POST GRADUATE DEGREE COURSE

M.TECH

IN

COMPUTER SCIENCE AND TECHNOLOGY

[W.E.F. 2024-25]

Department of Computer Science and Systems Engineering

Andhra University College of Engineering (A)

Andhra University

Visakhapatnam-530003

M.Tech - Computer Science and Technology

Scheme of Valuation w.e.f. 2024-25 AB

1st year I SEMESTER

Code	Name of the subject	Periods/week		Max.Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST 11	Mathematical Foundations of Computer Science	3	-	70	30	100	3
MTCST 12	Advanced Data Structures	3	-	70	30	100	3
MTCST 13	Elective-I	3	-	70	30	100	3
MTCST 14	Elective-II	3	-	70	30	100	3
MTCST 15	Research Methodology & IPR	3	-	70	30	100	2
MTCST 16	Organizational Behavior (Audit Course)	3	-	70	30	100	0
MTCST 17	Advanced Data Structures Lab -		3	50	50	100	2
MTCST 18	Elective – II Lab		3	50	50	100	2
	Total	**18**	**6**	**520**	**280**	**800**	**18**

Elective-I: Distributed Operating Systems/Artificial Intelligence/ Cloud Computing
Elective-II: Advanced Database Management Systems/Computer Networks//Embedded Systems

M.Tech - Computer Science and Technology

Scheme of Valuation w.e.f. 2024-25 AB

1st Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST 21	Machine Learning	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 22	Object Oriented Software Engineering	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 23	Elective-III	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 24	Elective-IV	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 25	Entrepreneurship (Audit Course)	**3**	**-**	**70**	**30**	**100**	**0**
MTCST 26	OOSE Lab	**-**	**3**	**50**	**50**	**100**	**2**
MTCST 27	Machine Learning Lab	**-**	**3**	**50**	**50**	**100**	**2**
MTCST 28	Integrating Design Thinking Into Innovation Engineering	**-**	**3**	**-**	**100**	**100**	**2**
Total		**15**	**9**	**450**	**350**	**800**	**18**

Elective III: Data Science / Cryptography & Network Security / Image Processing

Elective IV: Full Stack Development / Mobile Computing/Soft Computing

M.Tech - Computer Science and Technology

Scheme of Valuation w.e.f. 2024-25 AB

2nd Year I SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST 31	Elective-V	3	-	70	30	100	3
MTCST 32	Open Elective	3	-	70	30	100	3
MTCST 33	Dissertation-I/ Industrial project		-	100	-	100	10
Total		**6**	**-**	**240**	**60**	**300**	**16**

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

Open Elective: GPS Applications/Human Computer Interaction/4G – 5G Mobile Communication Networks

M.Tech - Computer Science and Technology

Scheme of Valuation w.e.f. 2024-25 AB

2nd Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST 41	Dissertation - II	-	-	100	-	100	16
	Total	**-**	**-**	**100**	**-**	**100**	**16**

MTCST11
M.Tech (CST) First Semester
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
Common for M. Tech (CST, IT)

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

Course Objectives:

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- To introduce the students to number theory and its applications.
- To introduce the concepts of Finite automata and the various languages associated with it.
- To introduce deterministic, non deterministic and theoretical model approaches in Computer science.

Course Outcomes: At the end of the course, student will be able to

- Apply mathematical foundations algorithmic principles to design computational systems
- Analyze and solve practical computing problems using basic number theory and finite automata concepts.
- Analyze the Regular expressions and determine the types of languages generated by them.
- Apply the theoretical concepts in present day computer science applications.

Syllabus

UNIT-I

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

UNIT-II

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

UNIT-III

Number theory: Introduction, 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.

UNIT-IV

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 Vs Regular Languages and their applications.

UNIT-V

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.

UNIT-VI

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

UNIT-VII

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 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

M.Tech (CST) First Semester

ADVANCED DATA STRUCTURES

Common for M. Tech (CST, IT)

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

Course Objectives:

- The fundamental design, analysis, and implementation of basic data structures.
- Basic concepts in the specification and analysis of programs.
- Principles for good program design, especially the uses of data abstraction.
- Significance of algorithms in the computer field 5. Various aspects of algorithm development

Course Outcomes:

- Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
- Master a variety of advanced abstract data type (ADT) and data structures and their implementations.
- Master different algorithm design techniques (brute‐force, divide and conquer, greedy, etc
- Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

Syllabus

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, Mehta, 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

M.Tech (CST) First Semester

DISTRIBUTED OPERATING SYSTEMS

Common for M.Tech (CST, IT)

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

Course Objectives:

- To provide hardware and software issues in modern distributed systems
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
- To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.

Course Outcomes:

- To provide hardware and software issues in modern distributed systems.
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
- To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.
- To know about Shared Memory Techniques.

Syllabus

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

UNIT-II
Communication in Distributed Systems, Lay red Protocols, ATM networks, The Client – server model, Remote Procedure call, Group communication.

UNIT-III
Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

UNIT-IV
Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real-time Distributed System.

UNIT-V
Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

UNIT-VI

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

TEXT BOOK:

Distributed Operating Systems, Andrew S. Tanenbanm

Reference Book:

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

MTCST13
Elective-I
M.Tech (CST) First Semester
ARTIFICIAL INTELLIGENCE
Common for M.Tech (CST, IT)

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

Course Objectives:

- Gain a historical perspective of Artificial Intelligence (AI) and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
- Explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcomes:

At the end of the course, student will be able to

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Solve problems with uncertain information using Bayesian approaches.

Syllabus

UNIT-I

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, Uninformed 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.

UNIT-II

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, Overview of Prolog, Production System usingProlog

UNIT-III

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;.

UNIT-IV

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

UNIT-V

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

UNIT-VI

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

UNIT-VII

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

Text Book:

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

References:

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

MTCST13
Elective-I
M.Tech (CST) First Semester
CLOUD COMPUTING
Common for M.Tech (CST, IT,AIML)

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

Course Objectives:

- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build a Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

Course Outcomes:

At the end of the course, student will be able to

- Interpret the key dimensions of the challenge of Cloud Computing
- Examine the economics, financial, and technological implications for selecting cloud computing for your own organization.
- Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
- Evaluate own organizations' needs for capacity building and training in cloud computing- related IT areas. Illustrate Virtualization for Data-Center Automation.

Syllabus

UNIT-I

Introduction: Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing. **Parallel and Distributed Systems:** Introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

UNIT-II

Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing,

UNIT-III

Cloud Computing : Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research.

UNIT-IV

Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades,

UNIT-V

Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling.

UNIT-VI

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2), **Cloud Security:** Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

UNIT-VII

Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1), **Google:** Google App Engine, Google Web Toolkit (Text Book 2), **Microsoft:** Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book2).

Text Books:

1.Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
2.Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter,TMH

Reference Book:

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi,TMH

MTCST14
Elective-II
Advanced Database Management Systems
Common for M.Tech (CST, IT)

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

Course Objectives:

The students should have an

- Understanding of database design and knowledge of object based databases
- Understanding of Query processing and query optimization
- Understanding of different database system architectures
- Knowledge of different types of databases and their applications.

Course Outcomes:

At the end of the course the students will have the ability to:

- Apply functionality and Normalization in databases.
- Recognize and fetch data from object oriented, parallel and distributed databases.
- Use XML and understand the concepts of parallel systems.
- Implement advanced concepts of database in different applications

Syllabus

UNIT-I

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-II

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-III

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-IV

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-V

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-VI

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. Silberschatz, Korth, Sudershan,―Database System Concepts‖, Tata MCGraw 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, 3rdEdition 2004
3. N.TamerOzsu, Patrick Valduriez, ―Principles of Distributed Database Systems‖, Prentice Hal International Inc., 1999
4. Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian,“ Advanced Database Systems”, Morgan Kaufman Series, 1997

MTCST14

ELECTIVE-II

COMPUTER NETWORKS

Common for M.Tech (CST, IT)

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

Course Objectives:

The students will

1. Learn the basics of computer networks.
2. Understand the design principles and various layers in computer networks
3. Understand the different protocols and architectures of network protocols in networks
4. Understand the various security issues in network protocols

Course Outcomes:

At the end of the course, the student will have

1. Knowledge on the concepts of Computer Networks and different Transmission Media.
2. Ability to differentiate and know various protocols which play a major role in providing Computer Networks.
3. Knowledge on various protocol layers and architectures of network protocols.
4. Knowledge on various security issues in network protocols.

Syllabus

UNIT-I

Introduction to Computer Networks: Introduction, Network Hardware, Network Software, OSI and TCP/IP Reference Models

UNIT-II

Data Communications: Transmission Media, Wireless Transmission, Transmission in ISDN, BroadBand ISDN , ATM Networks,

UNIT-III

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.

UNIT-IV

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.

UNIT-V

Internet Transport Protocols: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols

UNIT-VI

Overview of: DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols

UNIT-VII

Overview 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.

UNIT-VIII

Overview of Advanced Concepts in Networks: Cellular Networks, AdhocNetworks, Mobile Adhoc Networks, Sensor Networks, Virtual Private Networks. Delay Tolerant Networks, IPv6

Text Book:

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

References:

1. Data Communications and Networking ,Behrouz A Forouzan , Tata McGraw-Hill Co Ltd, Second Edition,
2. Computer networks, Mayank Dave, CENGAGE.
3. Computer networks, A System Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier.
4. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
5. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

MTCST14

Elective-II

EMBEDDED SYSTEMS

Common for M.Tech (CST, IT)

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

Course Objectives:

- To study the basics of embedded systems and its examples.
- To study the 8051 Microcontroller architecture and its instruction set.
- To discuss various software architectures in embedded systems.
- To discuss Inter Task Communication procedures in RTOS and design issues of RTOS.
- To study various embedded software development tools and debugging techniques.

Course Outcomes:

- Student will understand the basic architecture of 8051 microcontroller.
- ability to write ALP programs using 8051 instruction set.
- Ability to understand the concepts related to RTOS and its Inter Task Communication.
- Ability to understand various design issues of RTOS.
- Understand about embedded software development tools

Syllabus

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

UNIT-VI

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

UNIT-VII

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

UNIT-VIII

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

Text Book:

1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.
2. An Embedded Software Primer, David E. Simon, Pearson Education ,2005.

Reference Book:

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

MTCST15
RESEARCH METHODOLOGY AND IPR
Common for M.Tech (CST, IT, CN&IS, AI&ML)

Instruction:3 Periods/week	**Time:3 Hours**	**Credits:2**
Internal:30 Marks	**External:70 Marks**	**Total: 100 Marks**

Course Objectives:

- To give an overview of the research methodology and explain the technique of defining a research Problem.
- To learn the importance of literature survey and understand the theoretical and conceptual frameworks.
- To know the various research designs and different data collection methods.
- To explain various forms of the intellectual property and its rights, its relevance and business impact in the changing global business environment.

Course Outcomes:

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem.
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs and their characteristics.
- Analyze and Understand the concepts of Intellectual property rights, patents and Designing.

Syllabus

UNIT-I

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

UNIT-II

Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT-III

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-IV

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

UNIT-V

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

UNIT-VI

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, 2ndEdition, ―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&IS, AI&ML)

Instruction:3 Periods/week	**Time:3 Hours**	**Credits:0**
Internal:30 Marks	**External:70 Marks**	**Total: 100 Marks**

Course Objectives:

This course deals with human behavior in organizations:

1. To learn Conceptual frameworks, case discussions.
2. To learn skill-oriented activities applied to course topics which include: motivation, learning and development, group dynamics, leadership, communication, power and influence,
3. change, diversity, organizational design, and culture.
4. To learn Class sessions and assignments are intended to help participants acquire skills and analytic concepts to improve organizational relationships and effectiveness.

Course Outcomes:

At the end of the course the student will be able to:

1. Explain the importance & role of management in the business organizations.
2. Analyze knowledge on the importance of planning and organizing.
3. Identify various leadership styles and their suitability to the situation.
4. Apply organizational behavior theories and concepts to individual work experiences.
5. Know how to work more effectively in a team environment.

Syllabus

UNIT-I

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

UNIT-II

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

UNIT–III

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

UNIT-IV

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

UNIT-V

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

UNIT-VI

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

UNIT-VII

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

Text Books.

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

Reference Books.

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

MTCST17
ADVANCED DATA STRUCTURES LAB
Common for M. Tech (CST, IT)

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

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

Course Objectives:

- To demonstrate the Graph traversal techniques.
- To make students learn the concepts of iterative and recursive algorithms.
- To impart knowledge on Dictionaries using hashing techniques.
- To demonstrate the basic operations on AVL tree, B-tree and Binary heap.
- To enable the students to learn about B-tree and B+-tree operations.

Course Outcomes:

At the end of the course student will be able to:

- Identify the appropriate data structure for a given problem.
- Implement a Dictionary by using hashing techniques.
- Analyze various basic operations of AVL tree, B-tree to improve the efficiency.
- Build a Binary Heap using Priority queues
- Apply the concepts in various domains such as DBMS, compiler construction etc.

Syllabus

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) In order c) Post order.

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 the 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 framework, W.J.Collins, McGraw Hill. 8 Java: the complete reference, 7th All edition, Herbert Schildt, TMH
8. 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/week **Time:3 Hours** **Credits: 3**
Internal:30 Marks **External:70 Marks** **Total: 100 Marks**

Course Objectives:

- Knowledge of database design
- A general understanding of database, design and dependency
- Understanding of different types of databases 4 Knowledge of databases on the internet
- Application on enhanced database

Course Outcomes:

At the end of the course the students should be able to:

- Basic knowledge and understanding of ER diagram and UML class diagram.
- Ability to apply functionality and Normalization in relational databases.
- Recognize and fetch data from object oriented, parallel and distributed databases.
- Use XML and understand unstructured data 5 Implement concept and deduction of enhanced database on different applications

Syllabus

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/Addison Wesley, 2007

MTCST18
Elective II Lab
COMPUTER NETWORKS LAB
Common for M.Tech (CST, IT)

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

Course Objectives:

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes

Course Outcomes:

- Identify and use various networking components Understand different transmission media and design cables for establishing a network
- Implement any topology using network devices
- Analyze performance of various communication protocols.
- Compare routing algorithms
- Understand the TCP/IP configuration for Windows and Linux

Syllabus

Network Programming

1. Socket Programming

a. TCP Sockets

b. UDP Sockets

c. Applications using Sockets

2. Simulation of Sliding Window Protocol

3. Simulation of Routing Protocols

4. RPC

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

Web Programming

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

Reference Books:

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

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

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

Course Objectives:

- To introduce basics of electronics and reading electronics diagrams
- To introduce students to basics of Arduino programming language and IDE
- Assembly language program using 8051
- Interfacing 8051 Microprocessor
- embedded system design using msp430

Course Outcomes:

At the end of this course, students will:

- Learn the basics of electronics, including reading schematics (electronics diagrams) and how to prototype circuits with a breadboard.
- Learn the Arduino programming language and IDE
- Acquire knowledge on how to program basic Arduino/ RASPBERRY Pi/8051/MSP430 using assembler language or C language.
- students able to learn how to build prototype models and interfacing various sensor to Arduino/ RASPBERRY Pi/8051/MSP430

Syllabus

PART- I:

1. Simple Assembly Program for
   Addition | Subtraction | Multiplication | Division
   Operating Modes, System Calls and Interrupts, Loops, Branches
2. Write an Assembly program to configure and control General Purpose Input/Output (GPIO) port pins.
3. Write an Assembly program 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 IDE environment
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 in the debug 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 the IDE environment uses a debug terminal to trace the program.
15. Generation of PWM Signal
16. Program to demonstrate SD-MMC Card Interface.

PART- II:

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

1. Create an application that creates two tasks that wait on a timer whilst the main task loops.
2. Write an application that creates a task which is scheduled when a button is pressed, which illustrates the use of an event set between an ISR and a task
3. Write an application that Demonstrates the interruptible ISRs(Requires timer to have higher priority than external interrupt button)
4. a).Write an application to Test message queues and memory blocks. b).Write an application to Test byte queues
5. Write an application that creates two tasks of the same priority and sets the time slice period to illustrate time slicing. Interfacing Programs:
6. Write an application that creates a two task to Blinking two different LEDs at different timings
7. Write an application that creates a two task displaying two different messages in LCD display in two 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.

M.Tech - Computer Science and Technology

Scheme of Valuation w.e.f. 2024-25 AB

1st Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST 21	Machine Learning	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 22	Object Oriented Software Engineering	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 23	Elective-III	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 24	Elective-IV	**3**	**-**	**70**	**30**	**100**	**3**
MTCST 25	Entrepreneurship (Audit Course)	**3**	**-**	**70**	**30**	**100**	**0**
MTCST 26	OOSE Lab	**-**	**3**	**50**	**50**	**100**	**2**
MTCST 27	Machine Learning Lab	**-**	**3**	**50**	**50**	**100**	**2**
MTCST 28	Integrating Design Thinking Into Innovation Engineering	**-**	**3**	**-**	**100**	**100**	**2**
Total		**15**	**9**	**450**	**350**	**800**	**18**

Elective-III: Data Science/Cryptography & Network Security/Image Processing

Elective-IV: Full Stack Development/Mobile Computing/Soft Computing

SECOND SEMESTER
MTCST21
MACHINE LEARNING
Common for M.Tech (CST, AI&ML)

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

Course Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes:

After completing this course, the student will be able to

- Appreciate the importance of visualization in the data analytics solution.
- Apply structured thinking to unstructured problems.
- Understand a very broad collection of machine learning algorithms and problems.
- Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory.
- Develop an appreciation for what is involved in learning from data.

Syllabus

UNIT-I

Introduction: Introduction to Machine Learning, learning task- illustration, Approaches to Machine Learning, Machine Learning algorithms- Theory, Experiment in biology and Psychology.

UNIT-II

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, success criteria

UNIT-III

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 active queries

UNIT-IV

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 in ANN.

UNIT-V

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-based Reasoning

UNIT-VI

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.

UNIT-VII

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

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,

MTCST22
OBJECT ORIENTED SOFTWARE ENGINEERING
Common for M.Tech (CST, IT)

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

Course Objectives: The students would be able to

- Learn the concepts of Object Oriented software engineering and software process models.
- Understand requirements engineering processes, Unified Modeling Language and its notations and diagrams.
- Understand various architectural styles,the software process and project management activities.
- Understand various types of testing and quality assurance issues.

Course Outcomes: At the end of the course the students will have the:

- Knowledge of best practices of Object Oriented software engineering and will be able apply various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.
- Ability to analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project.
- Ability to create various design models for a software system to meet the user needs.
- Knowledge on various types of testing and software process in the development of a software product.

Syllabus

UNIT-I

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 Release Model, The Spiral Model, Evolutionary Model, The Concurrent Engineering Model

UNIT-II

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.

UNIT-III

Unified Modeling Language & Use Case Modeling: Introduction To UML, Modeling Concepts, Types Of UML Diagrams With Examples; User-Centered 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.

UNIT-IV

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

UNIT-V

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

UNIT-VI

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

UNIT-VII

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.

UNIT-VIII

CASE STUDY: Simple Chat Instant Messaging System, GPS Based AutomobileNavigation System, Waste Management Inspection Tracking System(WMITS), Geographical Information System

Text Book:

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

References:

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

MTCST 23
Elective-III
DATA SCIENCE

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

Course Objectives:

From the course the student will learn

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- Learn to statistically analyze a dataset;

Course Outcomes:

At the end of the course, student will be able to

- Describe what Data Science is and the skill sets needed to be a data scientist
- Explain in basic terms what Statistical Inference means. Identify probability distributions commonly used as foundations for statistical modeling. Fit a model to data
- Use R to carry out basic statistical modeling and analysis
- Apply basic tools (plots, graphs, summary statistics) to carry out EDA Describe the Data Science Process and how its components interact.

Syllabus

UNIT-I

Introduction: The Ascendance of Data, Motivating Hypothetical: Data Sciencester, Finding Key Connectors, The Zen of Python, Getting Python, Virtual Environments, Whitespace Formatting, Modules, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries defaultdict, Counters, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object-Oriented Programming, Iterables and Generators, Randomness, Regular Expressions, Functional Programming, zip and Argument Unpacking, args and kwargs, Type Annotations, Type Annotations.

UNIT-II

Visualizing Data: matplotlib, Bar Charts, Line Charts, Scatterplots. Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation.

UNIT-III

Gradient Descent: The Idea Behind Gradient Descent, Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent.
Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs,

UNIT-IV

Working with Data: Exploring Your Data Using Named Tuples Data classes, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

UNIT-V

Machine Learning: Modeling, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, Naive Bayes, Simple Linear Regression, Multiple Regression, Digression, Logistic Regression Support Vector Machines, Decision Trees

UNIT-VI

Neural Networks: Perceptrons, Feed-Forward Neural Networks, Backpropagation. Clustering: The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering. Recommender Systems: Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization

UNIT-VII

Data Ethics, Building Bad Data Products, Trading Off Accuracy and Fairness, Collaboration, Interpretability, recommendations, Biased Data, Data Protection IPython, Mathematics, NumPy, pandas, scikit-learn, Visualization, R Up Hierarchical Clustering.

Text books:

1. Joel Grus, "Data Science From Scratch", OReilly.
2. Allen B.Downey, "Think Stats", OReilly.

Reference Books:

1. Doing Data Science: Straight Talk From The Frontline, 1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013.
2. Mining of Massive Datasets, 2nd Edition, Jure Leskovek, AnandRajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014.
3. "The Art of Data Science", 1st Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
4. "Algorithms for Data Science", 1st Edition, Steele, Brian, Chandler, John, Reddy, Swarna, Springer's Publications, 2016.

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MTCST 23
Elective-III
Cryptography & Network Security

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

Course Objectives:

1. Introduction of the issues in network security- its need and importance, taxonomy and terminology.
2. Discussion of various cryptographic techniques.
3. Exploration of different types of security threats and remedies.
4. Understanding of Internet security protocols and standards.

Course Outcomes:

1 Realize the need and importance of network and data security in the Internet and in distributed environments.
2 Identify the different types of network security issues and their remedies.
3 Application of various cryptographic tools and techniques in different contexts and as per need of security levels.
4 Implementation of some Internet security protocols and standards

Syllabus

UNIT-I

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

UNIT-II

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.

UNIT-III

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—Steal thing—Backdoors, Root kits, Counter measures.
Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of- Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack.

UNIT-IV

Intrusion Detection: Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Distributed Adaptive Intrusion Detection, Intrusion Detection Exchange Format, Honey pots, Example System: Snort. Firewalls and IntrusionPreventionSystems:TheNeedforFirewalls,FirewallCharacteristics,TypesofFirewalls,FirewallBasing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.

UNIT-V

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.

UNIT-VI

Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, 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: Secure Hash Function, HMAC, The RSA Public-Key Encryption Algorithm, Diffie-Hellman and Other Asymmetric Algorithms.

UNIT-VII

Internet Security Protocols and Standards: Secure E-mail and S/MIME, Domain Keys IdentifiedMail,SecureSocketLayer(SSL)andTransportLayerSecurity(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.

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. NetworkSecurityEssentialsApplicationsandStandards,byWilliamStallings,PearsonEducation Asia, New Delhi

MTCST 23
ELECTIVE-III
IMAGE PROCESSING

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

Course Objectives:

1 To explain fundamentals of Image processing concepts.
2 To provide mathematical foundation of image enhancement, image compression and image segmentation.
3 To explain the students about Morphology and its applications in image processing.
4 To explain various methods and techniques for image transformation.

Course Outcomes:

By the end of the course, the student should obtain:

1 Ability to develop algorithms for fundamental concepts in Image processing.
2 Ability to perform image enhancement, image compression and image segmentation using various methods.
3 Ability to implement Image transformation techniques

Syllabus

UNIT-I

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

UNIT-II

Image Transforms : A Detail Discussion On Fourier Transform, DFT,FFT, Properties WALSH Transform , WFT, HADAMARD Transform ,DCT

UNIT-III

Image Enhancement:Arithmetic and Logical Operations, Pixel or Point Operations, Size Operations, Smoothing Filters-Mean, Median, Mode Filters – Comparative Study, Edge Enhancement Filters – Directorial Filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF Filters, Prewitt Filter, Contrast Based Edge Enhancement Techniques–Comparative Study Low Pass Filters, High Pass Filters, Sharpening Filters. – Comparative Study Color Fundamentals and Color Models Color Image Processing.

UNIT-IV

Image Enhancement: Design of Low Pass, High Pass, EDGE Enhancement, Smoothening Filters In Frequency Domain. ButterWorth Filter, Homomorphic Filters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

UNIT-V

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

UNIT-VI

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, Split and Merge Technique, Motion in Segmentation

UNIT-VII

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

UNIT-VIII

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

Text Books:

1. 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 PublishingHouse.
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
MOBILE COMPUTING

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

Course Objectives

- To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
- To explore both theoretical and practical issues of mobile computing.
- To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.

Course Outcomes:

On successful completion of course learner will be able**:**

- To identify basic concepts and principles in mobile communication & computing, cellular architecture.
- To describe the components and functioning of mobile networking.
- To classify variety of security techniques in mobile network.
- To describe and apply the concepts of mobility management.

Syllabus

UNIT-I

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.

UNIT-II

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

UNIT-III

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.

UNIT-IV

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

UNIT-V

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

Unit-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 SMSBearer.

Text Books:

1. Mobile Computing - Technology Applications And Service Creation, Asoke K Talukder and Roopa.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, 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/week	**Time:3 Hours**	**Credits: 3**
Internal:30 Marks	**External:70 Marks**	**Total: 100 Marks**

Course Objectives:

1. To make the student understand the role of imprecision and uncertainty in real world scenarios.
2. To explain the role of Soft Computing in addressing the imprecision and uncertainty.
3. To explain the principal components of soft computing that include Fuzzy Sets and Fuzzy Logic, Artificial Neural Networks, Genetic Algorithms and Rough Sets.
4. To learn the Design and Implementation of Soft Computing methodologies.
5. To explain the design of hybrid systems which is a combination of one or more soft computing methodologies mentioned.

Course Outcomes:

By the end of the course, the student should be able to obtain:

1. Ability to represent Uncertainty / imprecision data.
2. Ability to select a suitable method of Soft Computing to solve a particular problem.
3. Ability to build hybrid systems using Soft Computing techniques.

Syllabus

UNIT-I

Introduction to Intelligent systems and Soft Computing:

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

UNIT-II

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

UNIT-III

Fuzzy logic Control:

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

UNIT-IV

Fundamentals of Artificial Neural networks:

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

UNIT-V

Major classes of Neural networks:

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

UNIT-VI

Dynamic Neural networks and their Applications:

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

UNIT-VII

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

UNIT-VIII

Evolutionary Computing:

Overview of evolutionary computing, Genetic algorithms, and Optimization, 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 CST, IT, AI & ML, and CN&IS)

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

Course Objectives:

- To create an awareness about entrepreneurship.
- To demonstrate key entrepreneurial leadership qualities.
- To explain the key strategies for starting a new enterprise.
- To provide knowledge about government plans and programmes and availability of resources.
- To provide knowledge on appropriate training skills required to become first generation entrepreneurs.
- To develop an entrepreneurial mind set.

Course Outcomes:

- Identify the readiness and aptitude for entrepreneurship.
- Ability to prepare business plans.
- Ability to mobilize physical, financial and human resources.
- Apply financial, operational, organizational and marketing knowledge in managing an enterprise.
- Understand how entrepreneurship can impact society.

Syllabus

UNIT-I

Introduction:-

Meaning and Definition of Entrepreneurship - Characteristics and functions of Entrepreneurs – Classification of Entrepreneurs – Barriers to Entrepreneurship – Motivational Factors for Entrepreneurship.

UNIT-II

Business Planning Process:-

Business Plan – Marketing Plan – Production / Operational Plan – Oganisational Plan – Financial Plan.

UNIT-III

Institutions in aid of Entrepreneurs:-

Role of Government in Promoting Entrepreneurship – Role of Commercial Banks – Role of Development Financial Institutions, IDBI, SIDBI, ICICI, NABARD and State Financial Corporations – Role of Consultancy Organisations.

UNIT-IV

Small Scale Industries:

Definition of S.S.I – Types of SSIs – Strengths and Weaknesses of Small Scale Industries – Sickness in SSIs – Reasons and Remedies – MSME's.

UNIT-V

Women Entrepreneurship:-

Importance and Need for Women Entrepreneurship – Problems of Women Entrepreneurs – Government and support for Women Entrepreneurs.

UNIT-VI

Business Project Management:

Business idea- Sources - Project Identification – Project Formulation – Project Report Preparation – Project Design – Project Appraisal – Project Planning – Project Financing.

UNIT-VII

Training for Entrepreneurship Development:-

Need and Importance of Training Entrepreneurs – Objectives and Methods of Training for New and existing Entrepreneurs – Institutions imparting training to Entrepreneurs – Feed Back and Performance of Trainee.

Text Books:

1. Madhurima Lall, ShikhaSahi:**Entrepreneurship**, Excel Books, New Delhi.
2. Vasant Desai: **Dynamics of Entrepreneurship Development**, Himalaya Publishing House,New Delhi.

Reference Books:

1. C.V. Bakshi: **Entrepreneurship Development**, Excel Books, New Delhi.
2. Jain: **Hand Book of Entrepreneurs** OXFORD University Press.

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MTCST26

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

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

Course Objectives:

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

Course Outcomes:

- Ability to define a problem and perform Requirements Engineering.
- Ability to draw UML diagrams for the requirements gathered.
- Ability to implement the designed problem in Object Oriented Programming Language.
- Test whether all the requirements specified have been achieved or not.

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

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

Syllabus

Projects

- Documentation including
  - o A problem statement
  - o A requirements document
- A Requirements Analysis Document.
- A System Requirements Specification.
- A Software Requirements Specification.
- A design document
  - o A Software Design Description and a System Design Document.
- A test specification.
- Manuals/guides for
  - o Users and associated help frames
  - o Programmers
  - o Administrators (installation instructions)
- A project plan and schedule setting out milestones, resource usage and estimated costs.
- A quality plan setting out quality assurance procedures
- An implementation.

Reference Books:

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, Pearson Education
2. VisualModellingwithRationalRose2002andUML,TerryQuatrini,Pearson Edusction
3. UML2 Toolkit, Hans -Erik Eriksson, etc;Wiley

MTCST27
MACHINE LEARNING LAB

Instruction: 3 Periods/week **Time:3 Hours** **Credits:2**
Internal: 30 Marks **External:70 Marks** **Total: 100Marks**

Course Objectives:

- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes:

On completion of this course, the student will be able to

- Implement machine learning algorithms to real world problems
- Choose appropriate machine learning algorithm for a problem
- Interpret the results of two different machine learning algorithms

Syllabus

List of Experiments:

1. Implement **Principal Component Analysis (PCA)** on an unsupervised dataset using NumPy.
2. Implement and demonstrate the **Singular Value Decomposition (SVD**) on a given set of training data samples. Read the training data from a .CSV file and use NumPy.
3. 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.
4. 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.
5. Write a program to implement the **naïveBayesian 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 classifier.
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 Neighbour 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.
11. Create the following **plots** using Matplotlib, Pandas Visualization, Seaborn on iris dataset, wine reviews datasets.
    - 11.0. Scatter Plot
    - 11.1. Line chart
    - 11.2. Histogram
    - 11.3. Heatmap

Text Books:

1. Hands–On Machine Learning with Scikit–Learn and TensorFlow 2e: Concepts, Tools, and Techniques to Build Intelligent Systems, AurelienGeron, 2019.

References:

1. https://scikit-learn.org/stable/tutorial/index.html
2. https://archive.ics.uci.edu/ml/index.php
3. https://towardsdatascience.com/pca-and-svd-explained-with-numpy-5d13b0d2a4d8
https://towardsdatascience.com/introduction-to-data-visualization-in-python-89a54c97fbed

MTCST 28

INTEGRATING DESIGN THINKING INTO INNOVATION ENGINEERING

Instruction: 3 Periods/week **Time:3 Hours** **Credits:2**
Internal: 30 Marks **External:70 Marks** **Total: 100Marks**

Course Objectives:

- To expose students to the design process as a tool for innovation.
- To develop students' professional skills in client management and communication.
- To study about various ideation tools and generate creative solutions.
- To understand about prototyping

Course Outcomes: After Successful Completion of this activity the student will be able to

- Outline a problem, apply methods of Empathy on user groups
- Describe and Define the problem specific to the user group
- Apply Ideation tools to generate Ideas to solve the problem
- Develop prototype
- Test the ideas and demonstrate Storytelling ability to present the Ideas

Students shall form into groups and Identify a problem (preferably societal problem with engineering orientation to solve) suitable for the design thinking and go through the process week-wise. At the end of each phase, brief documentation shall be submitted and a final report covering all phases has to be submitted at the end of the semester.

Introduction to Design Thinking: A primer on design thinking - Traditional approach, The new design thinking approach. Stages in Design Thinking : Empathize, Define, Ideate, Prototype, Test. Mindset For Design thinking, Design thinking for product and process innovation, Difference between engineering design and design thinking.

Case Studies: General, Engineering and Service applications.

Activities: Identify an Opportunity and Scope of the Project Explore the possibilities and Prepare design brief

Methods and Tools for Empathize and Define phases:
Empathize - Methods Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer Observation, Trend analysis

Define-Methods of Define Phase : Storytelling, Critical Items Diagram, Define Success
Activities: Apply the methods of empathize and Define Phases Finalize the problem statement

Methods and Tools for Ideate phase:
Ideate-Brainstorming, 2x2 Matrix, 6-3-5 method, NABC method;

Activities: Apply the methods of Ideate Phase: Generate lots of Ideas

Methods and Tools for Prototype Phase:
Prototype-Types Of Prototypes-Methods Of Prototyping**-**Focused Experiments, Exploration Map, Minimum Viable Product;

Activities: Apply the methods of Prototype Phase: Create prototypes for selected ideas

Methods and Tools for Test Phase:
Test- Methods of Testing: Feedback capture grid, A/B testing

Activities: Collect feedback; iterate and improve the ideas

Solution Overview-Create a Pitch - Plan for scaling up - Roadmap for implementation

Activities: Present your solution using Storytelling method

Project Submission: Fine tuning and submission of project report

Reference Books:

1. Tim Brown, Change by Design : How Design Thinking Transforms Organizations and Inspires Innovation, Harper Collins-books, 2009.
2. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Toolbox, John Wiley & Sons, 2020.
3. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Playbook, John Wiley & Sons, 2018.
4. Kristin Fontichiaro, Design Thinking, Cherry Lake Publishing, USA, 2015.
5. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation - Research and Practice, Springer Series, 2016.
6. Gavin Ambrose, Paul Harris, DesignThinking, AVA Publishing, 2010.
7. Muhammad Mashhood Alam, Transforming an Idea into Business with Design Thinking, First Edition, Taylor and Francis Group, 2019.
8. S.Balaram, Thinking Design, Sage Publications, 2011.

Web References:

1. https://designthinking.ideo.com/
2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/
3. https://www.coursera.org/learn/design-thinking-innovation
4. https://swayam.gov.in/nd1_noc20_mg38/preview

M.Tech - Computer Science and Technology

Scheme of Valuation w.e.f. 2024-25 AB

2nd Year I SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST 31	Elective-V	3	-	70	30	100	3
MTCST32	Open Elective	3	-	70	30	100	3
MTCST 33	Dissertation-I/ Industrial project		-	100	-	100	10
Total		**6**	**-**	**240**	**60**	**300**	**16**

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

Open Elective: GPS Applications/Human Computer Interaction/4G – 5G Mobile Communication Networks

THIRD SEMESTER
MTCST31
ELECTIVE-V
BIG DATA ANALYTICS

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

Course Objectives:

This course is aimed at enabling the students to

- Provide an overview of an exciting growing field of big data analytics.
- Introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- Optimize business decisions and create competitive advantage with Big Data analytics.

Course Outcomes:

After the completion of the course, student will be able to

- Illustrate on big data and its use cases from selected business domains.
- Interpret and summarize on NoSQL, Cassandra
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.
- Make use of Apache Spark, RDDs etc. to work with datasets.
- Assess real time processing with Spark Streaming.

Syllabus

UNIT-I

Getting Ready to Use R and Hadoop, Installing R, Installing R-Studio, Understanding the nature of R Language , Installing Hadoop, Understanding Hadoop features, Learning the HDFS and Map Reduce architecture, Understanding Hadoop subprojects.

UNIT-II

Writing Hadoop Map Reduce Programs Understanding the basics of Map Reduce, Introducing Hadoop Map Reduce, Understanding the Hadoop Map Reduce fundamentals, Writing a Hadoop Map Reduce example, Learning the different ways to write Hadoop Map Reduce in R.

UNIT-III

Integrating Rand Hadoop Introducing RHIPE,Installing RHIPE ,Understanding the architecture of HIPE, Understanding RHIPE samples, Understanding the R HIPE function ,Introducing R Hadoop, Understanding the architecture of R Haoop, Understanding R Hadoop examples, Understanding the R Hadoop function reference

UNIT-IV

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.

UNIT-V

Learning Data Analytics with R and Hadoop Understanding the data analytics project life cycle, Understanding data analytic s problems, Exploring web pages categorization, Computing the frequency of stock market change, Predicting the sale price of blue book for bulldozers–case study.

UNIT-VI

Understanding Big Data Analysis with Machine Learning Introduction to machine learning, Supervised machine-learning algorithms, Unsupervised machine learning algorithm, Recommendation algorithms.

UNIT-VII

Importing and Exporting Data from Various DBs Learning about data files and 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 Vignesh Prajapati,
2. BigDataAnalytics By Venkat Ankam,Packt Publishing Ltd.(Open Source -book available)

Reference Books:

1. Big Data Analytics Made Easy By Y.Lakshmi Prasad, Notion Press.
2. BigDataAnalytics:DisruptiveTechnologiesforChangingtheGame,Dr.ArvindSathi,FirstEditionOctober2012, IBM Corporation
3. MiningofMassiveDatasets,AnandRajarama,JureLeskovec,JeffreyD.Ullman.E-book,2013

THIRD SEMESTER
MTCST31
ELECTIVE-V
INTERNET OF THINGS

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

Course Objectives:

- Vision and Introduction to Internet of Things(IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes:

At the end of the course, student will be able to

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
- Use basic sensing and measurement and tools to determine the real-time performance of a network of devices.
- Develop prototype models for various applications using IoT technology.

Syllabus

UNIT-I

Introduction to the internet of things. IoT Architecture: HistoryofIoT,M2M–Machine to Machine, Web of Things, IoT protocols The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

UNIT-II

prototyping connected objects. Open-source prototyping platforms.

UNIT-III

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

UNIT-IV

Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

UNIT-V

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

UNIT-VI

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 Communication

THIRD SEMESTER
MTCST31
ELECTIVE-V
DEEP LEARNING

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

Course Objectives:

The objective of this course is to cover the review of ML

- Fundamentals of feed forward neural networks.
- Regularization methods and optimization in deep models as well as some advanced topics such as convolutional neural networks.
- Recurrent neural networks, long short-term memory cells.

Course Outcomes:

After completion of course, students would be able to:

- Explore feed forward networks and Deep Neural networks
- Mathematically understand the deep learning approaches and paradigms
- Complex feature extraction with CNN and RNNs
- Apply the deep learning techniques for various applications

Syllabus

UNIT-I

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

UNIT-II

Deep forward Networks:

Learning XOR, Gradient -based Learning, Hidden Units, Architecture Design, Back-propagation and other Differentiation algorithms

UNIT-III

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

UNIT-IV

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,

UNIT-V

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 unsupervised features

UNIT-VII

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

UNIT-VII

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 2

MTCST32
OPEN ELECTIVE
GPS APPLICATIONS

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

Course Objectives:

- Understand the basic concept of the Global Position system.
- know various types of estimation procedures.
- Familiarize various methods of processing GPS data.
- Understand navigational methods and their Range and Accuracy.

Course Outcomes:

After successful completion of the course, the students can be able to

- Explain the basic concepts of the Global Position System.
- Explain various estimation procedures.
- Understand various methods of processing GPS data.
- Classify various Navigational methods.
- Explain techniques like TACAN, ILS and MLS.

Syllabus

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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-VI

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

UNIT-VII

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.Hofmann-Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

MTCST32
OPEN ELECTIVE
HUMAN COMPUTER INTERACTION

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

Course Objectives:

- To gain an overview of Human-Computer Interaction, with an understanding of user interface design in general, and alternatives to traditional "keyboard and mouse" computing
- be able to predict user performance in various human-computer interaction tasks
- appreciate the importance of a design that maintains a focus on the user; be familiar with a variety of both conventional and non-traditional user interface paradigms

Course Outcomes:

By the end of the course, the student should be able to:

- apply HCI and principles to interaction design.
- appreciate importance of user documentation and information search

Syllabus

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
2. Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
3. 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.

MTCST32

OPEN ELECTIVE

4G – 5G MOBILE COMMUNICATION NETWORKS

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

Course Objectives:

- To learn the evolution of wireless networks.
- To get acquainted with the fundamentals of 5G networks.
- To study the processes associated with 5G architecture.
- To study spectrum sharing and spectrum trading.
- To learn the security features in 5G networks.

Course Outcomes:

- To understand the evolution of wireless networks.
- To learn the concepts of 5G networks.
- To comprehend the 5G architecture and protocols.
- To understand dynamic spectrum management.
- To learn the security aspects in 5G networks.

UNIT-I

Introduction

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

UNIT-II

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-III

Multi-gigabit wireless networks

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

UNIT-IV

Indoor localization and RF sensing

Smartphone localization - Wi-Fi fingerprinting - protocols and challenges - Non-Wi-Fi 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-V

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-VI

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-VII

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_communicatio n_ 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-networ ks-a- physical layer-perspective

M.Tech - Computer Science and Technology

Scheme of Valuation w.e.f. 2024-25 AB

2nd Year II SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTCST 41	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 BINDING SPECIFICATIONS:

The dimension of the project report should be in A4 size. The project report should be bound using a 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.**

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.

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.

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.**

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

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.

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.

Chapters – The chapters may be broadly divided into 3 parts (i) Introductory chapter, (ii) Chapters developing the main theme of the project work (iii) and Conclusion. The main text will be divided

into several chapters and each chapter may be further divided into several divisions an dsub-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.

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.

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:

1. 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.