DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

(R21 M. TECH. CSE)

COURSE STRUCTURE & SYLLABUS

M. Tech. COMPUTER SCIENCE AND ENGINEERING

EFFECTIVE FROM ACADEMIC YEAR 2021 - 22 ADMITTED BATCH

R21 COURSE STRUCTURE AND SYLLABUS

I YEAR I – SEMESTER

SNO	Course Code	Course Title	Category	Int	Ext	L	T	P	Credits
1	21CS6111	Mathematical Foundations of Computer Science	PC	30	70	3	0	0	3
2	21CS6112	Advanced Data Structures	PC	30	70	3	0	0	3
	Professional Elective-I								
3	21CS6171	InformationSecurity	PE	30	70	3	0	0	3
	21CS6172	Mobile ApplicationDevelopment	PE	30	70				
	21CS6173	Machine Learning	PE	30	70				
	Professional Elective-II								
4	21CS6174	Soft Computing	PE	30	70	3	0	0	3
	21CS6175	CloudComputing	PE	30	70				
	21CS6176	Data Mining	PE	30	70				
5	21CS6151	Advanced Data Structures Lab	PC	30	70	0	0	4	2
6	21CS6152	Machine Learning Lab	PC	30	70	0	0	4	2
7	21MC6111	Research Methodology & IPR	MC	30	70	2	0	0	2
8	21AU6101	Stress Management by Yoga	Audit	30	70	2	0	0	0
		Total				**16**	**0**	**8**	**18**

I YEAR II –SEMESTER

S.NO	Course Code	Course Title	Category	Int	Ext	L	T	P	Credits
1	21CS6211	Advanced Algorithms	PC	30	70	3	0	0	3
2	21CS6212	Advanced Computer Architecture	PC	30	70	3	0	0	3
	Professional Elective-III								
3	21CS6271	Natural Language Processing	PE	30	70	3	0	0	3
	21CS6272	Internet ofThings		30	70				
	21CS6273	Data Science		30	70				
	Professional Elective-IV								
4	21CS6274	Cyber Security	PE	30	70	3	0	0	3
	21CS6275	Advanced ComputerNetworks		30	70				
	21CS6276	Big DataAnalytics		30	70				
5	21CS6251	Advanced Algorithms Lab	PC	30	70	0	0	4	2
6	21CS6252	Data Science Lab	PC	30	70	0	0	4	2
7	21CS6291	Mini Project with Seminar	PW	30	70	0	0	4	2
8	21AU6201	English for Research Paper Writing	Audit	30	70	2	0	0	0
		Total				**14**	**0**	**12**	**18**

II YEAR I –SEMESTER

S.NO	Course Code	Course Title	Category	Int	Ext	L	T	P	Credits
	Professional Elective-V								
1	21CS7171	Digital Forensics	PE	30	70	3	0	0	3
	21CS7172	High PerformanceComputing		30	70				
	21CS7173	DeepLearning		30	70				
	Open Electives								
2	21ME7161	Industrial Safety	OE	30	70	3	0	0	3
	21ME7162	Operations Research		30	70				
	21BM7161	Cost Management of Engineering Projects		30	70				
	21ME7163	Composite Materials		30	70				
	21SE7161	Energy from Waste Material		30	70				
3	21CS7181	Dissertation Work Review - I	PW	30	70	0	0	12	6
		Total				**6**	**0**	**12**	**12**

II YEAR II – SEMESTER

S.NO	Course Code	Course Title	Category	Int	Ext	L	T	P	Credits
1	21CS7281	Dissertation Work Review - II	PW	100	0	0	0	12	6
2	21CS7282	Dissertation (Viva-Voce)	PW	0	100	0	0	28	14
		Total				**0**	**0**	**40**	**20**

S.No.	Semester wise	Credits
1	Semester-I	18
2	Semester-II	18
3	Semester-III	12
4	Semester-IV	20
	Total	**68**

M. Tech – CSE – I Year – I Semester

M. Tech – CSE – I Year – I Semester

21CS6111: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

L	T	P	C
3	0	0	3

Pre-Requisites: UG level course in Discrete Mathematics/ Mathematical Foundations of Computer Science.

Course Objectives:

- To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machinelearning.
- To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming languagedesign, andconcurrency.
- To study various sampling and classificationproblems.

Course Outcomes: After completion of course, students would be ableto:

- To understand the basic notions of discrete and continuousprobability**.**
- Tounderstandthemethodsofstatisticalinference,andtherolethatsamplingdistributionspla y in thosemethods.
- To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

UNIT – I

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation,

Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

UNIT - II

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood,

UNIT - III

Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of over fitting model assessment.

UNIT – IV

Graph Theory: Isomorphism, Planar graphs, graph colouring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems

UNIT-V

ComputerscienceandengineeringapplicationsDatamining,Networkprotocols,analysisofWebtraffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machinelearning.

Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bio-informatics, soft computing, and computer vision.

Text Book:

1. John Vince, Foundation Mathematics for Computer Science, Springer.

References:

1. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications.Wiley.
2. M. Mitzenmacher and E. Upfal. Probability and Computing: Randomized Algorithms and ProbabilisticAnalysis.
3. Alan Tucker, Applied Combinatorics,Wiley

M. Tech - CSE – I Year – I Semester

21CS6112:ADVANCED DATA STRUCTURES

L	T	P	C
3	0	0	3

Pre-Requisites: UG level course in Data Structures

Course Objectives:

- The student should be able to choose appropriate data structures, understandthe ADT/libraries, and use it to design algorithms for a specificproblem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs ofcorrectness.

Course Outcomes: After completion of course, students would be able to:

- Understand the implementation of symbol table using hashingtechniques.
- Understand the implementation of symbol table using hashingtechniques.
- Develop algorithms for text processingapplications.
- Identify suitable data structures and develop algorithms for computational geometryproblems.
- Analyze and implement hashing and trees using computational geometric.

UNIT - I

Dictionaries:

Definition, Dictionary, Abstract Data Type, Implementation of Dictionaries.

Hashing:

Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT -II

Skip Lists:

Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT - III

Trees:

Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT - IV

Text Processing:

Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem

UNIT - V

Computational Geometry:

One Dimensional Range Searching, Two-Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

References:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley,2002.

M. Tech - CSE – I Year – I Semester

21CS6171:INFORMATION SECURITY (Professional Elective - I)

L	T	P	C
3	0	0	3

Prerequisites

- A Course on "Computer Networks and a course on Mathematics

Course Objectives

- To understand the fundamentals ofCryptography.
- To understand various key distribution and managementschemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks.
- To apply algorithms used for secure transactions in real worldapplications.

Course Outcomes

- Demonstrate the knowledge of cryptography, network security concepts andapplications.
- Ability to apply security principles in systemdesign.
- Abilitytoidentifyandinvestigatevulnerabilities.
- Ability to identify securitythreatsandmechanismstocounter them.
- Ability to deploy tools of firewall in switches and routers.

UNIT - I

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security.

Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

UNIT - II

Public key Cryptography Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

UNIT - III

Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service.

Email Security: Pretty Good Privacy (PGP) and S/MIME.

UNIT - IV

IP Security:

Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.
Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

UNIT - V

Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

Text Book:

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.

Reference Books:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman,Thomson.

M. Tech - CSE – I Year – I Semester

21CS6172:MOBILE APPLICATION DEVELOPMENT (Professional Elective - I)

L	T	P	C
3	0	0	3

Pre-Requisites:

- Acquaintance with JAVAprogramming.
- A Course on DBMS.

Course Objectives:

- To demonstrate their understanding of the fundamentals of Android operatingsystems.
- To improves their skills of using Android software developmenttools.
- Todemonstratetheirabilitytodevelopsoftwarewithreasonablecomplexityonmobileplatform.
- To demonstrate their ability to deploy software to mobiledevices.
- To demonstrate their ability to debug programs running on mobiledevices.

Course Outcomes:

- Student understands the working of Android OSPractically.
- Student will be able to develop Android userinterfaces.
- Student will be able to develop, deploy and maintain the AndroidApplications.
- Student can able to deploy software to mobiledevices.
- Student can able to debug programs running on mobiledevices.

UNIT - I

Introduction to Android Operating System: Android OS design and Features – Android development framework,SDKfeatures,InstallingandrunningapplicationsonAndroidStudio,CreatingAVDs,Types of Android applications, Best practices in Android programming, Androidtools

Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT - II

Android User Interface: Measurements – Device and pixel density independent measuring UNIT - s Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components – Editable and non editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments–

Creatingfragments,Lifecycleoffragments,Fragmentstates,AddingfragmentstoActivity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screenActivities

UNIT - III

IntentsandBroadcasts:Intent–
UsingintentstolaunchActivities,ExplicitlystartingnewActivity,Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to sendSMS

BroadcastReceivers–
UsingIntentfilterstoserviceimplicitIntents,ResolvingIntentfilters,findingand using Intents received within anActivity
Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT - IV

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

UNIT - V

Database–
IntroductiontoSQLitedatabase,creatingandopeningadatabase,creatingtables,inserting
retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve andupdate)

Text Books:

1. Professional Android 4 Application Dnetwork evelopment, Reto Meier, Wiley India, (Wrox) , 2012
2. AndroidApplicationDevelopmentforJavaProgrammers,JamesCSheusi,CengageLearni ng, 2013

Reference:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

M. Tech - CSE – I Year – I Semester

21CS6173:MACHINE LEARNING (Professional Elective - I)

L	T	P	C
3	0	0	3

Course Objectives:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IoTnodes.
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recentadvances.
- Explore supervised and unsupervised learning paradigms of machinelearning.
- To explore Deep learning technique and various feature extractionstrategies.

Course Outcomes: After completion of course, students would be able to:

- Extract features that can be used for a particular machine learning approach in various IoT applications.
- To compare and contrast pros and cons of various machine learning techniques.
- To apply a particular machine learningapproach.
- To mathematically analyze various machine learning approaches andparadigms.
- To apply Machine Learning techniques in IoT.

UNIT - I

Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes. Linear models: Linear Regression, Logistic Regression, Generalized Linear Models.

Support Vector Machines, Nonlinearity and Kernel Methods.

Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

UNIT – II

Unsupervised Learning:

Clustering: K-means/Kernel K-means.

Dimensionality Reduction: PCA and kernel PCA. Matrix Factorization and Matrix Completion.

Generative Models (mixture models and latent factor models).

UNIT - III

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

UNIT - IV

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

UNIT - V

Scalable Machine Learning (Online and Distributed Learning) A selection from some other

advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.
Recent trends in various learning techniques of machine learning and classification methods for IoT applications. Various models for IoT applications.

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely availableonline)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer,2007

M. Tech – CSE – I Year – I Semester

21CS6174: SOFT COMPUTING (Professional Elective - II)

L	T	P	C
3	0	0	3

Course Objectives:

- To give students knowledge of soft computing theories fundamentals, i.e. Fundamentals of artificial and neural networks, fuzzy sets and fuzzy logic and genetic algorithms.
- To learn the basic concept of soft computing.
- To become familiar with various techniques like Neural Networks, Gentic algorithm & fuzzy systems.
- To apply soft computing techniques to solve the problem.
- Applications of soft computing techniques to solve a number of real life problems.

Course Outcomes:

- Able to learn fuzzy logic and its applications.
- Able to learn Artificial Neural networks and its applications.
- Able to solve problems using genetic algorithms.
- Able to solve Applications in various don mains using soft computing techniques.
- Able to solve a number of real life problems.

UNIT- I

AI Problems and Search: AI problems, Techniques, Problem Spaces and Search, HeuristicSearch Techniques- Generate and Test, Hill Climbing, Best First Search Problem reduction, Constraint Satisfaction and Means End Analysis. Approaches to Knowledge Representation-Using Predicate Logic and Rules.

UNIT- II

Artificial Neural Networks: Introduction, Basic models of ANN, important terminologies,Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT- III

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet,Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT- IV

Introduction to Classical Sets (crisp Sets) and Fuzzy Sets: operations and Fuzzy sets. Classical Relations -and Fuzzy Relations- Cardinality, Operations, Properties and composition. Tolerance and equivalence relations.

Membership functions: Features, Fuzzification, membership value assignments,Defuzzification.

UNIT- V

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning FuzzyDecision making Fuzzy Logic Control Systems
Genetic Algorithm: Introduction and basic operators and terminology applications:

Optimization of TSP, Internet Search Technique.

TEXT BOOKS

1. Principles of Soft Computing- S N Sivanandam, S N Deepa, Wiley India, 2007
2. Soft Computing and Intelligent System Design -Fakhreddine O Karray, Clarence D Silva,.Pearson Edition, 2004.

REFERENCE BOOKS

1. Artificial Intelligence and Soft Computing- Behavioral and Cognitive Modeling of the Human
2. Brain- Amit Konar, CRC press, Taylor and Francis Group.
3. Artificial Intelligence – Elaine Rich and Kevin Knight, TMH, 1991, rp2008.
4. Artificial Intelligence – Patric Henry Winston – Third Edition, Pearson Education.
5. A first course in Fuzzy Logic-Hung T Nguyen and Elbert A Walker, CRC. Press Taylor and Francis Group

M. Tech - CSE – I Year – I Semester

21CS6175: CLOUD COMPUTING (Professional Elective - II)

L	T	P	C
3	0	0	3

Pre-Requisites: Computer Networks, Web Programming.

Course Objectives:

- The student will also learn how to apply trust-based security model to real-world security problems.
- An overview of the concepts, processes, and best practices needed to successfully secure information within Cloudinfrastructures.
- Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service deliverymodel.

Course Outcomes: After completion of course, students would be able to:

- Identify security aspects of each cloudmodel.
- Develop a risk-management strategy for moving to theCloud.
- Implement a public cloud instance using a public cloud serviceprovider.
- Apply trust-based security model to differentlayers.
- Able to deploy applications in cloud environment.

UNIT – I

Introduction to Cloud Computing:

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing

UNIT – II

Cloud Computing Architecture:

Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model

Cloud Deployment Models:

KeyDriverstoAdoptingtheCloud,TheImpactofCloudComputingonUsers,GovernanceintheCloud, Barriers to Cloud Computing Adoption in theEnterprise

UNIT - III

Security Issues in Cloud Computing:

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level,DataSecurityandStorage,AspectsofDataSecurity,DataSecurityMitigationProviderDataand ItsSecurity

Identity and Access Management:

TrustBoundariesandIAM,IAMChallenges,RelevantIAMStandardsandProtocolsfor CloudServices, IAM Practices in the Cloud, Cloud AuthorizationManagement

UNIT - IV

Security Management in the Cloud

Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS

Privacy Issues

Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

UNIT - V

Audit and Compliance

Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

Advanced Topics

Recent developments in hybrid cloud and cloud security.

References:

1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2,2009.
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September2009.

M. Tech - CSE – I Year – I Semester

21CS6176: DATA MINING (Professional Elective - II)

L	T	P	C
3	0	0	3

Course Objectives:

- To understand data miningconcepts.
- To learn about various data preprocessingtechniques.
- To learn about datawarehousing.
- To learn about various data mining functionalities such as association rule mining, clustering, classification and outlier analysis.

Course Outcomes (COs):

- Understand Classification of Data Mining systems.
- Understand OLAP concepts.
- Remove redundancy and incomplete data from the dataset using data preprocessing methods.
- Characterize the kinds of patterns that can be discovered by association rule mining.
- Discover interesting patterns from large amounts of data to analyze for predictions and classification.
- Develop a data mining application for data analysis using various tools.

UNIT - I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Issues in Data Mining.

Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT - II

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Usage of Data Warehousing Online Analytical Processing and Mining

Data Cube Computation: Efficient Methods for simple Data Cube Computation (Full Cube, Iceberg Cube, Closed Cube and Shell Cube), Discovery Driven exploration of data cubes, Attribute-Oriented Induction for data characterization and its implementation

UNIT - III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, The Apriori algorithm for finding frequent itemsets using candidate generation, Generating association rules from frequent itemsets, Mining frequent itemsets without candidate generation, Mining various kinds of Association Rules, Correlation Analysis

UNIT - IV

Classification and Prediction: Description and comparison of classification and prediction, preparing data for Classification and Prediction

Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Backpropagation

Prediction, linear and non-linear regression, evaluating accuracy of a Classifier or a Predictor

UNIT - V

Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major ClusteringMethods, k- means and k-mediods methods, CLARANS, Agglomerative and divisive hierarchical clustering, chameleon dynamic modeling, DBSCAN, Grid based clustering method: STING, Conceptual Clustering, Constraint-Based Cluster Analysis, OutlierAnalysis.

Text Books:

1. Data Mining – Concepts and Techniques - Jiawei Han, Micheline Kamber and Jian Pei, 3rd edition, Morgan Kaufmann Publishers,ELSEVIER.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

References:

1. Data Warehousing in the Real World – Sam Aanhory & Dennis Murray Pearson EdnAsia.
2. Insight into Data Mining, K. P. Soman, S. Diwakar, V. Ajay, PHI,2008.
3. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley studentEdition
4. The Data Warehouse Life cycle Tool kit – Ralph Kimball Wiley studentedition
5. Building the Data Warehouse By William H Inmon, John Wiley & Sons Inc,2005.
6. Data Mining Introductory and advanced topics –Margaret H Dunham, Pearsoneducation
7. Data Mining Techniques – Arun K Pujari, 2nd edition, UniversitiesPress.
8. Data Mining, V. Pudi and P. Radha Krishna, Oxford UniversityPress.
9. Data Mining: Methods and Techniques, A.B. M Shawkat Ali and S. A. Wasimi, Cengage Learning.
10. Data Warehouse 2.0, The Architecture for the next generation of Data Warehousing, W.H. Inmon, D. Strauss, G. Neushloss, Elsevier, Distributed bySPD.

M. Tech - CSE – I Year – I Semester

21CS6151: ADVANCED DATA STRUCTURES LAB (Lab - I)

L	T	P	C
0	0	4	2

Prerequisites: A course on Computer Programming & Data Structures

Course Objectives:

- Introduces the basic concepts of Abstract DataTypes.
- Reviews basic data structures such as stacks andqueues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, andB-trees.
- Introduces sorting and pattern matchingalgorithms.

Course Outcomes:

- Ability to select the data structures that efficiently model the information in aproblem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and patternmatching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, andB-trees.

List of Programs

1. Write a program to perform the followingoperations:
   a) Insert an element into a binary searchtree.
   b) Delete an element from a binary searchtree.
   c) Search for a key element in a binary searchtree.

2. Write a program for implementing the following sortingmethods:
   a) Mergesort b)Heapsort c) Quicksort

3. Write a program to perform the followingoperations:
   a) Insert an element into a B-tree.
   b) Delete an element from a B-tree.
   c) Search for a key element in a B-tree.

4. Write a program to perform the followingoperations:
   a) Insert an element into a Min-Maxheap
   b) Delete an element from a Min-Maxheap
   c) Search for a key element in a Min-Maxheap

5. Write a program to perform the followingoperations:
   a) Insert an element into a Lefiisttree
   b) Delete an element from a Leftisttree
   c) Search for a key element in a Leftisttree

6. Write a program to perform the followingoperations:
   a) Insert an element into a binomialheap
   b) Delete an element from a binomialheap.
   c) Search for a key element in a binomialheap
7. Write a program to perform the followingoperations:
   a) Insert an element into a AVLtree.
   b) Delete an element from a AVL searchtree.
   c) Search for a key element in a AVL searchtree.

8. Write a program to perform the followingoperations:
   a) Insert an element into a Red-Blacktree.
   b) Delete an element from a Red-Blacktree.
   c) Search for a key element in a Red-Blacktree.

9. Write a program to implement all the functions of a dictionary usinghashing.

10. Write a program for implementing Knuth-Morris-Pratt pattern matchingalgorithm.

11. Write a program for implementing Brute Force pattern matchingalgorithm.

12. Write a program for implementing Boyer pattern matchingalgorithm.

TEXT BOOKS:

1. Fundamentals of Data structures in C, E.Horowitz, S.Sahni and Susan Anderson Freed, 2nd Edition, UniversitiesPress
2. Data Structures Using C – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein,PHI/Pearson education.
3. Introduction to Data Structures in C, Ashok Kamthane, 1st Edition, Pearson.

REFERENCES:

1. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/PearsonEducation
2. C Programming with problem solving, J.A. Jones & K. Harrow, DreamtechPress
3. Data structures: A Pseudocode Approach with C, R.F.Gilberg And B.A.Forouzan, 2nd Edition, CengageLearning.

M. Tech – CSE – I Year – I Semester

21CS6152: MACHINE LEARNING LAB (Lab – II)

L	T	P	C
0	0	4	2

Course Objective:

- The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them usingpython.

Course Outcomes: After the completion of the "**Machine Learning**" lab, the student can able to:

- Understand complexity of Machine Learning algorithms and theirlimitations.
- Understand modern notions in data analysis-orientedcomputing.
- Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own.
- Be capable of performing experiments in Machine Learning using real-worlddata.

List of Experiments

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is theprobability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans:15%)
2. Extract the data from database usingpython
3. Implement k-nearest neighbours classification usingpython
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3centroids)

VAR1	VAR 2	CLAS S
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

   medium skiing design single twenties no -> highRisk high golf trading married forties yes ->lowRisk

   low speedway transport married thirties yes -> medRisk medium footballbanking single thirties yes -> lowRisk high flying media married fifties

yes ->highRisk
low footballsecurity single twenties no -> medRisk
medium golf media single thirties yes ->
medRisk medium golf transport married forties yes -
> lowRisk high skiing banking single
thirties yes -> highRisk low golf unemployed
married forties yes ->highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression usingpython.
7. Implement Naïve Bayes theorem to classify the Englishtext
8. Implement an algorithm to demonstrate the significance of geneticalgorithm
9. Implement the finite words classification system using Back-propagationalgorithm

Text Books:

1. Machine Learning – Tom M. Mitchell,MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – HwangJuang.

Reference Book:

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

M. Tech – CSE – I Year – I Semester

21MC6111: RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

Course Objectives:

1. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concepts, and creativity.
2. To follow research related information
3. Understandthe role of IPR in the growth of industry in the contemporary world.

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

1. To identify research problem from the real world.
2. To analyze research problem formulation in iterative process.
3. To write the technical report and research proposal
4. To Understand the nature of IPR and Patents
5. To Know the information of Patent rights in various sectors

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.

UNIT II

Data collection, analysis, interpretation, necessary instrumentations, Effective literature studies approaches, analysis Plagiarism, and 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: Form of IPR: Patents, Designs, Trade, Copyright, Copy left, Creative Commence, IPR and Development - technological research, innovation, patenting, development, IPR Laws. International Scenario- International cooperation on intellectual property, Procedure for grants of patents.

UNIT V

Patents Rights: Scope of Patents Rights, Licensing and transfer of technology, Patents information and databases, Geographical Indications, New developments in IPR - IPR of Biological Systems, Computer Software etc., Case Studies: Barriers of IPR in case of traditional knowledge.

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, 2ND Edition, " Research methodology: A Step by Step Guide for beginners"
4. Halbert, " Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, " Industrial Design", McGraw Hill, 1992.
6. Niebel, " Product Design", McgRAW Hill, 1974.
7. Asimov, " Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age". 2016.
9. T. Ramappa, " Intellectual Property Rights Under WTO", S. Chand, 2008
10. https://www.gnu.org/
11. https://creativecommons.org/, GPL ver 2.0,30; CC by,CC By SA,CC by NC,CC by ND.

M. Tech – CSE – I Year – I Semester

21AU6101: STRESS MANAGEMENT BY YOGA

L T P C

2 0 0 0

Prerequisite: None

Course Objectives:

- To achieve overall health of body andmind.
- To overcomestress.

Course Outcomes: Students will be able to:

- Develop healthy mind in a healthy body thus improving social healthalso.
- Improve efficiency.

UNIT-I:

Definitions of Eight parts of yoga. (Ashtanga)

UNIT-II:

Yam and Niyam.

UNIT-III:

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya andaparigraha

ii) Shaucha, santosh, tapa, swadhyay,ishwarpranidhan

UNIT-IV:

Asan and Pranayam

UNIT-V:

i) Various yog poses and their benefits for mind &body

ii) Regularization of breathing techniques and its effects-Types ofpranayam

TEXT BOOKS/ REFERENCES:

1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "RajayogaorconqueringtheInternalNature"bySwamiVivekananda,AdvaitaAshrama (Publication Department), Kolkata

M. Tech - CSE – I Year – II Semester

M. Tech - CSE – I Year – II Semester

21CS6211: ADVANCED ALGORITHMS

L	T	P	C
3	0	0	3

Pre-Requisites: UG level course in Algorithm Design and Analysis.

Course Objectives:

- Introduce students to the advanced methods of designing and analyzingalgorithms.
- The student should be able to choose appropriate algorithms and use it for a specificproblem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- Students should be able to understand different classes of problems concerning their computationdifficulties.
- To introduce the students to recent developments in the area of algorithmicdesign.

Course Outcomes: After completion of course, students would be able to:

- Analyze the complexity/performance of differentalgorithms.
- Determine the appropriate data structure for solving a particular set ofproblems.
- Categorize the different problems in various classes according to theircomplexity.
- Students should have an insight of recent activities in the field of the advanced data structure.

UNIT –I

Sorting:

Review of various sorting algorithms, topological sorting

Graph:

Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT – II

Matroids:

Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching:

Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT - III

Flow-Networks:
Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum- flow algorithm.

Matrix Computations:
Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT - IV
Shortest Path in Graphs:
Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

Modulo Representation of integers/polynomials:
Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

Discrete Fourier Transform (DFT):
In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

UNIT - V
Linear Programming:
Geometry of the feasibility region and Simplex algorithm

NP-completeness:
Examples, proof of NP-hardness and NP-completeness.

One or more of the following topics based on time and interest:
ApproximationalgorithmsRandomizedAlgorithmsInteriorPointMethodAdvancedNumberTheoretic Algorithm
RecentTrendsinproblemsolvingparadigmsusingrecentsearchingandsortingtechniquesbyapplying recently proposed datastructures.

References:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft,Ullman.
3. "Algorithm Design" by Kleinberg andTardos.

M. Tech - CSE – I Year – II Semester

21CS6212: ADVANCED COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

Prerequisites: Computer Organization

Course Objectives:

- To impart the concepts and principles of parallel and advanced computerarchitectures.
- To develop the design techniques of Scalable and multithreadedArchitectures.
- To Apply the concepts and techniques of parallel and advanced computer architectures to design modern computersystems.

Course Outcomes: Gain knowledge of

- Computational models and ComputerArchitectures.
- Concepts of parallel computermodels.
- Scalable Architectures, Pipelining, Superscalar processors,multiprocessors.

UNIT - I

Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multicomputers,MultivectorandSIMDComputers,PRAMandVLSImodels,Architecturaldevelopment tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

UNIT - II

Principals of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

UNIT - III

Bus Cache and Shared memory, Backplane bus systems, Cache Memory organizations, Shared- Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

UNIT - IV

Parallel and Scalable Architectures, Multiprocessors and Multicomputers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputers, Message-passing Mechanisms, Multivetor and SIMD computers, Vector Processing Principals, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5,

UNIT - V

Scalable, Multithreaded and Dataflow Architectures, Latency-hiding techniques, Principals of Multithreading, Fine-Grain Multicomputers, Scalable and multithreaded Architectures, Dataflow and hybrid Architectures.

Text Book

1. Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw HillPublishers.

References:

1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition,ELSEVIER.
2. Advanced Computer Architectures, S.G.Shiva, Special Indian edition, CRC, Taylor&Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & FrancisGroup.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearsoneducation.
5. Computer Architecture, B. Parhami, Oxford Univ.Press.

M. Tech - CSE – I Year – II

21CS6271: NATURAL LANGUAGE PROCESSING (Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisites: None.

Course Objectives:

- Able to explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP).
- Understand approaches to syntax and semantics in NLP.
- Understand current methods for statistical approaches to machine translation.
- Understand language modeling.
- Understand machine learning techniques used in NLP.

Course Outcomes:

- Demonstrate understanding of the core tasks in NLP.
- Demonstrate understanding of state-of-the-art algorithms and techniques for text-based processing of natural language.
- Demonstrate understanding of human languages and be familiar with the most mainstream descriptive and theoretical frameworks for handling their properties.

UNIT-I

Introduction To Natural Language Understanding: The study of Language, Applicationsof NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

UNIT –II

SEMANTICS AND LOGICAL FORM: Semantics and logic form, word sense andambiguity, the basic logical form language, encoding ambiguity in the logical form, verbs and states in logical form, thematic roles, speech acts and embedded sentences and defining semantics structure model theory.

UNIT –III

GRAMMARS AND PARSING: Grammars and sentence Structure,Top-Down and Bottom-UpParsers, Transition Network Grammars, Top- Down ChartParsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

UNIT-IV

GRAMMARS FOR NATURAL LANGUAGE: Auxiliary Verbs and Verb Phrases,Movement Phenomenon Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser

UNIT-V

AMBIGUITY RESOLUTION: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities,Part-of- Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars,Best First Parsing.Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

TEXT BOOKS

1 James Allen, Natural Language Understanding, Pearson Education

REFERENCE BOOKS

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, NLP: A Paninian Perspective, Prentice Hall, New Delhi.
2. D. Jurafsky, J. H. Martin, Speech andLanguage Processing, Pearson Education.
3. L.M. Ivansca, S. C. Shapiro, Natural Language Processing and Language Representati
4. T. Winograd, Language as a Cognitive Process, Addison-Wesley .

M. Tech - CSE – I Year – II Semester

21CS6272: INTERNET OF THINGS (Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisites: None.

Course Objectives:

- To introduce the terminology, technology and itsapplications.
- To introduce the concept of M2M (machine to machine) with necessaryprotocols.
- To introduce the Python Scripting Language which is used in many IoTdevices.
- To introduce the Raspberry PI platform, that is widely used in IoTapplications.
- To introduce the implementation of web-based services on IoTdevices.

UNIT - I

Introduction to Internet of Things –Definition and Characteristics of IoT,
Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs
IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates
DomainSpecificIoTs–
Home,City,Environment,Energy,Retail,Logistics,Agriculture,Industry,health and Lifestyle

UNIT - II

IoTandM2M–
Softwaredefinednetworks,networkfunctionvirtualization,differencebetweenSDNand NFV forIoT
Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT - III

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT - IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming–
PythonprogramwithRaspberryPIwithfocusofinterfacingexternalgadgets,controlling output, reading input frompins.

UNIT - V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs
Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

Text Books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN:9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson &Shawn Wallace, O'Reilly (SPD), 2014, ISBN:9789350239759

M. Tech - CSE – I Year – II Semester

21CS6273: DATA SCIENCE *(*Professional Elective - III)

Prerequisites: None.

L	T	P	C
3	0	0	3

Course Objectives:

- Provide you with the knowledge and expertise to become a proficient datascientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for datascience.
- Produce Python code to statistically analyse adataset.
- Critically evaluate data visualizations based on their design and use for communicating stories fromdata.

Course Outcomes: After completion of course, students would be able to:

- Explain how data is collected, managed and stored for datascience.
- Understand the key concepts in data science, including their real-world applications and the toolkit used by datascientists.
- Implement data collection and management scripts usingMongoDB.

UNIT – I

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

UNIT – II

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data Sources

UNIT-III

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT-IV

Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT-V

Applications of Data Science, Technologies for visualization, Bokeh (Python).
Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

References:

1. CathyO'NeilandRachelSchutt.DoingDataScience,StraightTalkfromTheFrontlineO'Reilly .
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets v2.1, Cambridge UniversityPress.

M. Tech - CSE – I Year – II Semester

21CS6274: CYBER SECURITY (Professional Elective - IV)

L	T	P	C
3	0	0	3

Prerequisites: None.

Course Objectives:

- To learn about cyber crimes and how they areplanned.
- To learn the vulnerabilities of mobile and wirelessdevices.
- To learn about the crimes in mobile and wirelessdevices.

UNIT - I

Introduction to Cybercrime: Introduction, Cybercrime and Information security, who are cybercriminals, Classifications of Cybercrimes, Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Cyber offenses: How criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT- II

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT - III

Cybercrimes and Cyber security: the Legal Perspectives

Introduction, Cyber Crime and Legal Landscape around the world, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario In India, Digital signaturesandtheIndianITAct,AmendmentstotheIndianITAct,CybercrimeandPunishment,Cyber law, Technology and Students: IndianScenario.

UNIT - IV

Understanding Computer Forensics

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital ForensicsLifecycle,ChainofCustodyconcept,NetworkForensics,Approachingacomputer,Forensics Investigation, Challenges in Computer Forensics, Special Tools and Techniques, ForensicsAuditing

UNIT - V

Cyber Security: Organizational Implications

Introduction,CostofCybercrimesandIPRissues,WebthreatsforOrganizations,SecurityandPrivacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges forOrganizations.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, WileyINDIA.
2. IntroductiontoCyberSecurity**,**Chwan-Hwa(john)Wu, J.DavidIrwin.CRCPressT&FGroup.

Reference Book:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC

M. Tech - CSE – I Year – II Semester

21CS6275: ADVANCED COMPUTER NETWORKS (Professional Elective - IV)

L	T	P	C
3	0	0	3

Prerequisites: Data Communication, Basic Networking Principles.

Course Objective:

- This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computernetworks.

Course Outcomes:

- Understanding of holistic approach to computernetworking.
- Ability to understand the computer networks and theirapplication.
- Ability to design simulation concepts related to packet forwarding innetworks.

UNIT - I

ReviewofComputerNetworks,DevicesandtheInternet:Internet,Networkedge,Networkcore,Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, Networking and Internet - Foundation of Networking Protocols: 5-layer TCP/IP Model, 7- Layer OSI Model, Internet Protocols andAddressing.

UNIT - II

Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, RouterStructure. The Link Layer and Local Area Networks-Link Layer, Introduction and Services, Error- Detection and Error-Correction techniques, Multiple Access Protocols, LinkLayer

Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization

UNIT- III

Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, CellularNetworks,MobileIP,WirelessMeshNetworks(WMNs),MultipleaccessschemesRouting and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.

UNIT - IV

Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LANandWAN.TransportLayer,TransmissionControlProtocol(TCP),UserDatagramProtocol(UDP), Mobile Transport Protocols, TCP Congestion Control. Principles of

NetworkApplications,

UNIT - V

The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, building a Simple Web Server Creating simulatednetworksandpassingpacketsthroughthemusingdifferentroutingtechniques.Installinga nd using network monitoringtools.

Text books:

1. Computer Networking: A Top-Down Approach, James F. Kuros and Keith W. Ross, Pearson, 6th Edition,2012.
2. Computer Networks and Internets, Duglas E. Comer, 6th Edition,Pearson.

References:

1. A Practical Guide to Advanced Networking, Jeffrey S. Beasley and Piyasat Nilkaew, Pearson, 3rd Edition,2012
2. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, PrenticeHall.

M. Tech - CSE – I Year – II Semester

21CS6276: BIG DATA ANALYTICS (Professional Elective - IV)

L	T	P	C
3	0	0	3

Course Objectives:

- To understand about bigdata.
- To learn the analytics of BigData.
- To Understand the MapReducefundamentals.

UNIT - I

Big Data Analytics: What is big data, History of Data Management; Structuring Big Data; Elements of Big Data; Big Data Analytics; Distributed and Parallel Computing for Big Data;
Big Data Analytics: What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype AroundBigDataAnalytics,Classificationof Analytics,GreatestChallengesthatPreventBusinessfrom Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source AnalyticsTools;

UNIT - II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics;
Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

UNIT - III

Understanding MapReduce Fundamentals and HBase : The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFC Files, File system types, commands, org.apache.hadoop.iopackage,HDF,HDFSHighAvailability;IntroducingHBase,Architecture,Storing BigDatawithHBase,InteractingwiththeHadoopEcosystem;HBaseinOperations-Programmingwith HBase; Installation, Combining HBase andHDFS;

UNIT - IV

Big Data Technology Landscape and Hadoop: NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors;HDFC(HadoopDistributedFileSystem),HDFCDaemons,read,write,ReplicaProcessing of Data with Hadoop; Managing Resources and Applications with HadoopYARN.

UNIT - V

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social

Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;
Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

Text Books:

1. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wileypublications.
2. Big Data, Black Book™ , DreamTech Press, 2015Edition.
3. Business Analytics 5e , BY Albright|Winston

Reference Books:

1. RajivSabherwal,IrmaBecerra-Fernandez,"BusinessIntelligence– Practice,Technologiesand Management", John Wiley2011.
2. Lariss T. Moss, Shaku Atre, "Business Intelligence Roadmap", Addison-Wesley ItService.
3. Yuli Vasiliev,"OracleBusinessIntelligence:TheCondensedGuidetoAnalysisandReporting", SPD Shroff,2012.

M. Tech - CSE – I Year – II Semester

21CS6251: ADVANCED ALGORITHMS LAB (Lab - III)

L	T	P	C
0	0	4	2

Prerequisites: None.

Course Objective: The student can able to attain knowledge in advance algorithms.

Course Outcomes: The student can able to analyze the performance of algorithms.

List of Experiments

1. Implement assignment problem using Brute Forcemethod
2. Perform multiplication of long integers using divide and conquermethod.
3. Implement solution for knapsack problem using Greedymethod.
4. Implement Gaussian eliminationmethod.
5. Implement LUdecomposition
6. Implement Warshallalgorithm
7. Implement Rabin Karpalgorithm.
8. Implement KMPalgorithm.
9. Implement Harspoolalgorithm
10. Implement max-flowproblem.

Text Book:

1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press

References:

1. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest and C.Stein,PHI Pvt. Ltd./ PearsonEducation.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, UniversitiesPress.
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearsoneducation.

M. Tech - CSE – I Year – II Semester

21CS6252: DATA SCIENCE LAB (Lab – IV)

L	T	P	C
0	0	4	2

Prerequisites: None.

Course Objectives:

- To make students understand learn about a Big Data – R Programming, way of solving problems.
- To teach students to write programs in Scala to solveproblems.

Introduction to R Programming:

What is R and RStudio? R is a statistical software program. It has extremely useful tools for data exploration, data analysis, and data visualization. It is flexible and also allows for advanced programming. RStudio is a user interface for R, which provides a nice environment for working with R.

1. Write an R program to evaluate the following expression ax+b/ax-b.
2. Write an R program to read input from keyboard (hint: readLine()).
3. Write an R program to find the sum of n natural numbers: 1+2+3+4+….n
4. Write an R program to read n numbers.
   (i) Sum of all even numbers (ii) Total number of even numbers.
5. Write an R program to read n numbers.
   (i) Total number of odd numbers (ii) Sum of all odd numbers
6. Write an R program to obtain
   (i)sum of two matrices A and B (ii) subtraction of two matrices A and B
   (iii) Product of two matrices.
7. Write an R program for "declaring and defining functions "
8. Write an R program that uses functions to add n numbers reading from keyboard
9. Write an R program uses functions to swap two integers.
10. Write an R program that use both recursive and non-recursive functions for implementing the
    Factorial of a given number, n.
11. Write an R program to reverse the digits of the given number {example 1234 to be written as
    4321}
12. Write an R program to implement
    (i)Linear search (ii) Binary Search.
13. Write an R program to implement
    (i)Bubble sort (ii) selection sort.
14. Write a R program to implement the data structures
    (i) Vectors (ii) Array (iii) Matrix (iv) Data Frame (v) Factors
15. Write a R program to implement scan(), merge(), read.csv() and read.table() commands.
16. Write an R program to implement "Executing Scripts" written on the note pad, by calling to the R console.
17. Write a R program, Reading data from files and working with datasets
    (i) Reading data from csv files, inspection ofdata.
    (ii) Reading data from Excelfiles.

18. Write a R program to implement Graphs
(i) Basic high-level plots (ii)Modifications of scatter plots
(iii) Modifications of histograms, parallel boxplots.

Suggested Books for Lab:

1. Big data – Black Book: 2015 edition: dreamtech press. Pg. (490-642)
2. Introducing to programming and problem solving by scala, mark c. lewis, lisa l.lacher. CRC press, second edition

Suggested Links:

1. https://www.tutorialspoint.com/scala/

https://www.tutorialspoint.com/r/

M. Tech - CSE – I Year – II Semester

21CS6291: Mini Project with Seminar

L	T	P	C
0	0	4	2

M. Tech - CSE – I Year – II Semester

21AU6201: ENGLISH FOR RESEARCH PAPER WRITING

L	T	P	C
2	0	0	0

Prerequisite: None.

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability.
- Learn about what to write in eachsection.
- Understandtheskillsneededwhen writingaTitleEnsurethegoodqualityofpaperatveryfirst-timesubmission.

UNIT-I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:

keyskillsareneededwhenwritingaTitle,keyskillsareneededwhenwritinganAbstract,keyskillsare needed when writing an Introduction, skills needed when writing a Review of theLiterature,

UNIT-V:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London,2011

M. Tech – CSE – II Year – I Semester

M. Tech – CSE – II Year – I Semester

21CS7171: DIGITAL FORENSICS (Professional Elective - V)

L	T	P	C
3	0	0	3

Pre-Requisites: Cybercrime and Information Warfare, ComputerNetworks.

Course Objectives:

- Providesanin-depthstudy oftherapidlychangingandfascinatingfieldof computerforensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digitalcrimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discoverytools.
- E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Course Outcomes: On completion of the course the student should be able to

- Understand relevant legislation and codes ofethics.
- Computer forensics and digital detective and various processes, policies andprocedures.
- E-discovery, guidelines and standards, E-evidence, tools andenvironment.
- Email and web forensics and networkforensics.

UNIT - I

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
ComputerCrime: Criminalisticsasitrelatestotheinvestigativeprocess,analysisofcyber-criminalistics area, holistic approach tocyber-forensics

UNIT - II

Cyber Crime Scene Analysis:

Discussthevariouscourtordersetc.,methodstosearchandseizureelectronicevidence,retrievedand un-retrievedcommunications,Discusstheimportanceofunderstandingwhatcourt documentswouldbe required for a criminalinvestigation.

UNIT - III

Evidence Management & Presentation:

Createandmanagesharedfoldersusingoperatingsystem,importanceoftheforensicmindset,define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probablecause.

UNIT - IV

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case,

Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V

Mobile Forensics: mobile forensics techniques, mobile forensics tools.

Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

References:

1. John Sammons, The Basics of Digital Forensics,Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, LaxmiPublications

M. Tech - CSE – II Year – I Semester

21CS7172: HIGH PERFORMANCE COMPUTING (Professional Elective -V)

L	T	P	C
3	0	0	3

Prerequisites: Computer Organization & Architecture, Operating SystemProgramming.

Course Objectives:

- To Improve the systemperformance.
- To learn various distributed and parallel computingarchitecture.
- To learn different computingtechnologies.

Course Outcomes:

- Understanding the concepts in gridcomputing.
- Ability to set up cluster and run parallelapplications.
- Ability to understand the cluster projects and clusterOS.
- Understanding the concepts of pervasive computing & quantumcomputing.

UNIT - I

Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm).

UNIT - II

Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O.

UNIT - III:

Example Cluster System – Beowulf; Cluster Operating Systems: Compas And Nanos Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface.

UNIT - IV

Device Connectivity; Java For Pervasive Devices; Application Examples.

UNIT - V

ClassicalVsQuantumLogicGates;One,Two&ThreeQubitQuantum Gates;Fredkin&ToffoliGates; Quantum Circuits; QuantumAlgorithms.

Text Book:

1. “Selected Topics In Advanced Computing” Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, 2005 Pearson Education.

References:

1. J. Joseph & C. Fellenstien: ‘Grid Computing ‘, PearsonEducation
2. J. Burkhardt et.al: ‘pervasive computing’ PearsonEducation
3. Marivesar:’ Approaching quantum computing’, PearsonEducation.
4. Raj kumar Buyya:’High performance cluster computing’, PearsonEducation.
5. Neilsen & Chung L:’Quantum computing and Quantum Information’, Cambridge University Press.
6. A networking approach to Grid Computing, Minoli,Wiley.

M. Tech – CSE – II Year – I Semester

21CS7173: DEEP LEARNING (Professional Elective - V)

L	T	P	C
3	0	0	3

Prerequisites: None.

Course Objectives:

- To introduce the foundations of Artificial NeuralNetworks.
- To acquire the knowledge on Deep LearningConcepts.
- To learn various types of Artificial NeuralNetworks.
- To gain knowledge to apply optimizationstrategies.

Course Outcomes:

- Ability to understand the concepts of NeuralNetworks.
- Ability to select the Learning Networks in modeling real worldsystems.
- Ability to use an efficient algorithm for DeepModels.
- Ability to apply optimization strategies for large scaleapplications.

UNIT - I

Deep Feedforward Networks: Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms, Historical Notes

UNIT - II

Regularization for Deep Learning:

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under- Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi- Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier.

UNIT - III

Optimization for Training Deep Models, How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta- Algorithms

UNIT - IV

Convolutional Networks:

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms,RandomorUnsupervisedFeatures,TheNeuro-scientificBasisforConvolutionalNetworks, Convolutional Networks and the History of DeepLearning

UNIT - V

Applications:

Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications

Text Book:

1. Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning series), MIT Press.

Reference Books:

1. Li Deng and Dong Yu, Deep Learning Methods and Applications, Foundations andTrends® in Signal Processing Volume 7 Issues 3-4, ISSN:1932-8346.
2. Dr. N.D. Lewis, Deep Learning Made Easy with R A Gentle Introduction for Data Science. Create Space Independent Publishing Platform (January 10,2016).
3. François Chollet, JJ Allaire, MEAP Edition Manning Early Access Program Deep Learning with R Version 1, Copyright 2017 ManningPublications.

M. Tech – CSE – II Year – I Semester

21CS7181: DISSERTATION WORK REVIEW - I

L	T	P	C
0	0	12	6

1. Project must be carried out by an Individual Student only.
2. Choose Area of Research for doing project.
3. Download Recent Articles (Min 5no..) as a base paper on yourresearchinterest.(IEEETransactions,ACM,Springer,Elsiever,Inderscience, etc.,)
4. SelectOne article from the base papers where you choosed.
5. Detailed Literature survey must be completed from the selected article (all reference articles from the base paper).
6. Problem Statement must be determined clearly before Proceeding into the project Reviews.
7. Well defined proceedings (Modules) for implementing the project work must be incorporated in project documentation.

M. Tech - CSE – II Year – II Semester

M. Tech - CSE – II Year – II Semester

21CS7281: DISSERTATION WORK REVIEW-II

L	T	P	C
0	0	12	06

General Instructions

1. Project must be carried out by an Individual Student only.
2. Problem Statement must be determined clearly before proceeding into the project Reviews.
3. Implementation work must be carried out during the stages of the project.
4. Project Documentation should be submitted before conducting Viva-Voce.
5. Final Research Work must convert to article and publish the same in Scopus Journals.

M. Tech - CSE – II Year – II Semester

21CS7282: DISSERTATION VIVA-VOCE

L	T	P	C
0	0	28	14

General Instructions

1. Project must be carried out by an Individual Student only.
2. Problem Statement must be determined clearly before proceeding into the project Reviews.
3. Implementation work must be carried out during the stages of the project.
4. Project Documentation should be submitted before conducting Viva-Voce.
5. Final Research Work must convert to article and publish the same in Scopus Journals.