UNIVERSITY OF JAMMU

(NAAC ACCREDITED A + GRADE UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

NOTIFICATION

(23/Sept/Adp/ 85)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Competent Bodies, has been pleased to authorize the adoption of the revised Syllabi and Courses of Studies of **Master of Technology (M.Tech.) in Computer Science and Engineering for Semester I to IV** under Credit Based System (as given in the Annexure) for the Examinations to be held in the years indicated against each Semester as under:-

Branch	Semester	For the Examination to be held in the years
Computer Science & Engineering	**Semester-I**	**December 2023, 2024, 2025**
	Semester-II	**May 2024, 2025, 2026**
	Semester-III	**December 2024, 2025, 2026**
	Semester-IV	**May 2025, 2026, 2027**

The Syllabi of the course are available on the University Website: www.jammuuniversity.ac.in.

Sd/-
DEAN ACADEMIC AFFAIRS

No. F.Acd/III/23/10040-10046
Dated: 14/09/2023
Copy for information & necessary action to:-

1. Dean Faculty of Engineering
2. Principal, GCET
3. C.A to the Controller of Examinations
4. Joint/Assistant Registrar (Exams Prof./Eval Prof./Confidential)
5. Incharge University Website

14/Sept/23
Assistant Registrar (Academic)
14/9/23 14/09/23

ANNEXURE-I

UNIVERSITY OF JAMMU, JAMMU
Course Scheme

M. Tech 1st Semester Computer Science & Engineering
For Examinations to be held in the December 2023, 2024, 2025

M. Tech CSE – Semester 1st

Contract Hours/Week: 23

S. No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks		% Change
			L	T	P		Internal	External	
1	MHUM101	Research Methodology	3	1	-	4	25	75	15%
2	MCSE101	Advanced Data Structures and Algorithms	3	1	-	4	25	75	20%
3	MCSE102	Advanced Computer Networks	3	1	-	4	25	75	20%
4	MCSE103	Distributed Systems	3	1	-	4	25	75	20%
5	MOOC300	NPTEL / SWAYAM / MOOC	3		-	3	100	-	100%
6	MCSE111	Advanced Data Structures and Algorithms Lab	-	-	2	1	50	-	40%
7	MCSE112	Advanced Computer Networks Lab	-	-	2	1	50	-	20%
Total Credits and Marks						21	300	300	

ANNEXURE-II

UNIVERSITY OF JAMMU, JAMMU
Course Scheme

M. Tech 2nd Semester Computer Science & Engineering
For Examinations to be held in the May 2024, 2025, 2026

M. Tech CSE - Semester II

Contract Hours/Week: 28

S.No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks		% Change
			L	T	P		Internal	External	
1.	MCSE201	Advance Machine Learning	3	1	-	4	25	75	100%
2.	MCSE202	Object Oriented Modelling & Design	3	1	-	4	25	75	100%
3.	MCSE203	Information and Storage Management	3	1	-	4	25	75	100%
4.	MCSE2A1	**Elective A** Cloud Computing	3	1	-	4	25	75	30%
	MECE201	IOT and its Industrial Applications							100%
5.	MCSE2B1	**Elective B** Software Quality Assurance and Testing	3	1	-	4	25	75	20%
	MCSE2B2	Mobile Computing							100%
6.	MCSE211	Advance Machine Learning lab	-	-	2	1	50	-	100%
7.	MCSE2AA	**Elective A Lab** Cloud Computing Lab			2	1	50	-	20%
	MECE211	IOT and its Industrial Applications Lab							100%
8.	MCSE212	Seminar	-	-	4	2	100	-	0%
Total Credits and Marks						**24**	**325**	**375**	

ANNEXURE-III

UNIVERSITY OF JAMMU, JAMMU
Course Scheme

M. Tech 3rd Semester Computer Science & Engineering

For Examinations to be held in the December 2024, 2025, 2026

M. Tech CSE - Semester III

Contract Hours: 26

S.No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks		% Change
			L	T	P		Internal	External	
1	MCSE3C1	**Elective C** Big Data Analytics	3	1	-	4	25	75	100%
	MCSE3C2	Digital Image Processing							30%
2	MCSE3D1	**Elective D** Cyber Security and Digital Forensics	3	1	-	4	25	75	40%
	MCSE3D2	Data Science							100%
3	MCSE3CA	**Elective C Lab** Big Data Analytics Lab	-		2	1	50	-	100%
	MCSE3CB	Digital Image Processing Lab							100%
4	MCSE3DA	**Elective D Lab** Cyber Security and Digital Forensics Lab	-		2	1	50	-	40%
	MCSE3DB	Data Science Lab							100%
5	MCSE311	Dissertation – I			14	7	150	-	0%
Total Credits and Marks						**17**	**300**	**150**	

ANNEXURE-IV

UNIVERSITY OF JAMMU, JAMMU
Course Scheme

M. Tech 4th Semester Computer Science & Engineering
For Examinations to be held in the May 2025, 2026, 2027

M. Tech CSE - Semester IV

Contract Hours/Week: 36

S.No	Subject Code	Subject	Teaching Hours/ Week			Credit	Marks		Percentage Change
			L	T	P		Internal	External	
1	MCSE411	**Dissertation-II** (Students have to submit the final project report at the end of the semester which will be evaluated followed by a seminar, presentation and viva -voce examination.)	-	-	36	18	300	150	0%
Total Credits						18	450		

For Examinations to be held in the December 2023, 2024, 2025

Class: M. Tech 1st Semester
Branch: CSE
Course Title: Research Methodology
Course No.: MHUM101
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: Research Methodology is a hands-on course designed to impart education in the foundational methods and techniques of academic research in social sciences and business management context. Research scholars would examine and be practically exposed to the main components of a research framework i.e. problem definition, research design, data collection,ethical issues in research, report writing, and presentation. Once equipped with this knowledge, participants would be well- placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.

Course Outcomes: By the end of the course students shall be able to:

CO 1	To develop understanding of the basic framework of research process by exploring various research designs and techniques.
CO 2	To identify various data collection, processing and analysis methods.
CO 3	To develop an understanding of the ethical dimensions of conducting applied research.
CO 4	To develop and practice the skills necessary to conduct, review and publish research.

Detailed Syllabus

Unit 1: Research Methodology: Introduction, Objectives of Research, Significance of Research, Research Methods versus Methodology, Types of Research - Exploratory Research, Descriptive Research, Casual Research, Research Process, Defining a Research Problem, Techniques involved in defining a Problem. **(11hrs)**

UNIT 2: Research Design: Need for Research Design, Features of Good Design, Different Research Designs, , Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sample size determination, Questionnaire Design and Testing, Measurement and Scaling, Scaling Techniques. **(12hrs)**

UNIT 3: Methods of Data Collection and presentation: Methods of Data Collection, Collection of Primary and Secondary Data, Selection of appropriate method, Data Processing Operations, Diagrammatic and graphical representation of data with Pie chart, Bar diagram, Line chart, Histogram, Frequency Polygon, Ogive curves and Spreadsheets. **(14hrs)**

Unit 4: Statistical tools: : Measure of central tendencies – Arithmetic Mean (For individual observation, Discrete series & continuous series) Median, Mode, Quartiles, Deciles and Percentiles; Measure of Dispersion- Range, Quartile Deviation, Standard Deviation, Variance and Coefficient of Variance. **(12hrs)**

UNIT 5: Techniques of Hypotheses: Hypotheses meaning and basics concepts, Flow diagram, Power of hypothesis test, Types of hypothesis, Limitations of tests of hypothesis, Chi-square Test, Correlation and Regression, Conversion of Chi to Phi, Caution in using Chi-square test. **(11hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabusbased on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

1. C.R. Kothari, Wiley Eastern ,Research Methodology,
2. Willkinson K.P, L Bhandarkar ,Formulation of Hypothesis, Himalaya Publication, Bombay.
3. John W Best and V. Kahn ,Research in Education , PHI Publication
4. A. Lemley , Intellectual Property in New Technological Age , 2016.
5. Booth,Colomb andWilliams,The Craft of Research,University of Chicago Press,Chicago & London,Second edition, 2003.
6. John W. Creswell. Research Design, Sage Publications, New Delhi, Third Edition, 2009.

For Examinations to be held in the December 2023, 2024, 2025

Class: M. Tech 1st Semester
Branch: CSE
Course Title: Advanced Data Structures and Algorithm
Course No.: MCSE101
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: This course aims to provide the advanced methods of designing and analyzing algorithms and ability to choose appropriate algorithms and use it for a specific problem. It familiarize students with design paradigms and advanced data structures used to solve advanced algorithmic problems and to understand different classes of problems concerning their computation difficulties.

Course Outcomes: By the end of the course student shall be able to:

CO1	To gain knowledge about the Algorithm Design techniques, Advanced Data Structures and mathematical tools to analyze algorithms for effective problem solving in computing.
CO2	Apply various algorithmic design paradigms and employ advanced Data Structures to model a variety of real-world problems.
CO3	To analyze the complexity and performance of different algorithms
CO4	To Understand the limits of efficient computation through the concepts of P, NP and NP-Complete problems and get familiar with main thrust of work in algorithm sufficient to give some context for formulating and seeking known solutions to an algorithmic problem.

Detailed Syllabus

UNIT 1 : Complexity Analysis: Growth Rate of Functions, Asymptotic Notation, Asymptotic Analysis, Analyzing Algorithm Control Structures, Standard Notations and Common Functions; Recurrences: The Substitution Method,Iteration method, Master method; Amortized Analysis: Aggregate, Accounting and Potential Method **(5 hrs)**

UNIT 2: Advanced Trees :AVL Trees: Balance Factor, Insertion in AVL Trees;; Splay Trees ; Red-Black trees: Properties of Red-Black Trees, Rotations, Insertion, Deletion; B-Trees: Basic operations on B-Trees, Inserting and Deleting a key from a B-Tree. **(12 hrs)**

UNIT 3: Binomial and Fibonacci Heaps: Binomial Heaps:Representation ,Properties and its operations ; Fibonacci Heaps : Structure, Potential function, Merge-heap operations: Insert, Union, decreasing a key and deleting a node, Finding and Deleting the minimum ,Bounding the maximum degree. **(07 hrs)**

UNIT 4 : Graphs and related Algorithms: Depth and Breadth first Traversals, Topological Sort, Minimum Spanning Trees: Kruskal,Prim; Single Source Shortest Paths:Dijkstra's algorithm, Bellman Ford algorithm, Single source Shortest paths in Directed Acyclic Graphs ; All-Pairs Shortest Paths:Shortest Paths:Matrix Multiplication, Floyd-Warshall's Algorithm. **(12 hrs)**

UNIT 5: Algorithm Design Techniques: Dynamic Programming:Principle of Optimality, Elements of Dynamic Programming, Matrix-Chain Multiplication ,Longest Common Subsequence; Greedy Algorithms: Characteristics and features of problems solved by Greedy Algorithms, Basic Structure of Greedy Strategy, An Activity Selection Problem, Huffman Codes. **(10 hrs)**

UNIT 6 : NP Completeness, Approximation and Randomized Algorithms: P, NP and NP-Complete and NP Hard complexity classes, NP-Completeness and Reducibility; Approximation algorithm: Introduction, Performance ratio, Approximation algorithms for Vertex cover and Travelling Salesman problem; Randomized Algorithm: Las Vegas and Monte Carlo algorithms, Randomized Quick Sort, Randomized Minimum cut algorithm **(10 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours.The candidates shall have to attempt any 5questions.

Suggested Books:

1. ThomasH.Cormen,CharlesE.Leiserson,RonaldL.Rivest,CliffordStein,Introduction to Algorithms, MIT Press, 2022
2. Peter Brass , Advanced Data Structures , Cambridge University Press.
3. Ellis Horowitz and SartajSahni,Fundamentals of ComputerAlgorithms-(secondedition),UniversitiesPress
4. RobertSedgewickandKevinWayne,Algorithms,FourthEdition,PearsonEducation.
5. S.Sridhar,DesignandAnalysisofAlgorithms,FirstEdition,OxfordUniversityPress.2014
6. AlfredV.Aho,JohnE.Hopcroft,JeffreyD.Ullman,—DataStructuresandAlgorithms,PearsonEducation, Reprint2006.
7. Udit Agarwal , Algorithms Design and Analysis, Educational & Technical Publishers

For Examinations to be held in the December 2023, 2024, 2025

Class: M. Tech 1st Semester
Branch: CSE
Course Title: Advanced Computer Networks
Course No.: MCSE102
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course overview: This course introduces software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behaviour of an entire network.

Course Outcomes: By the end of the course students shall be able to:

CO1	To understand various types of routing & switching techniques and also understand various network architectures deployed in networking.
CO 2	Understand the concept of SDN basic paradigm, requirements and challenges
CO 3	Analyse the implications of shifting from traditional network architectures to SDN

Detailed Syllabus

UNIT 1:Packet Switching Network: Historical background, Network services and Internal operations, Packet Network Topology, Datagram and virtual circuit, Routing in Packet Networks, Shortest Path Routing, Traffic Management and QOS at packet level; Traffic management at flow level (Congestion control). **(08 hrs)**

UNIT 2: Advanced Network Architecture: Overview of ATM Networks ,IP forwarding Architecture, Overlay Models, MPLS, Integrated Services in Internet, RSVP, Differentiated Services, Realtime Transport Protocol. **(10hrs)**

UNIT 3 :Introducing SDN : SDN Origins and Evolution – Introduction – Why SDN?:Evolution of Switches and Control Planes: Cost, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs,The Genesis of SDN , How SDN works ?:- SDN Architecture, Centralised and distributed Control planes, and Data Planes ,open flow switches, southbound and northbound protocols, Open daylight, Open flow , Alternatives definitions of SDN Methods,SDN Controllers. **(12hrs)**

UNIT 4: SDN in the Data Center: Abstract, Data Centre Definition, Data Center Demands, Tunnelling Technologies for the Data Centre, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations **(08 hrs)**

UNIT 5Network Topology and Topological Information Abstraction: Introduction, Network, Topology, Traditional Methods, LLDP, BGP-TE/LS, ALTO, I2RS Topology, SDN Applications: Reactive versus Proactive Applications, Analysing SDN Applications, Background on controllers, using Floodlight controller, Open Daylight Controller, Switch consideration, creating network virtualization tunnels, offloading flows in the data centres, Traffic Engineering for service providers. **(10hrs)**

UNIT 6 :SDN in Other Environments: Abstract, Consistent Policy configuration, Global Network View, Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, In-Line Network Functions, Optical Networks, SDN vs. P2P/Overlay Networks. Introduction to Network Function Virtualisation **(06 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

1 Communication Network by Alberto Leon Garcia and IndraWidjaja.
2 SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media
3 Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan
4 Kaufmann.

For Examinations to be held in the December 2023, 2024, 2025

Class: M. Tech 1st Semester
Branch: CSE
Course Title: Distributed Systems
Course No.: MCSE103
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems, and addressing the characteristics and the challenges that must be addressed in their design: scalability, heterogeneity, security and failure handling being the most significant. This course also covers issues and solutions related to the design and the implementation of distributed applications.

Course Outcomes : By the end of the course students shall be able to:

CO 1	Learn issues related to clock Synchronization and the need for global state in distributed systems when designing, implementing, and debugging distributed systems
CO 2	Understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
CO 3	Compare replication schemes with respect to performance, availability, and consistency concerns

Detailed Syllabus

UNIT 1:Introduction: Definition , Relation to computer system components , Motivation , Relation to parallel systems , Message-passing systems versus shared memory systems ,Primitives for distributed communication ,Synchronous versus asynchronous executions , Design issues and challenges. A model of distributed computations: A distributed program , A model of distributed executions , Models of communication networks , Global state , Cuts , Past and future cones of an event , Models of process communications. Logical Time: A framework for a system of logical clocks , Scalar time , Vector time , Physical clock synchronization: NTP. **(10hrs)**

UNIT 2: Global state& Snapshots recording algorithms: Introduction to System model and definitions , Snapshot algorithms for FIFO channels, Variation of Chandy-Lamport algorithm, snapshot algorithms for non-FIFO channels, snapshots in casual delivery system, Monitoring global state, Necessary and sufficient conditions for consistent global snapshot, Finding consistent global snapshot in a distributed computation. **(08hrs)**

UNIT 3: Topology abstraction and overlays: Classification and basic concepts, complexity measures and metrics, Program structure, Elementary Graph algorithms, Maximal independent set (MIS), Connected dominating set, compact routing tables, Leader election. **(06 hrs)**

UNIT 4: Message ordering and Group Communication: Message ordering paradigms, Asynchronous execution with synchronous communication, synchronous program order on a asynchronous system, Group communication, Casual ordering(CO), Total order, Multicast: propagation trees for multicast algorithms, Fault tolerant group communication, Distributed multicast algorithm at network layer. **(08 hrs)**

UNIT 5: Distributed Mutex & Deadlock: Distributed mutual exclusion algorithms: Introduction , Preliminaries , Lamport's algorithm , Ricart-Agrawala algorithm. Deadlock detection in distributed systems: Introduction , System model ,Preliminaries , Models of deadlocks , Knapp's classification, Algorithms for the single resource model, the AND model and the OR model. **(08hrs)**

UNIT6: Recovery & Consensus: Check pointing and rollback recovery: Introduction, Background and definitions ,Issues in failure recovery ,Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm ,Algorithm for asynchronous check pointing and recovery. Consensus and Agreement algorithms: Problem definition, Overview of results, Agreement in a failure–free system, Agreement in synchronous systems with failures. **(10hrs)**

UNIT 7: Authentication & Self stabilization: Authentication Introduction and basic definitions: protocols based on symmetric cryptosystems and asymmetric cryptosystems, password based authentication, authentication protocol failures Introduction to self-stabilization, Issues in designing various self-stabilizing algorithms, methodologies for designing self-stabilizing systems, self-stabilizing distributed spanning trees, Self-stabilization as a solution to fault tolerance. **(08hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

- Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
- Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
- Tanenbaum A.S., Van Steen M., —Distributed Systems: Principles and Paradigmsl, Pearson Education, 2007.
- Liu M.L., —Distributed Computing, Principles and Applicationsl, Pearson Education, 2004.
- Nancy A Lynch, —Distributed Algorithmsl, Morgan Kaufman Publishers, USA, 2003

For Examinations to be held in the December 2023, 2024, 2025

L	T	P	C	Theory (External)	Internal
3	-	-	3	-	100

Class: M. Tech 1st Semester
Branch: CSE
Course Title: NPTEL / SWAYAM
Course No.: MOOC300
Duration Exam: 3 HRS

The students shall register for a 12 week NPTEL/ SWAYAM course offered by IIT Madras ,out of the list of courses floated by SWAYAM around the time of commencement of the semester. However, the selected NPTEL course should not be similar to the regular courses offered as a part of the department curriculum. The choice of course needs to be duly endorsed by the Department Academic Committee.

The overall monitoring of the NPTEL course will be under the supervision of the teacher incharge of the department.

The NPTEL/SWAYAM certification course comprises of Assignments (25%) and Proctored Examination (Online examination MCQ's based =75%) conducted at the end of the semester by IIT Madras as per the schedule.

The marks obtained by the students in the NPTEL/SWAYAM certification course will be tabulated by the concerned department.

NOTE: - *In case the student does not pass the certification exam or remains absent in the proctored examination, no certificate will be given to the candidate by NPTEL and the student will be deemed to have failed in that course. The student will have to register again for the next semester NPTEL course and pass the examination along with a certificate.*

For Examinations to be held in the December 2023, 2024, 2025

Class: M. Tech 1st Semester
Branch: CSE
Course Title: Advanced Data Structures and Algorithms Lab
Course No.: MCSE111

L	T	P	C	Internal
-	-	2	1	50

Course Overview: To learn and implement advanced Data Structures and various algorithmic design strategies for efficient problem solving

Course Outcomes: By the end of the course students shall be able to

CO1	To provide deeper insight on advanced Data Structures and Algorithm Design Strategies
CO2	To Implement various operations on advanced Data Structures
CO3	Apply various algorithmic design paradigms and employ advanced Data Structures to solve a variety of real world problems.

Suggested Lab Exercises

1. Implement AVL Trees
2. Implement Red Black Trees
3. Implement Spaly Trees
4. Implement B-Trees
5. Implement Binomial Heaps
6. Implement Fibonacci Heaps
7. Implement Kruskal's algorithm for Minimum Spanning Tree
8. Implement Prim's algorithm for Minimum Spanning Tree
9. Implement Dijkstra's algorithm for single source shortest path
10. Implement Bellman-Ford algorithm for single source shortest path
11. Implement Floyd- Warshall algorithm for all pair's shortest paths
12. Implement Matrix Chain Multiplication using Dynamic Programming
13. Implement Longest Common Subsequence using Dynamic Programming
14. Implement Activity Selection Problem using Greedy Strategy
15. Implement Huffman Codes using Greedy Strategy.
16. Implement any schema to find the optimal solution for the Travelling Salesman Problem and then solve the same instance using any approximation algorithm and determine the error in the approximation.

Note: Student has to implement at least 10 programs from above list

Laboratory work will be evaluated on Internal scheme with following components:
1) Lab. Work (Continuous Assessment) 70%
2) Viva-voce test 30%

For Examinations to be held in the December 2023, 2024 , 2025

Class: M. Tech 1st Semester
Branch: CSE
Course Title: Advanced Computer Networks Laboratory
Course No.: MCSE112

L	T	P	C	Internal
-	-	2	1	50

Course overview: To learn Advance Computer Network concepts and their relevance to an emerging paradigm in Computer Networking.

Course Outcomes: By the end of the course students shall be able to:

CO1	Identify and understand the various design issues of internetworking and routing protocols.
CO2	Understand the concept of network virtualization framework.
CO3	Understand the working principles and design issues of various SDN controllers and protocols.

Laboratory work:
1. Use network Simulator (NS2/NS3/NetSim/Omnet etc.) and Network Emulator GNS3
2. Experiments related to routing protocols
3. To understand the concepts of networking in virtual machines
4. Use of Network Tools e.g. tools for file transfer, network monitoring etc.
4. Case study on SDN controllers
5. Case study on Building SDN Framework like Juniper SDN Framework, Open Daylight Controller/Frame work
6. Explore current research trends in computer networks.

Note: Laboratory work will be evaluated on Internal scheme with following components:
1) Lab. Work (Continuous Assessment) 70%
2) Viva-voce test 30%

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: Advanced Machine Learning
Course No.: MCSE201
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview : This course provides an advanced level of understanding to machine learning and statistical pattern recognition. It offers some of the most cost-effective approaches to automated knowledge acquisition in emerging data-rich disciplines and focuses on the theoretical understanding of these methods, as well as their computational implications..

Course Outcomes: By the end of the course students shall be able to:

CO1	Demonstrate in-depth knowledge of methods and theories in the field of machine learning.
CO2	Demonstrate the use Bayesian perspective on machine learning, Artificial neural networks, back propagation algorithm
CO3	Assess the learning algorithms modelled after biological evolution, including genetic algorithms and genetic programming.
CO4	To demonstrate the ability to critically evaluate and compare different learning models and learning algorithms.

Detailed Syllabus

Unit 1 Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning (Classification and Regression Trees, Support vector machines), Unsupervised learning (Clustering), Instance-based learning (K-nearest Neighbor, Locally weighted regression, Radial Basis Function), Reinforcement learning (Learning Task, Qlearning, Value function approximation, Temporal difference learning). **(12 hrs)**

Unit 2 Decision Tree Learning: Decision tree representation, appropriate problems for decision tree learning, Univariate Trees (Classification and Regression), Multivariate Trees, Basic Decision Tree Learning algorithms, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **(10 hrs)**

Unit 3 Bayesian Learning: Bayes theorem and concept learning, Bayes optimal classifier, Gibbs algorithms, Naive Bayes Classifier, Bayesian belief networks, The EM algorithm. **(8 hrs)**

Unit 4 Artificial Neural Network: Neural network representation, Neural Networks as a paradigm for parallel processing, Linear discrimination, Pairwise separation, Gradient Descent, Logistic discrimination, Perceptron, Training a perceptron, Multilayer perceptron, Back propagation Algorithm. Recurrent Networks, Dynamically modifying network structure. **(12 hrs)**

Unit 5 Genetic Algorithms: Basic concepts, Hypothesis space search, Genetic programming, Models of evolution and learning, Parallelizing Genetic Algorithms. Inductive and Analytical Learning: Learning rule sets, Comparison between inductive and analytical learning, Analytical learning with perfect domain theories: Prolog-EBG. Inductive-Analytical approaches to learning, Using prior knowledge to initialize hypothesis (KBANN Algorithm), to alter search objective (Tangent Prop and EBNN Algorithm), to augment search operators (FOCL Algorithm). **(12 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Recommended Books

1. Mitchell T.M., Machine Learning, McGraw Hill (1997).
2. Alpaydin E., Introduction to Machine Learning, MIT Press (2010).
3. Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag (2006).
4. Michie D., Spiegelhalter D. J., Taylor C. C., Machine Learning, Neural and Statistical

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: Object Oriented Modelling & Design
Course No.: MCSE202
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: This course provides a comprehensive introduction to Object Oriented Development. Participants will gain knowledge about different modelling techniques like state, class and interaction modelling. They will also come understand the development life cycle of process and gain the knowledge about various design patterns.

Course Outcomes: By the end of the course students shall be able to:

CO202.1	Describe the concepts of object-oriented and basic class modelling.
CO202.2	Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
CO202.3	Choose and apply a befitting design pattern for the given problem.

Detailed Syllabus

Unit 1: Introduction: What is Object Orientation? What is OO development? OO themes, Evidence for usefulness of OO development, OO modelling history. Modelling as Design Technique: Modelling, Abstraction; The three models. Class Modelling: Object and class concepts, Link and associations concepts, Generalization and inheritance, A sample class model, Navigation of class models. **(09 hrs)**

Unit 2: Advanced Class Modelling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modelling: Events, States, Transitions and Conditions, State Diagrams, State diagram behaviour. Advanced State Modelling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models. **(10 hrs)**

Unit 3: Use Case Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. **(08 hrs)**

Unit 4: Process Overview: Development stages; Development life Cycle. System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. **(08 hrs)**

Unit 5: Use Case Realization: The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design Class Diagrams; Interaction Diagrams- Realizing Use Case and defining methods; Designing with Sequence and Communication Diagrams;Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for 3- Layer Design. **(10 hrs)**

Unit 6: Introduction: what is a design pattern? Describing design patterns, the catalogue of design patterns, Organizing the catalogue, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. Creational Patterns: Abstract Factory; Builder; Prototype; Singleton. Structural Patterns: Adaptor; Flyweight; Proxy. **(09 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

1 Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005
2 Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
3 Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns –Elements of Reusable Object-Oriented Software, Pearson Education,2007.

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: Information Storage & Management
Course No.: MCSE203

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: This course provides a comprehensive introduction to the fundamentals of Data Storage technology. Participants will gain knowledge of the core logical and physical components that make up a Storage Systems Infrastructure.

Course Outcomes: By the end of the course students shall be able to:

CO1	The demand from businesses for highly available and secure access to data
CO2	The Storage systems and infrastructure architectures and solutions available to support business needs
CO3	The key tasks in successfully managing and monitoring a data storage infrastructure.

Detailed Syllabus

UNIT 1: Introduction to Information Storage and Business Continuity: Meeting Today's Data Storage Needs, Value of data to business, Challenges in data storage and data management, List the solutions available for data storage, Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. **(09 hrs)**

UNIT 2: Information Storage & Data Center Infrastructure: Information Storage - Data, Types of Data, Big Data, Information, Storage, Evolution of Storage Architecture, Data Center Infrastructure - Core Elements, Key Characteristics, Managing a Data Center, Virtualization and Cloud Computing. **(06 hrs)**

UNIT 3: Data Protection using RAID: RAID Implementation Methods - Software RAID & Hardware RAID, RAID Array Components, RAID Techniques - Striping, Mirroring & Parity, RAID Levels - 0, 1, Nested, 3, 4, 5, 6, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. **(08 hrs)**

UNIT 4: Fibre Channel Storage Area Networks: Overview, Components - Node Ports, Cables and Connectors, Interconnect Devices & SAN Management Software, FC Connectivity - Point-to-Point, Arbitrated Loop, Switched Fabric, FC-SW Transmission, Switched Fabric Ports, FC Architecture - FC Protocol Stack, FC Addressing &World-Wide Names, Zoning & its types, FC SAN Topologies - Mesh & Core-Edge Fabric. **(09 hrs)**

UNIT 5: Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations & Connectivity - Unified, Gateway and Scale-Out, NAS File-Sharing Protocols - NFS & CIFS, Factors Affecting NAS Performance. **(08 hrs)**

UNIT 6: Backup and Archive: Purpose, Considerations, Granularity, Recovery Considerations, Methods, Architecture, Restore Operations, Topologies, Backup in NAS Environments, Backup Targets - Disk, Tape & Tape Library, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture Use Case - E-mail Archiving & File Archiving. **(07 hrs)**

UNIT 7: Managing the Storage Infrastructure: Monitoring the Storage Infrastructure - Parameters, Components & Alerts, Management Activities - Availability, Capacity, Performance & Security Management, Reporting, Storage Infrastructure Management in a Virtualized Environment, Information Lifecycle Management. **(07 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

- Information Storage and Management, Wiley, EMC Educational Services
- Building Storage Networks, Tata McGraw Hill
- Storage Networks: The Complete Reference, Tata McGraw Hill

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FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: Cloud Computing
Course No.: MCSE2A1
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: The course introduces the principles of distributed and parallel computing underlying cloud architectures and specifically focuses on virtualization. It explains how to make design choices and trade-offs to consider when building applications to run in a virtual cloud environment.

Course Outcomes: By the end of the course students shall be able to:

CO1	Understand cloud computing models and architecture.
CO2	Understand security implications in cloud.
CO3	Analyse the operation , implementation and performance of cloud computing systems and relative merits and suitability of each for complex data intensive applications.
CO4	Analyse the migration risks and cost in cloud computing.

Detailed Syllabus

UNIT 1: Introduction: Historical and Evolution : Distributed Systems ,Virtualization, Web Service-Oriented Computing, Types of computing, Building Cloud Computing Environments, Principles of Parallel and Distributed Computing: Parallel vs. Distributed Computing, General Concepts , Definitions and Components of a Distributed System, Architectural Styles for Distributed Computing, Models for Inter-Process Communication, Technologies for Distributed Computing : Remote Procedure Call, Distributed Object Frameworks, Service Oriented Computing. **(08 hrs)**

UNIT 2: Introduction to Virtualization: Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization i.e. server, storage and network virtualization,Virtualization security threats and security recommendations Virtualization and Cloud Computing, Pros and Cons of Virtualization, Case Studies:Xen(Para virtualization), VMware(Full Virtualization),Microsoft(Hyper-V). **(10hrs)**

UNIT 3: Cloud Computing Architecture: Cloud Definition, Cloud Reference Model, Architecture, Infrastructure /Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds (Public, Private, Hybrid and Community), SaaS and Paas : Saleforce.com and Force.com , Migrating to cloud : Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud. **(10hrs)**

UNIT 4: Cloud Computing Issues and Challenges: Open challenges and benefits: Cloud interoperability, Scalability and Fault Tolerance, Cloud Bursting, Capacity Planning ,Load Balancing, Role of Service Oriented Architecture, Security Trust and Privacy Issues: Cloud Security, Threats to cloud, Infrastructure and Information Security, Cloud Security Management Framework, Security –as –a service, Privacy and Compliance Issues, Portability and Interoperability Issues. **(08 hrs)**

UNIT 5: Cloud Implementation and Environment :Technologies and Tools for Cloud Computing Aneka Cloud Platform, Aneka Resource Provisioning Service, Hybrid Cloud Implementation, Workflow Engine for Clouds: Workflow Management Systems and Clouds, Architecture of Workflow Management Systems, Utilizing Cloud for Workflow Execution, Data intensive computing: Technologies, Map Reduce Programming Model, SLA Management in Cloud Computing. **(10hrs)**

UNIT 6: Cloud Platforms in Industry: Amazon Web services, Elastic Compute Cloud (EC2), Simple Storage Services (S3), Simple Queuing Services(SQS), Google App Engine- PaaS, Windows Azure, A comparison of cloud computing platforms. **(08 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

- Rajkumar Buyya , Christian Vecchiola, S ThamaraiSelvi, —Mastering Cloud Computing, McGraw Hill.
- Rajkumar Buyya , James Broberg, Andrzej Goscinski, — CLOUD COMPUTING Principles and Paradigms, John Wiley & Sons, Inc., Hoboken, New Jersey
- T. Velte, A. Velte, R. Elsenpeter, Cloud Computing, A Practical Approach, McGraw-Hill, 2009Barrie Sosinsky, Cloud Computing Bible, Wiley
- Jurg Van Vliet and Flavia Paganelli, Programming Amazon EC2, O'Rielly

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: IoT and its Industrial Applications
Course No.: MECE201
Duration of Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview:
In this course, student will explore various components of Internet of things such as Sensors, internetworking and cyber space. In the end they will also be able to design and implement IIoT circuits and solutions.

Course Outcomes:

CO1	Attain knowledge of IoT, design, Architecture, communication protocols and sensors.
CO2	Implement the concepts Python programming tools, Res-pi and Aurdino.
CO3	Analyze challenges in Iot and its applications in real time scenario.
CO4	While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.

UNIT 1: Introduction to IoT:
IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. **(8 Hours)**

UNIT 2: IoT to M2M: IoT and M2M fundamentals, Devices and gate ways, Definitions, M2M Value Chains, IoT Value Chains, Difference between IoT and M2M. **(6 Hours)**

UNIT 3:Network and communication protocol:
IoT standards and protocol, Wireless medium access issues, MAC control survey, constrained application protocol (CoAP). Message queue Telemetry transport protocol(MQTT), AMQP, security ion IoT protocol, Sensor deployment and node discovery, Data handling and analyst, Cloud Platform for IoTs. **(8 Hours)**

UNIT 4 Sensors and Actuators Modules:
Concept, layout, working and different applications of sensors and actuators, Temperature Sensor, Pressure Sensor, Proximity Sensor, Accelerometer and Gyroscope Sensor, IR Sensor, Optical Sensor, Gas Sensor, Smoke Sensor. ultrasonic sensor, relay. **(8 Hours)**

UNIT 5 Developing IoT based systems:
Introduction to Python, Implementing IoT concepts with python, Introduction to Arduino and Raspberry Pi programming, Implementation of IoT sensors with Arduino and Raspberry, Smartphone (Cellular), Bluetooth, LoRaWAN, Zigbee and wifi interfacing with R-Pi and Arduino. Introduction to ESP8266. **(12 Hours)**

UNIT 6: Control & Supervisory Level of Automation
Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA). HMI in an automation process, ERP & MES. **(8 Hours)**

UNIT 7: Application of IIOT
Health monitoring, IOT smart city, Smart irrigation, Robot surveillance.Home Appliances Control Using Blynk Application, IIoT based smart energy meter. **(10 Hours)**

Note: The Question paper will comprise of 7 questions of 15 marks each, uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1st Edition, Academic Press, 2014.
2. "Internet of Things (A Hands-onApproach)", Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014
3. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",Francis da Costa, 1st Edition, Apress Publications, 2013
4. "Getting Started with the Internet of Things", Cuno Pfister, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
5. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
6. Industrial Internet of Things: Cyber manufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
7. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M.Tech 2nd Semester
Branch: CSE
Course Title: Software Quality Assurance and Testing
Course No.: MCSE2B1
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course overview: The production and use of quality software is critical to the survival of many projects and organizations. For the successful production of software, attention must be paid to quality during every phase of the development process. This course will describe the testing methods that can be used at each stage and will show how the testing processes form part of the overall quality assurance objectives for the organization.

Course outcomes: By the end of the course students shall be able to:

CO1	Perform functional and non-functional tests in the life cycle of the software product.
CO2	Understand system testing and test execution process and identify defect prevention techniques and software quality assurance metrics.
CO3	Apply techniques of quality assurance for typical applications.

Detailed Syllabus

UNIT 1: Need For Software Quality – Quality Challenges – Software Quality Assurance (SQA) -Definition And Objectives – Software Quality Factors – McCalls Quality Model – SQA System and Architecture – Software Project Life Cycle Components – Management of SQA components – Pre-Project Software Quality Components – Contract Review– Development and Quality Plans. Software Quality: People's Quality Expectations, Frameworks and ISO-9126, Quality Characteristics ISO 9000:2000, Software Quality Standard, Maturity models: Test Process Improvement,Testing Maturity Model. **(10 hrs)**

UNIT 2: Software Testing - Concepts, Issues and Techniques Quality Revolution, Verification and Validation, Failure, Error, Fault and Defect, Objectives of Testing, Testing Activities, Test Case Selection , White Box and Black test Planning and design, Test Tools and Automation, Power of Test, Test Team Organization and Management, Test Groups, Software Quality Assurance Group ,System Test Team Hierarchy, Team Building. **(08 hrs)**

UNIT 3: System Testing: System Testing, System Integration Techniques: Incremental, Top Down, Bottom Up, Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration, Built-in Testing, Functional testing :Testing a Function in Context, Boundary Value Analysis, Decision Table, Acceptance testing : Selection of Acceptance Criteria, Acceptance Test Plan, Execution Test, software reliability : Fault and Failure, Factors Influencing Software, Reliability Models **(08 hrs)**

UNIT 4: System Test Categories: Taxonomy of System Tests, Interface Tests, Functionality Tests, GUI Tests, Security Tests, Feature Tests, Robustness Tests, Boundary Value Tests, Power Cycling Tests ,Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests, Test Generation from FSM models: State-Oriented Model, Finite-State Machine, Transition Tour Method, Testing with State Verification, Test Architectures: Local, distributed, Coordinated, Remote, system test design. **(10 hrs)**

UNIT 5: Software Quality Infrastructure: Procedures And Work Instructions – Supporting Quality devices – Templates – Checklists -Staff Training and Certification – Corrective and Preventive Actions – Configuration Management –Software Change Control – Configuration Management Audit -Documentation Control – Storage and Retrieval. **(08 hrs)**

UNIT 6 Software Quality Assurance: Quality Assurance - Root C use Analysis, Modelling, technologies, standards and methodologies for defect prevention; Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees, Comparing Quality Assurance Techniques and Activities, QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement, Case Study: FSM-Based Testing of Web-Based Applications. **(10 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

- Software Testing And Quality Assurance-Theory and Practice, Kshirasagar Nak Priyadarshi Tripathy, John Wiley & Sons Inc,2008
- Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.
- Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004
- Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: MTech 2nd Semester
Branch: CSE
Course Title: Mobile Computing
Course No.: MCSE2B2
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: This course helps students to define concepts of wireless communication; compare and contrast propagation methods, channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication; Explain CDMA, GSM. Mobile IP, Wlmax and Different Mobile OS; Illustrate various Markup Languages CDC, CLDC, MIDP Programming for CLDC, MIDlet model and security concerns.

Course Outcomes: By the end of the course students shall be able to:

CO1	Explain state of art techniques in mobile communication.
CO2	Discover CDMA, GSM, MobileIP, WIMax.
CO3	Demonstrate program for CLDC, MIDP let model and security concerns.

Detailed Syllabus

UNIT 1: Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks: Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications. **(12 hrs)**

UNIT 2: GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices **(10 hrs)**

UNIT 3: Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators **(12 hrs)**

UNIT 4: Building Wireless Internet Applications: Thin client overview: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, 10 Hours HTML, cHTML, XHTML, VoiceXML. **(10 hrs)**

UNIT 5: J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.. **(10hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

- Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
- Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: Advanced Machine Learning Lab
Course No.:MCSE211

L	T	P	C	Theory (External)	Internal
	-	2	1	-	50

Course Overview: In this course the students will be able to have clear understanding about the concepts of programming in python and familiarize themselves on various Free and Open Source Softwares(such as Scilab, Hadoop, Weka and Network Simulators ets.)

Suggested Lab Exercises: Students can choose a topic of their choice and perform a case study on recent advancements in that field. Some examples are shown below:

- Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm.
- Data Science: Pharmaceutical Robot Scientist, Data Science for Drug Discovery and sensors data.
- Use network simulators (NS2/NS3/NetSim etc.). Enhance any routing or mac layer protocol to provide quality of service metrics to VoIP or Video traffic.

Note: Laboratory work will be evaluated on internal scheme with following components:

1. Lab. Work (Continuous Assessment) 70%
2. Viva-voce test 30%

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: Cloud Computing Lab
Course No.: MCSE2AA

L	T	P	C	Theory (External)	Internal
	-	2	1	-	50

Course Overview: In this course the students will be able to appreciate cloud architecture, create and run virtual machines on open source OS, implement Infrastructure, storage as a Service, install and appreciate security features for cloud.

Course Outcomes: By the end of the course students shall be able to:

CO1	Install and configure various Cloud computing environments.
CO2	Understand deployment of service and its usage over cloud
CO3	Implement Virtualization using VM Ware's Workstation/KVM.

Laboratory Work:

1. Study of Cloud Computing & Architecture viz Eucalyptus, Nimbu, Open Nebukla, Cloud Sim
2. To implement Cloud using framework and related services
3. To understand various concepts practically about virtualisation and data storage applied using AWS / Azure / Google Cloud
4. Design and deploy a private cloud using open source tools
5. Project work for design of cloud environment using open sourse.
6. Case study on Amazon EC2
7. Case-study on Serverless architecture of AWS
8. Case study on Microsoft Azure

Note: Laboratory work will be evaluated on internal scheme with following components:

1. Lab. Work (Continuous Assessment) 70%
2. Viva-voce test 30%

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester.
Branch: CSE
Course Title: IoT and its Applications Lab
Course No. : MECE211

L	T	P	C	External	Internal
-	-	2	1	-	50

Course Outcomes: By the end of the course students shall be able to:

CO1	Familiarize with various controllers, sensors and actuators.
CO2	Acquire knowledge about various IoT based connectivity modules.
CO3	Design a real time project

List of Experiments:

1. Introduction to Raspberry pi, Arduino & ESP 32.
2. Experiment to perform interfacing of raspberry pi/Arduino with LED and switch.
3. Experiment to perform serial Communication using raspberry pi/Arduino.
4. Experiment to perform transferring of data through Bluetooth app to raspberry pi/Arduino.
5. Experiment to setup the thing speak cloud for data reception & transmission
6. Experiment to transmit temperature & humidity sensor data to thing speak cloud
7. Experiment to perform graphical Visualization of light intensity data on thing speak cloud and downloading of logged data into Excel format
8. Experiment to setup the Blynk app cloud for data reception & transmission
9. Experiment to perform Interfacing of raspberry pi/Arduino with relay module and controlling through blynk platform.
10. Experiment to perform Interfacing of Esp32 with stepper motor & control the direction of motor through IoT platform
11. Experiment to perform Interfacing of Esp32 with motion sensor & LCD display and display motion detection information on LCD.
12. Experiment to perform Interfacing of Esp32 with IR sensor & OLED display and display obstacle detection information on OLED
13. Experiment to study Digital Input/Output using Ladder Logic.
14. Experiment to study Timer/Counter using Ladder Logic.
15. Experiment to study Analog Input/Output of PLC.
16. Experiment to perform interfacing of HMT with PLC.
17. Experiment to perform IOT control application through SCADA.

NOTE: Minimum Eight experiments to be performed. Additional experiments based upon course contents. Project application consists of Home automation, Health sector, smart farming, Surveillance systems, connected vehicles, industrial automation etc.

Laboratory work will be evaluated on internal scheme with following components:

1. Lab. Work (Continuous Assessment) 70%
2. Viva-voce test 30%

FOR EXAMINATIONS TO BE HELD IN THE MAY 2024, 2025, 2026

Class: M. Tech 2nd Semester
Branch: CSE
Course Title: Seminar
Course No.: MCSE212
Duration Exam: 3 HRS

L	T	P	C	External	Internal
-	-	4	2	-	100

Course Overview: The course aims to expose students to the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions. To promote and develop presentation skills and import a knowledgeable society. To set the stage for future recruitment by potential employers.

Course Outcomes: By the end of the course, students will be able to:

CO1	An ability to work in actual working environment.
CO2	An ability to utilize technical resources.
CO3	An ability to write technical documents and give oral presentations related to the work completed.

General guidelines for Presentation and File:

Content: Report must contain abundant material clearly related to topic; points should be clearly made and all evidence must support the topic along with varied use of materials.
Coherence and Organization: Topic should be clearly stated and developed; specified examples must be incorporated that would clearly develop the concept; conclusion must be clear and must flow together well.
Multimedia Material used: Report should have a balanced use of multimedia materials to properly showcase the work done.

Note: Seminar will be evaluated on internal scheme with following components:

1) Presentation 30%
2) Viva-Voce 30%
3) Report 40%

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE
Course Title: Big Data and Analytics
Course No.: MCSE3C1
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course overview: This course brings together several key information technologies used in manipulating, storing, and analyzing big data. The course focuses on mining of massive data sets and machine learning algorithms for analyzing very large amounts of data or Big data The course reviews MapReduce techniques for parallel processing and Hadoop, an open source framework that allows us to cheaply and efficiently implement MapReduce on Internet scale problems. The course touches on related tools that provide SQL-like access to unstructured data: Pig and Hive and also analyzes so-called NoSQL storage solutions exemplified by HBase for their critical features: speed of reads and writes, data consistency, and ability to scale to extreme volumes.The memory resident databases and streaming technologies are analyzed.

Course Outcomes: By the end of the course students shall be able to:

CO1	Understand the need for Big Data Analytics using Big Data tools like Hadoop& Spark etc.
CO2	Access and Process Data on Distributed File System and Manage Job Execution in Hadoop Environment.
CO3	Gain insight into the issues and problems involved in massive on-line repository systems.

Detailed Syllabus

UNIT 1: Introduction to Big Data: Characteristics of Data, and Big Data Evolution of Big Data,Definition of Big Data, Challenges with bigdata, Data Warehouse environment, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of Big Data Analytics. Big Data Analytics: Introduction to big data analytics, Classification of Analytics, Challenges of Big Data, Importance of Big Data, Big Data Technologies, Data Science, Responsibilities, Soft state eventual consistency, Data Analytics Life Cycle. **(12hrs)**

UNIT 2: Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models. **(10hrs)**

UNIT 3 : HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Base Data structures. Applications with Hadoop YARN - Interacting with Hadoop Ecosystem Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features. **(12hrs)**

UNIT 4: Hadoop Eco System: Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, QueryingData and User Defined Functions.Hbase :HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.Introduction to Big SQL. **(12hrs)**

UNIT 5: Intoduction to Data Analytics with R

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Machine Learning Algorithms: Regression Model, Clustering, Collaborative Filtering, Associate Rule Making, DecisionTree, Big Data Analytics with Big R. **(10hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Text Book:

1. Tom White " Hadoop: The Definitive Guide" Fourth Edit on, O'reily Media, 2015.
2. SeemaAcharya, SubhashiniChellappan, "Big Data and Analytics", Wiley Publications, FirstEdition,2015

Suggested Books:

- Jimmy Lin and Chris Dyer, Data-Intensive Text Processing with Map Reduce, Morgan & Claypool Publishers, 2010. http://lintool.github.com/MapReduceAlgorithms/
- Chuck Lam, Hadoop in Action, December, 2010 | 336 pages ISBN: 9781935182191, Manning Publications
- Peter Zecevic and MarKoBonaci, Spark in Action, 2017 | 476 pages, ISBN: 9781617292606, Manning Publications
- Mohammed Guller, Big Data Analytics with Spark, Apress, 2015

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE
Course Title: Digital Image Processing
Course No.: MCSE3C2
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: This course provides a comprehensive introduction to digital image processing, and various image Transforms, Image Enhancement Techniques, Image restoration Techniques and methods, image compression and Segmentation used in digital image processing.

Course Outcomes: By the end of the course students shall be able to:

CO1	Describe the fundamentals of digital image processing.
CO2	Understand image formation and the role of human visual system in perception of gray and color image.
CO3	Apply image processing techniques in both the spatial and frequency (Fourier) domain.
CO4	Conduct independent study and analysis of image Enhancement and restoration techniques.

Detailed Syllabus

Unit 1: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Elements of Visual Perception, Light and Electromagnetic Spectrum. Image Sensing and Acquisition. Image Sampling and Quantization,Basic relationships between pixels, Lincar and non-linear operations. **(10 hrs)**

Unit 2: Basics of intensity transformation and spatial filtering,Intensity transformation functions: image negative, log transformation, power law, Piecewise-linear transformation functions, Histogram Processing: histogram stretching, histogram equalization. Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. **(10 hrs)**

Unit 3: Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT) of One Variables, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain. **(10 hrs)**

Unit 4: Image Restoration: Model of the image degradation/restoration process, Noise Models, Spatial and Frequency Properties of Noise, Some Important Noise Probability Density Functions, Periodic Noise,Estimation of noise parameters, Restoration in the presence of noise-spatial filtering- Mean filters, Order-statisticsfilters, Median filter, Max and Min filters, Mid-point filter, Alpha-trimmed mean filter, adaptive filters. Periodic Noise Reduction by Frequency Domain Filtering. **(10 hrs)**

Unit 5: Color Image Processing: Introduction to the color image processing, color models: RGB, HSI, CMY/ CMYK;Conversion of color models: converting colors from RGB to HSI, HSI to RGB, RGB to CMY and CMY to RGB; Pseudo coloring of images. **(06 hrs)**

Unit 6: Image Compression: Introduction to image compression, need of compression, methods of imagecompression: coding redundancy, spatial and temporal redundancy, irrelevant information, models of image compression, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding, Symbol-Based Coding, Bit-Plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding 604. **(09 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

- Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3rd edition, Pearson Education.
- David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", Prentice Hall
- A.K. Jain, "Fundamental of Digital Image Processing", PH

Approved

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE
Course Title: Cyber Security and Digital Forensics
Course No.: MCSE3D1
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: Fundamental security topics including cryptography, protocols, passwords, access control, software security, and network security. Additional topics selected from multilevel security, biometrics, tamper-resistant hardware ,information warfare, e-commerce, penetrating testing, malware analysis, software security, system evaluation and assurance, and intrusion detection. To correctly define , cite and analyze appropriate instances and evidences of Computer Forensic . Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Computer Forensics. To understand the ethics and laws by which cyber space is governed in our country and worldwide.

Course Outcomes: After studying this course, students shall be able to:

CO1	Understand basic design principals of symmetric and asymmetric cryptography , role of digital forensics and its relationship to traditional forensic science, traditional science . Also learn how Standard crypt analytic attacks work and there by how to avoid common design flaws.
CO2	Understand hash functions and existing techniques like Advanced Encryption Standard(AES),Rivest–Shamir–Adleman (RSA)and Discrete Log and Gain knowledge of the technologies that under pin the deployment and maintenance of a secure network.
CO3	Assess the security needs of computer and network systems and conduct digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting.
CO4	Use scientific methods and Recommend safe guard solutions and to manage the implementation and maintenance of security devices, systems, and procedures

Detailed Syllabus

UNIT1: Introduction to Cyber Security: Security mind-set, Computer Security Concepts, Threats, Attacks and Assets. The Principles of Security, Cyber security Safeguards, CIA Triad, Confidentiality, The Ethical Hacking terminology: Five stages of hacking, Information Gathering Principle or Confidentiality, Protecting Data Privacy, Controlling Access-Laws and Liability, Integrity: Principle or Data Integrity, Need for Data Integrity Checks, Availability, The Principle of Availability, Ensuring Availability. **(10hrs)**

UNIT 2: Practical Cryptography: Encryption, Decryption, Authentication, Hashing, Symmetric and Asymmetric cryptography, Steganography, Digital Signatures and Certificates. Network Security and Protocol Standards, Network security issues, sniffing, IP Spoofing, Common threats, E-mail security, Secure Socket Layer(SSL), Transport Layer Security(TLS),SSH, IPSEC, Pretty Good Privacy(PGP),Firewalls need and features of firewall, Types of firewall ,Intruder Detection Systems. **(08 hrs)**

UNIT3: Introduction to Cyber Crime : -Overview of Cyber Crime, Types of Cybercrime:- Like Cyber Terrorism, Extortion, Cyber Bullying/ Stalking, Internet Fraud, Cyber Warfare, Password Cracking, Keyloggers and Spyware, Virus and Worms, Trojan and backdoors, DOS and DDOS attack, SQL injection, Buffer Overflow, Characteristics of Cyber Crime, Cyber Crime Challenges, Prevention of Cyber Crime, Cyber Ethics, Cyber Laws & its Amendment , IT-Act 2000. **(08 hrs)**

UNIT 4: Incident Response, Risk Management and Disaster Recovery, from an Information Assurance & Cyber Security perspective, Cyber Security & Threat Intelligence, Hands on introduction to the concepts and tools of Cyber Threat intelligence, Its Life Cycle, Standard Cyber Threat intelligence Technologies, (e.g., CIF Servers, TAXII Servers, SIEMs), Introduction of Penetration Testing (Pen Testing) or Ethical Hacking, its Life Cycles, Pen Testing Tools, OS-Fingerprinting, Credential Gathering & Privilege Escalation, Malware Analysis. **(07 Hrs)**

UNIT 5: Digital Forensic :- What is Digital Forensics?, History of Digital forensics, Objectives of computer forensics, Process of Digital Forensics, Types of Digital Forensics, Disk, Memory, Network & E-Mail, Mobile Forensics, Challenges faced by Digital Forensics, Uses of Digital Forensics, Advantages/ Disadvantages DF. **(08 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5questions.

Suggested Books:

- Introduction to Modern Cryptography by Jonathan Katz and Yehuda Lindell, CRC Press Cryptography and Network Security by William Stallings,Fourth Edition,2006PrenticeHall.ISBN0-13-187316-4
- Handbook of Handbook of Applied Cryptography by Alfred J. Menezes, Paul C. van Oorschot and Scott A.Vanstone,CRC Press.
- Applied Cryptography: Protocols ,Algorithms and Source Codein CbyBruceSchneier, John Wiley and Son

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE
Course Title: Data Science
Course No.: MCSE3D2
Duration Exam: 3 HRS

L	T	P	C	Theory (External)	Internal
3	1	-	4	75	25

Course Overview: This course will provide 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; Produce code to statistically analyse a dataset; Critically evaluate data visualisations based on their design and use for communicating stories from data.

Course Outcomes: By the end of the course students shall be able to:

CO1	Explain how data is collected, managed and stored for data science
CO2	Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists
CO3	Become proficient in the statistical analysis of data and the use of computation tools for data analysis.
CO4	Design and implement various algorithms in a range of Real world applications.

Detailed Syllabus

Unit 1: Introduction to core concepts and technologies: Introduction to data Science, data science process, data science toolkit, Types of data, classification of data, Simple Visualizations, Example, applications. **(08 hrs)**

Unit 2:Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources **(08 hrs)**

Unit 3:Data Cleaning and Data Pre-processing: Introduction, Data Cleaning Techniques, Data integration, Data reduction, Data transformation and discretization. **(08 hrs)**

UNIT 4:Data analysis and Exploration : Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Prediction Models-The prediction task-Definition, Examples, training-test data, cross validation ; Machine learning algorithms: SVM, Naive Bayes, Decision trees, Rule learners, Linear/logistic regression, Nearest neighbor learning, Random Forest, properties with suitable example.
Deep learning Algorithms: Convolution Neural Networks (CNNs) , Recurrent Neural Networks (RNNs),Training via back propagation algorithm, properties with suitable example. **(12 hrs)**

Unit 5:Data Visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings. Cluster analysis of large scale data sets: partitioning methods, Clustering graphs and network data **(10 hrs)**

Unit 6: Data Optimization and Deployment : Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science , Technologies for visualization, Applications of Data Science- health care, image recognition, gaming, medicine etc **(10 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions. Suggested Books:

References:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE
Course Title: Big Data and Analytics Lab
Course No.: MCSE3CA
Duration Exam: 3 HRS

L	T	P	C	Internal
-	-	2	1	50

Course Outcomes: By the end of the course students shall be able to:

CO1	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
CO2	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQLin big data analytics.
CO3	Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

List of Practical

1	Study of Big Data Analytics and Hadoop Architecture.
2	To study various HDFS Commands (Atleast 10)
3	Implement following using Map-Reduce: i) Matrix Multiplication (ii) Sorting (iii) Indexing
4	Word Count Map Reduce program to understand Map Reduce Paradigm
5	Installation of SPARK framework with or without Hadoop framework.
6	Implementation of Matrix Algorithms in SPARK SQL programming.
7	Write a command for the following in Hive Query Language: i) changing directory to HIVE_HOME (ii) creating a database (iii) creating a table (iv) loading data in a table (v) counting number of rows in a table and (vi) exiting the Hive CLI
8	Consider a specific example where we have a dataset that originates from news arti-cles or blog posts and a prediction task where we want to determine the number of comments in the next 24 hours.
9	Use Pig Latin scripts to sort, group, join, project, and filter your data.
10	Creating Databases, Tables, Views, Functions and Indexes in Hive.

Note: Laboratory work will be evaluated on internal scheme with following components:

1. **Lab. Work (Continuous Assessment)** **70%**
2. **Viva-voce test** **30%**

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE
Course Title: Digital Image Processing Lab
Course No.: MCSE3CB

L	T	P	C	Internal
-	-	2	1	50

Course Overview: In this course the students will be able to appreciate cloud architecture, create and run virtual machines on open-source OS, implement Infrastructure, storage as a Service, install and appreciate security features for cloud.

Course Outcomes: By the end of the course students shall be able to:

CO1	Install and configure various concepts of MATLAB.
CO2	Understand the various concepts of Image Processing.
CO3	Apply image processing techniques in the spatial domain

Suggested Lab Exercises:

Pre-lab(Introduction to MATLAB).

1. To study the Image Processing concept.
2. To obtain histogram equalization image.
3. To implement smoothing or averaging filter in spatial domain.
4. Program for opening and closing of the image.
5. To fill the region of interest for the image.
6. Program for edge detection algorithm.
7. Program of sharpen image using gradient mask.
8. Program for morphological operation: erosion and dilation.

Note: Laboratory work will be evaluated on internal scheme with following components:

Lab. Work (Continuous Assessment)	**70%**
Viva-voce test	**30%**

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE

Course Title: Cyber Security and Digital Forensics Lab
Course No.: MCS3DA

L	T	P	C	Internal
-	-	2	1	50

Course Overview: Cyber security aims to understand the threats in networks and security concepts and use of authentication applications in different networks. Also helps to understand security services for email and awareness of firewall and its applications.

Course Outcomes: By the end of the course students shall be able to:

CO1	Implementation of Encryption and Decryption Algorithm using C/C++
CO2	Implementation of AES and RSA Algorithm using C/C++ or Java Platform.
CO3	Implementation of Steganography using Open Source Tools, Website Security using SSL/TLS Tools and Implementation of Software/Hardware Firewall
CO4	Implementation of Hashing using MD5 or SHA Tools, Disk Forensics using any Open Source Tools like Autopsy or FTK. Implementation of Memory Forensics using Dumpit and Volatility tools.

Suggested Lab Exercises:

1. To implement the Encryption or Decryption procedure using any Substitution or Transposition methods using C/C++ Languages.
2. To implement the Symmetric Key Cryptography Algorithm like **AES** using C/C++ Languages.
3. To implement the RSA Algorithm using C/C++ Languages.
4. To implement Image and Audio Steganography using Windows OS built in Feature.
5. To implement Website Security using SSL/TLS Certification
6. To implement the significance of Firewall using Windows Defender Firewall Rules.
7. To Implement Hashing Procedure using any OS Tools like HashCalc.
8. To implementation Disk Forensics using Autopsy or FTK Toolkit
9. To implement Memory Forensics using Volatility or Dumpit OS Tools.

Note: Laboratory work will be evaluated on internal scheme with following components:

1. **Lab. Work (Continuous Assessment)** **70%**
2. **Viva-voce test** **30%**

For Examinations to be held in the December 2024, 2025, 2026

L	T	P	C	Internal
-	-	2	1	50

Class: M. Tech 3rd Semester
Branch: CSE

Course Title: Data Science Lab
Course No.: MCS3DB

Course Overview: In this course the students will be able to Build a Strong Foundation for basic Statistical and Probabilistic measures for data science, get Familiar with Databases, Learn Programming With Python/R, and learn Data Analysis Methods.

Course Outcomes: By the end of the course students shall be able to:

CO1	To understand the python/R libraries for data science
CO2	To understand the basic Statistical and Probability measures for data science
CO3	To present and interpret data using visualization packages in Python/R

Suggested Lab Exercises:

1. Download, install and explore the features of different packages of python/R.
2. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the data set.
3. Write a program for Frequency distributions, Variability and Averages
4. Write a program to predict the class of the flower based on available attributes.
5. Write a Programs to implement decision tree and K Nearest Neighbour algorithms
6. Write a program to build a linear regression model and logistic regression model, check the model on a test data and predict the numerical quantities.
7. Use the diabetes data set for performing the following:
   a Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation
8. Write a program to identify the texts are positive and negative
9. Implementation of word count example
10. Apply and explore various plotting functions on data sets.
    a. Normal curves
    b. Density and contour plots
    c. Correlation and scatter plots
    d. Histograms

Note: Laboratory work will be evaluated on internal scheme with following components:

1 Lab. Work (Continuous Assessment) 70%

2 Viva-voce test 30%

For Examinations to be held in the December 2024, 2025, 2026

Class: M. Tech 3rd Semester
Branch: CSE
Course Title: Dissertation - I
Course No.: MCSE311
Duration Exam: 3 HRS

L	T	P	C	Internal
-	-	14	7	150

Course overview: The dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase–I: July/August to December/January and Phase-II: January/February to June/July.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

CO1	Conceive a problem statement either from rigorous literature survey or from the requirements raised by external entity.
CO2	Design, implement and test the prototype/algorithm in order to solve the conceived problem

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the Industry and Academics.

The dissertation should have the following:

- Relevance to social needs of society.
- Relevance to value addition to existing facilities in the institute.
- Relevance to industry need.
- Problems of national importance.
- Research and development in various domains.

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals etc. in the relevant areas and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution and submit the proposal to the department..

- **Phase–I Deliverables:** A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, a record of continuous progress.
- **Phase–I Evaluation:** Internal committee constituted by Head of Department comprising of guides of respective specialization, shall assess the progress/performance of the student based on report, presentation and viva voce

1) **Performance or work done** — **30% of total Internal marks**
2) **Seminar** — **25% of total Internal marks**
3) **Viva** — **25% of total Internal marks**
4) **Report** — **20% of total Internal marks**

For Examinations to be held in May 2025, 2026, 2027

Class M. Tech: 4th Semester
Branch: CSE
Course Title: DISSERTATION-II
Course No.: MCSE411

L	T	P	C	Internal	External
-	-	36	18	300	150

Course overview: Research and development projects based on problems of practical and theoretical interest, Problem definition, background research, development of overall project plan. Evaluation will be based on student seminars, written reports, and evaluation of the developed system and/or theories.

At least one publication in a journal of repute is mandatory for the final evaluation of Dissertation.

Note: Dissertation-II will be evaluated for internal and external evaluation.

Internal evaluation will be done based on following components:

1. **Presentation/ Demonstration : 40% of total Internal marks**
2. **Report : 40% of total Internal marks**
3. **Viva-Voce : 20% of total Internal marks**