoC, sensors, device drivers, IoT standards; Cloud computing for IoT; Bluetooth, Bluetooth Low Energy, beacons

4. Community Impact of IoT: Federal, State, and Local Municipalities

5. Security and Privacy Risks, Implications of IoT on various systems: Brand Damage, Loss of Trust, Intellectual Property Theft, Data Leakage

6. Threat Actors: Sophisticated Actors, Insider Threat, Attack Patterns, Targeted Attacks; Collateral Damage Risk, Social Engineering and Phishing, Remote Access; Vulnerability Landscape; Extensive Vendor Vulnerabilities; Patterns in IoT,

7. Network Vulnerabilities: Boundary protection, Information flow enforcement, Remote access, Least privilege, Physical access control, Security function isolation. Implementing a Risk-Based IoT Security Program: Assess, Inventory Assets, Map Network, Document Remote Access, Implementation, Network Segmentation, Harden Systems, Control Remote Access, Log all access, Monitor, Document Policies and Procedures, Training, Lifecycle.

8. Data Analytics using IoT Tools for IoT, Making Things Smart: Getting Things onto the Internet, IoT in Home, Cities/Transportation, Retail, Healthcare, Sports

*References:*

1. “Learning Internet of Things” by Peter Waher, Packt publisher

2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases by Anupama C. Raman and Pethuru Raj

3. “Practical Internet of Things Security” by Brian Russell, Drew Van Duren, Packt publisher

4. “Raspberry Pi with Java: Programming the Internet of Things (IoT)” by James L. Weaver and Stephen Chin, OraclePress

5. “The Internet of Things (The MIT Press Essential Knowledge series)”, By Samuel Greengard

6. “The Silent Intelligence: The Internet of Things”, by Daniel Kellmereit and Daniel Obodovski

**MTCSDA31 ELECTIVE-V**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 2

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Organizing data and Sensors: Domain, Vantage, Actions, and different types validity, attacker issues, understanding sensor placement in networks, network layers and addressing, validity challenges from middlebox network data, Sensors in Network Domain: Packet and frame formats, NetFlow. Data collection via IDS, Improving IDS performance, Middlebox Logs and their impact

2. Data and Sensors in Service Domain: Logfiles as the basis for Service data, accessing and manipulating Logfiles, Contents of Logfiles, Representative Logfile formats, SMTP, Additional Useful Logfiles, Logfiles Transport: transfers, Syslog and Message Queues

3. Data and Sensors in the Host and Active Domains: Host from network's view, network interfaces, Host tracking identity, Filesystem, Historical data, HIPS and AV, Discovery, assessmenst and maintenance in active domain, Discovery with ping, traceroute, netcat, and Half of nmap, Assessment with nmap, a Bunch of Clients and a Lot of Repositories, Vantage data for Verification

4. Exploratory Data Anaysis and Visualization: Goal of EDA, EDA workflow, Univariate visualization, BivariateDescription, Multivariate visualization, Fitting and Estimation

5. Analyzing Text and Fumbling: Text Encoding, Basic Skills, Techniques for Text Analytics, Fumbling: Misconfiguration, Automation and Scanning, Identifying Fumbling, Fumbling at service level, Detecting and Analyzing Fumbling

6. Network Traffic Volume, Timing and Structure: Workday and its impact on network traffic volume, Beaconing, File Transfers/ Raiding, Locality, Applying Volume and Locality Analysis, Graph attributes, Labeling, weight and paths, Components and Connectivity, Clustering Coefficient, Analyzing graphs, Component analysis for an alarm, Using centrality analysis and breadth-first searches for forensics and engineering,

7. Insider Threat and Threat Intelligence: Insider threat Versus other classes of attacks, Avoiding Toxicity, Modes of attacks, Insider Threat Data: Logistics and Collection, Defining Threat Intelligence, Creating a threat intelligence program- indentify goals, starting with free sources, determining data output, purchasing sources, prerequisites for creating threat intelligence.

*Text book:*

1. "Network Security through Data Analysis-from Data to Action", Michael Collins, published by O'Reilly in 2017

2. Network Security, by NehaGhai, Published by SK Kataria and Sons

*Reference Books:*

1. "Data-Driven Security- Analysis, Visualization and Dashboards", Jay Jacobs and Bob Rudis, published by John Wiley.

**MTCSDA31 ELECTIVE-V INTELLIGENT INFORMATION RETRIEVAL**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction and Modeling:

Information Versus Data Retrieval, Basic concepts, Retrieval process, A Taxonomy of Information Retrieval Models, Retrieval: Adhoc and Filtering, Formal Characterization of IR Model, Classic Information Retrieval Basic Concepts, Alternative Set Theoretic Models Fuzzy set, Alternative Algebraic Models Alternative Probabilistic Models Bayesian Networks, Structured Text Retrieval Models, Model Based on Non Overlapping Lists, Models for Browsing

2. Retrieval Evaluation and Query Languages: Retrieval Performance Evaluation, Recall and Precision, Alternative Measures Reference Collections, Query Languages: Keyword Based Querying, Pattern Matching, Structural Queries Fixed Structure, Query Protocols, Trends and Research Issues

3. Query Operations: User Relevance Feedback, Query Expansion and Term Reweighting for the Vector Model, Query Expansion and Term Reweighting for the Probabilistic model, A variant of Probabilistic Term Reweighting, Evaluation of Relevance Feedback Strategies, Automatic Local Analysis, Automatic Global Analysis, Trends and Research Issues.

4. Text and Multimedia Languages and Properties Metadata, Text, Formats, Information Theory, Modeling Natural Language, Similarity Models, Markup Languages: SGML, HTML, XML, Multimedia: Formats, Textual Images, Graphic and Virtual Reality, Hy Time, Trends and Research Issues.

5. Text Operations Document Preprocessing, Lexical Analysis of the Text, Elimination of stop words, Stemming, Index Terms Selection, Thesauri, Document Clustering, Text Compression: Motivation Basic Concepts ,Statistical Methods, Dictionary Methods ,Inverted File Compression, Comparing Text Compression Techniques

6. Indexing and Searching: Inverted Files, Other Indices for Text: Suffix Trees and Suffix Arrays, Signature Files, Boolean Queries, Sequential Searching, Pattern Matching: String Matching Allowing Errors, Regular Expressions and Extended Patterns, Pattern Matching Using Indices, Structural Queries, Compression: Sequential Searching Compressed Indices

7. Searching The Web Challenges, Characterizing the Web: Measuring the Web, Modeling the Web, Search Engines: Centralized and Distributed Architecture, User Interfaces, Ranking, Crawling the Web, Indices, Browsing: Web Directories, Combing Searching with Browsing, Helpful Tools, Metasearchers, Finding the Needle in the Haystack:User Problems, Some Examples, Teaching the User, Searching using Hyperlinks: Web Query Languages, Dynamic Search and Software Agents

*Text Book:*

1. Modern Information Retrieval by RichrdoBaeza -Yates and BerthierRibeiro\_Net, Pearson Education Publishers

2. Information Process and Retrieval, C.K. Sharma & A.K. Sharma, Atlantic Publishers

**MTCSDA32 OPEN ELECTIVE: GPS APPLICATIONS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. History evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites. GPS configuration: Space segment, Control segment, and User segment, GPS working principle.

2. RINEX format, Satellite orbital parameters, GPS observables, basic equations for finding user position, user position estimation using Least Squares estimator and Kalman Filter.

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

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

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.

6. GPS time, GPS Error sources, error correction models, ionospheric effects on GPS signals.

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, NewDelhi, 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, ArtechHouse, 685 Canton Street, Norwood, MA 02062, 2009.

2. James Ba – Yen Tsui, „Fundamentals of GPS receivers – A software approach?, JohnWiley&Sons(2001).

3. B.Hoffmann-Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

**MTCSDA32 OPEN ELECTIVE: OPERATIONS RESEARCH**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

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, BigM Me th od , 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. Non Linear Programming, Dynamic Programming, Recursive Nature of Dynamic Programming, Forward and Backward Recursion, Solutions of LPP As Dynamic Programming Technique, Integer Programming, Branch and Bound Algorithms, Cutting Plane Algorithm,

8. Introduction To Simulation, Simulation Models, Event Type Simulations, Generation of Random Numbers, Monte-Carle Simulation, Simulation Of Networks; Two Person Zero Sum Games, Mixed Strategy Games and Their Algorithms.

*TextBooks:*

1. Operations Research, Kanti Swaroop, P.K. Gupta, Man Mohan, Sulthan Chand& Sons Education

2. PublishersOperationsResearch–AnIntroduction,HandyATaha–PearsonEducation.

**MTCSDA32 OPEN ELECTIVE**

**COST MANAGEMENT OF ENGINEERING PROJECTS**

Instruction : 3 Periods/weekTime: 3 HoursCredits : 3

Internal : 30 Marks External : 70 MarksTotal : 100 Marks

1. Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

2. Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

3. Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

4. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

*References:*

1. Charles T. Horngren, Srikant M. Datar, Cost Accounting A Managerial Emphasis, Pearson, 13th Edition, 2009.

2. Ahmed Riahi- Belkaoui., Advanced Management Accounting, Greenwood Publication Group, 2001.

3. Robert S Kaplan Anthony A. Alkinson, Management Accounting, Prentice Hall, 4th Edition, 2003.

4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher, 1998.

5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd., 2015.

**FOURTH SEMESTER**

**M.TECH CST WITH SPL. IN CYBER SECURITY AND DATA ANALYTICS**

**MTCSDA41 Dissertation-II**

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

**IVSEMESTER**

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.

3.2 Abstract – Abstract should be one page synopsis of the project report typed one and half line spacing

3.3 p, Font Style Times New Roman and Font Size12.

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 roject report is given in Appendix3.

3.5 List of Tables – The list should use exactly the same captions as they appear above the tables in

3.6 the text. One and a half spacing should be adopted for typing the matter under this head.

3.7 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.

3.8 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.

3.9 Chapters

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

\* Each chapter should be given an appropriate title.

\* Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.

\* Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page, which refers to the material they annotate.

3.10 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.

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

*REFERENCES:*

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

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

4. TYPING INSTRUCTIONS: The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style Times New Roman and Font size 12 and chapter headings and subheadings shall be font size 14   
and bold.