Department of Computer Science and Engineering

Course Structure and Syllabus
for
M.Tech. Computer Science and Engineering (CSE) Programme.
(MR20 Regulations – Effective from Academic Year 2020-21 onwards)

MALLA REDDY ENGINEERING COLLEGE (Autonomous)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Proposed Course Structure for PG - M.Tech. (Computer Science and Engineering) Programme (MR-20 Regulations)

I YEAR I SEMESTER

S. No	Category	Course Code	Name of the Course	Contact Hours/Week			Credits
				L	T	P	
1	PCC	A5101	Advanced Data Structures	3	-	-	3
2	PCC	A5102	Ethical Hacking and Computer Forensic	3	-	-	3
3	PEC-I	A5103	Big Data Analytics	3	-	-	3
		A5104	Data Science				
		A5105	Machine Learning				
4	PEC-II	A5106	Cloud & Mobile Application and Development	3	-	-	3
		A5107	Introduction to Intelligent Systems				
		A5108	Software Architecture and Design Patterns				
5	HSMC	A0H08	Research Methodology and IPR	2	-	-	2
6	PCC	A5109	Advanced Data Structures Lab	-	-	4	2
7	PEC	A5110	Big Data Analytics Lab	-	-	4	2
		A5111	Data Science Lab				
		A5112	Machine Learning Lab				
			PE-1 Lab				
8	AC	A00A4	English for Research Paper Writing	2	-	-	-
Total				**16**	**-**	**8**	**18**
Contact Hours: 24							

I YEAR II SEMESTER

S. No	Category	Course Code	Name of the Course	Contact Hours/Week			Credits
				L	T	P	
1	PCC	A5113	Advanced Computer Networks	3	-	-	3
2	PCC	A5114	Web Services	3	-	-	3
3	PCC	A5115	Advanced Databases	2	-	-	2
4	PEC-III	A5116	Advanced Data Mining	3	-	-	3
		A5117	Computer Vision				
		A5118	Soft Computing				
5	PEC-IV	A5119	Software Engineering and Modeling	3	-	-	3
		A5120	Software Quality Assurance and Testing				
		A5121	Storage Area Networks				
6	PCC	A5122	Web Services Lab	-	-	4	2
7	PEC	A5123	Advanced Data Mining Lab	-	-	4	2
		A5124	Computer Vision Lab				
		A5125	Soft Computing Lab				
			PE-III Lab				
8	AC	A00A5	Value Education	2	-	-	-
Total				**16**	**-**	**8**	**18**
Contact Hours: 24							

II YEAR I SEMESTER

S. No	Category	Course Code	Name of the course	Contact hours/week			Credits
				L	T	P	
1	PEC-V	A5126	Parallel and Distributed Algorithms	3	-	-	3
		A5127	Wireless Sensor Networks				
		A5128	Information Retrieval Techniques				
2	OEC	A5129	Business Analytics	3	-	-	3
		A0B22	Advanced Optimization Techniques				
		A5130	Blockchain Technology and its Applications				
3	PROJ	A5131	Seminar	-	-	4	2
4	PROJ	A5132	Project / Dissertation Phase - I	-	-	16	8
Total				**6**	**-**	**20**	**16**
Contact Hours: 26							

II YEAR II SEMESTER

S. No	Category	Course Code	Name of the course	Contact hours/week			Credits
				L	T	P	
1	PROJ	A5133	Project / Dissertation Phase - II	-	-	32	16
Total				**-**	**-**	**32**	**16**
Contact Hours: 32							

- PCC - Professional Core Course
- PEC - Professional Elective Course
- OEC - Open Elective Course
- PROJ - Project

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5101	ADVANCED DATA STRUCTURES	L	T	P
Credits: 3		3	-	-

Prerequisites: Data structures and Object Oriented Programming

Course Objectives:
This course provides the students to learn and understand the theoretical and practical solutions for the fundamental design, analysis, and implementation of basic data structures like Stacks, Queues, Heaps, Searching, Sorting, Trees and Graphs, Significance of algorithms in the computer field, various aspects of algorithm development.

Module I: Introduction to Algorithms and Representations [10 Periods]
Algorithms Notations: Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation, Big Oh, Omega and Theta notations, Complexity Analysis Examples.

Data structures and Representations: Linear List ADT, Array representation, Linked representation, Vector representation, Singly Linked Lists: Insertion-Deletion-Search operations, Doubly Linked Lists: Insertion-Deletion operations, Circular lists, Representation of 1D and 2D arrays, sparse matrices and their representation.

Module II: Linear Data Structures [9 Periods]
Stack and Queue: Stack and Queue ADTs, array and linked list representations, infix to Postfix Conversion using Stack, Implementation of recursion, Circular Queue: Insertion-Deletion, Dequeue ADT, Array and Linked List Representations, Priority Queue ADT.

Heap: Implementation using Heaps, Insertion into Max Heap, Deletion from Max Heap, java.util package: Array List, Linked List, Vector classes, Stacks and Queues, Iterator.

Module III: Searching and Sorting [9 Periods]
A: Searching
Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hashing in java.util- HashMap, HashSet, Hash table.

B: Sorting
Bubble, Insertion, Quick, Merge, Heap, Radix, Comparison of sorting methods.

Module IV: Non-Linear Data Structures-I [10 Periods]
Trees: Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non-recursive traversals, Threaded binary trees.

Graphs: Graphs terminology, Graph ADT, Representations, Graph Traversals/Search Methods-DFS and BFS, Java code for Graph Traversals, Applications of Graphs-Minimum Cost Spanning Tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

Module V: Non-Linear Data Structures-II **[10 Periods]**

Search Trees: Binary search tree, Binary search tree ADT, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees, Definition and examples.

B-Trees: Definition, insertion and searching operations, Trees in java.util- Tree Set, Tree Map Classes, Tries (examples only), Comparison of Search trees. Text compression, Huffman coding and decoding, Pattern matching-KMP algorithm.

TEXT BOOKS

1. S. Sahni, "**Data structures Algorithms and Applications in Java"**, Universities Press.
2. Clifford A. Shaffer, "**Data structures and Algorithm analysis in Java"**, 3rd Edition, Courier Corporation.

REFERENCE BOOKS

1. Deitel and Deitel, "**Java for Programmers**", Pearson Education.
2. R. Lafore, "**Data structures and Algorithms in Java**", Pearson Education.

E-RESOURCES

1. https://www.cise.ufl.edu/~sahni/cop3530/presentations.htm
2. https://books.google.co.in/books?id=KK3DAgAAQBAJ&printsec=frontcover&dq=data+structures+and+algorithm+analysis+in+java
3. https://www.cse.msu.edu/~cse802/Papers/sammon.pdf
4. http://nptel.ac.in/courses/106102064/1/

Course Outcomes:

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

1. **Understand** the fundamental concepts related to basic data structures.
2. **Design** and Analyze the implementation of linear data structures.
3. **Apply** the concept related to different searching and sorting techniques.
4. **Learn** and implement the concept of nonlinear data structures.
5. **Acquire** knowledge regarding search trees and applications.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3		2	3		
CO2	2		3		3	2
CO3	2		3	2		
CO4	2		3	2		
CO5	2		3	2		3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5102	ETHICAL HACKING AND COMPUTER FORENSIC	L	T	P
Credits: 3		3	-	-

Prerequisites: Cryptography and Network Security

Course Objectives:
The objective of this course is to make the students to study about fundamental in ethical hacking and learn computer forensics, be familiar with forensics tools and to acquire knowledge in analyzing and validating forensics data.

UNIT – I: Introduction: [9 Periods]

Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT – II: The Business Perspective: [9 Periods]

Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement. Preparing for a Hacking case study example Technical Preparation, Social Engineering,

Module III: Introduction To Computer Forensics [11periods]
A: Computer Forensics
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation.

B: Incident Response
Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

Module IV: Evidence Collection And Forensics Tools [10 periods]
Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

Module V: Analysis And Validation [9 periods]
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

TEXT BOOKS:

1. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning
2. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning
3. Nelson, Phillips, Enfinger, Steuart, "**Computer Forensics and Investigations**", Cengage Learning, India Edition, 2008.

REFERENCE BOOKS

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005.
2. Richard E.Smith, "Internet Cryptography", 3 rd Edition Pearson Education, 2008.
3. MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rdEdition, Prentice Hall, 2013.
4. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press

E-RESOURCES

1. https://repo.zenk-security.com/Magazine%20E-book/EN-Ethical%20Hacking.pdf
2. http://ebook.eqbal.ac.ir/Security/Forensics/Guide%20to%20Computer%20Forensics%20and%20Investigations.pdf.
3. http://cybersd.com/sec2/lect/Chapter%207.pdf
4. http://nptel.ac.in/courses/106105031/
5. https://nptel.ac.in/courses/106/105/106105217/

Course Outcomes

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

1. **Discuss** the hacking framework, computer secuirty and ethical hacking.
2. **Apply** security in view business perspective.
3. **Explain** computer forensics.
4. **Use** forensics tools
5. **Analyze** and validate forensics data

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2					2
CO2	2					3
CO3				3	2	2
CO4	3		2	2		
CO5	3		2	3		3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5103	BIG DATA ANALYTICS (Professional Elective – I)	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Data Mining

Course Objectives:

This course provides the students to understand big data for business intelligence, learn business case studies for big data analytics, understand noSQL big data management and to perform map-reduce analytics using Hadoop and related Tools.

Module I: Introduction to Big data **[10 Periods]**

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Module II: NoSQL **[10 Periods]**

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer replication, sharding and replication, consistency, relaxing consistency,
version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

Module III: HDFS **[10 Periods]**

A: Hadoop

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts,

B: I/O

Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

Module IV: Mapreduce **[10 Periods]**

MapReduce workflows, Module tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Module V: Data Models **[8 Periods]**

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries. HiveQL queries. Hive database tables, views, functions and Indexes

TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "**Big Data, Big Analytics: Emerging"**
2. Tom White, "**Hadoop: The Definitive Guide**" 3rd Edition, O'reilly.

REFERENCE BOOKS

1. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
6. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
7. Alan Gates, "Programming Pig", O'Reilley, 2011.
8. DT Editorial Services by BIG DATA Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization

E-RESOURCES

1. http://newton.uam.mx/xgeorge/uea/Lab_Prog_O_O/materiales_auxiliares/Big_Java_4th_Ed.pdf
2. http://www.isical.ac.in/~acmsc/WBDA2015/slides/hg/Oreilly.Hadoop.The.Definitive.Guide.3rd.Edition.Jan.2012.pdf
3. https://static.googleusercontent.com/media/research.google.com/en//archive/mapreduce-osdi04.pdf
4. http://www.comp.nus.edu.sg/~ooibc/mapreduce-survey.pdf
5. http://freevideolectures.com/Course/3613/Big-Data-and-Hadoop/18

Course Outcomes:

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

1. **Develop** simple applications using concepts like stack, queues and classes.
2. **Analyze** file systems such as GFS and HDFS.
3. **Design** applications by applying Map reduce concepts.
4. **Build** up programs by making use of I/O.
5. **Explore** and inspect the big data using programming tools like Pig and Hive.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		1			
CO2	1		1	2	2	1
CO3	1		2	2	2	1
CO4	1	1				1
CO5	1		1		2	2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5104	DATA SCIENCE (Professional Elective – I)	L	T	P
Credits: 3		3	-	-

Prerequisites: Probability and Statistics

Course Objectives:

This course will make the students to provide with the knowledge and expertise to become a proficient data scientist, demonstrate an understanding of statistics and machine learning concepts that are vital for data science, understanding R and produce Program code to statistically analyze a dataset and critically evaluate data visualizations based on their design and use for communicating stories from data.

Module I: Fundamentals of Data science and R programming [9 Periods]

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

B:R Programming, R data types and objects, reading and writing data, sub setting, R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

Module II: Maintenance of Data and R Fundamental Concepts [10 Periods]

A: Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

B: R Fundamental Concepts: control structures, vectors, arrays, Lists, components, functions, data frames, factors tables, Classes, Statistical Analysis with R

Module III: Data analysis [9 Periods]

A: Basics of Data Analysis

Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT.

B: Algorithms

Basic machine learning algorithms, Linear regression, SVM, Naive Bayes**.**

Module IV: Data visualization [10 Periods]

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

Module V: **Data Science-Applications [10 Periods]**

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.

TEXT BOOKS

1. Alberto Boschetti, Luca Massaron, "**Python Data Science Essentials**", Packt Publications, 2nd Edition,2016.

2. Davy Cielen, Arno Meysman, Mohamed Ali, "**Introducing Data Science: Big Data, Machine Learning, and more, using Python tools**", Manning Publications; First Edition, 2016.
3. R Programming for Data Science by Roger D. Peng
4. The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage Learning
5. India

REFERENCE BOOKS

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

E-RESOURCES

1. https://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/
2. https://www.edureka.co/blog/learn-python-for-data-science/
3. https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf

Course Outcomes:

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

1. **Understand** the fundamentals of data science and R programming
2. **Explain** how data is collected, managed and stored for data science and R Programming fundamental concepts.
3. **Analyze** the data by applying various techniques.
4. **Explore** data visualization techniques.
5. **Investigate** several applications in data science.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2					
CO2		2		3		
CO3	2		2			
CO4					2	
CO5	3					2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5105	MACHINE LEARNING (Professional Elective – I)	L	T	P
Credits: 3		3	-	-

Prerequisites: Artificial Intelligence

Course Objectives:
This course provides the students to learn the concept of how to learn patterns , fundamentals in python and concepts from data without being explicitly programmed in various IOT nodes, design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances, explore supervised and unsupervised learning paradigms of machine learning and to investigate Deep learning technique and various feature extraction strategies.

Module I: Supervised Learning and Introduction to Python [10 Periods]
A: Introduction to Python - Python Basics, Objects- Python Objects, Standard Types, Other Built-in Types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

B: Basic methods: Distance-based methods, Nearest-Neighbors, 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.

Module II: Unsupervised Learning [9 Periods]
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)

Module III: Machine Learning algorithms [9 Periods]
A: Machine Learning Algorithms
Evaluating Machine Learning algorithms and Model Selection.
B: Ensemble Methods.
Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random forests)

Module IV: Sparse Models [9 Periods]
Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

Module V: Learning techniques [11 Periods]
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.

TEXT BOOKS

1. Tom M. Mitchell, "**Machine Learning**", MGH, 1st Edition, 2013.
2. Stephen Marsland, "**Machine Learning: An Algorithmic Perspective**", Chapman and Hall / CRC, 2nd Edition, 2014.
3. Core Python Programming, Wesley J. Chun, Second Edition, Pearson., 2nd Edition, 2006

REFERENCE BOOKS

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 available online)
3. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
4. Core Python Programming, Wesley J. Chun, Second Edition, Pearson., 3nd Edition, 2012

E-RESOURCES

1. http://www.zuj.edu.jo/download/machine-learning-tom-mitchell-pdf/
2. https://www.learnpython.org/
3. http://index-of.es/Python/Core.Python.Programming.2nd.Edition.Wesley.Chun.2006.pdf
4. http://index-of.es/Python/Core.Python.Applications.Programming.3rd.Edition.pdf
5. https://www.davekuhlman.org/python_book_01.pdf
6. http://www.ntu.edu.sg/home/egbhuang/pdf/ieee-is-elm.pdf
7. www.fxpal.com/publications/a-genetic-algorithm-for-video-segmentation-and-summarization.pdf
8. http://nptel.ac.in/courses/106106139/
9. http://nptel.ac.in/courses/106105152/

Course Outcomes:

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

1. **Identify** the way of extracting features that can be used for a particular machine learning approach in various IOT and Fundamentals in python
2. **Explore** unsupervised learning techniques
3. **Compare** and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
4. **Analyze** various machine learning approaches and paradigm mathematically.
5. **Investigate** various learning approaches.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2			2	
CO2	3		2			
CO3	2		2			
CO4	2			2		1
CO5	2					

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5106	CLOUD & MOBILE APPLICATION AND DEVELOPMENT (Professional Elective-II)	L	T	P
Credits: 3		3	-	-

Prerequisites: Cloud Computing

Course Objectives:
This course enables the students to learn the basic fundamentals in mobile cloud, architecture, classification and associated cooperation approaches, study the utilization of resources in mobile clouds, study about the maintenance, simulate and develop mobile cloud applications.

Module I: Fundamentals of Mobile cloud **[10 Periods]**
Mobile Connectivity Evolution: From Single to Multiple Air Interface Devices, Network Evolution: The Need for Advanced Architectures.

Module II: Approaches **[9 Periods]**
Mobile Clouds: An Introduction, Cooperation and Cognition in Mobile Clouds, Mobile Cloud Classification and Associated Cooperation Approaches.

Module III: Utilization of resources **[9 Periods]**
A: Resource sharing
Sharing Device Resources in Mobile Clouds.
B: Enabling technologies
Wireless Communication Technologies, Building Mobile Clouds.

Module IV: Maintenance of Mobile Cloud **[10 Periods]**
Mobile Cloud Formation and Maintenance, Cooperative Principles by Nature, Social Mobile Clouds, Green Mobile Clouds: Making Mobile Devices More Energy Efficient.

Module V: Mobile apps **[10 Periods]**
Mobile Clouds Applications, Future Developments of Mobile Clouds.
Android OS design and Features – Android development framework, Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

TEXT BOOKS

1. Frank H. P. Fitzek, Marcos D. Katz, "**Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks**", Wiley Publications, ISBN: 978-0-470- 97389-9, Jan 2014.
2. Dijiang Huang Huijun Wu, "**Mobile Cloud Computing: Foundations and Service Models**", Morgan Kaufmann, First Edition, 2018.
3. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012
4. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCE BOOKS

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, and Michael Morgano, **Android for Programmers: An App-Driven Approach**, Prentice Hall, November 3, 2011.
2. Richard Rodger, "**Beginning Mobile Application Development in the Cloud**", Wiley, 2011.

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1. https://leseprobe.buch.de/images-adb/8d/01/8d01a05a-1854-4e56-ae54-ce8fcd5c6237.pdf
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118801338
3. http://nptel.ac.in/courses/106105167/31

Course Outcomes:

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

1. **Understand** the fundamentals of Mobile cloud.
2. **Analyze** classification and associated cooperation approaches.
3. **Investigate** several technologies and implement the way of sharing resources.
4. **Explore** the formation of mobile cloud and know about its maintenance.
5. **Develop** Mobile applications.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2					3
CO2	2					2
CO3			3	2		
CO4				2	2	
CO5	2				2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5107	INTRODUCTION TO INTELLIGENT SYSTEMS	L	T	P
Credits: 3	(Professional Elective - II)	3	-	-

Prerequisites: Artificial Intelligence, Data Structures

Course Objectives:

The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

Module I: Fundamentals of Intelligent systems-I [9 Periods]

Biological foundations to intelligent systems I: Artificial neural networks, Backpropagation networks, Radial basis function networks, and recurrent networks.

Module II: Foundations to Intelligent systems-II 10 Periods]

Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

Module III: Search Techniques [9 Periods]

A: Search Techniques-I

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search.

B: Search Techniques-II

Heuristic search methods: best-first search, admissible evaluation functions, hill climbing search, Optimization and search such as stochastic annealing and genetic algorithm.

Module IV: Knowledge Representation [10 Periods]

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

Module V: Learning and evolutionary algorithms [10 Periods]

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning. Recent trends in Fuzzy logic, Knowledge Representation.

TEXT BOOKS

1. James M. Keller, Derong Liu, David B. Fogel, "**Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation**", John Wiley & Sons, 13-Jul-2016.
2. Elaine Rich, "**Artificial Intelligence**", Tata McGraw-Hill Education, 2004.

REFERENCE BOOKS

1. Luger G.F. and Stubblefield W.A. (2008)," **Artificial Intelligence: Structures and strategies for Complex Problem Solving**". Addison Wesley, 6th edition.
2. Russell S. and Norvig P. (2009). "**Artificial Intelligence: A Modern Approach**". Prentice-Hall, 3rd edition.

E-RESOURCES

1. https://books.google.co.in/books?id=c1fzgQj5lhkC&printsec=frontcover&dq=intelligent+systems&hl=en&sa=X&ved=0ahUKEwilrbLv0LncAhUKaI8KHVO2Cd8Q6AEIKDAA#v=onepage&q=intelligent%20systems&f=false
2. http://www.nptelvideos.in/2012/11/intelligent-systems-and-control.html
3. https://freevideolectures.com/course/2348/intelligent-systems-and-control

Course Outcomes:

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

1. **Demonstrate** knowledge of the fundamental principles of intelligent systems.
2. **Understand** the algorithms and its applications
3. **Analyze** and compare the relative merits of a variety of AI problem solving techniques. and indexes.
4. **Explore** various knowledge representation techniques**.**
5. **Learn and apply** the evolutionary and learning algorithms**.**

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			3			2
CO2		2				
CO3	2		2	2	2	
CO4	3		2			
CO5	2		2			2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5108	SOFTWARE ARCHITECTURE AND DESIGN PATTERNS (Professional Elective-II)	L	T	P
Credits: 3		3	-	-

Prerequisites: Software Engineering

Course Objectives:
This course makes the students to learn the different types of Software Architectures and analyze various architectures such as Comprehensive and Quantitative approaches to implement the different types of Design patterns such as Creational, Structural and Behavioral patterns.

Module I: Introduction to Software Architecture [10 Periods]
Envisioning Architecture: Architecture Business Cycle, Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.
Creating Architecture: Quality Attributes, Achieving qualities, Architectural styles and patterns, Designing Architecture, Documenting Software Architectures, Reconstructing Software Architecture.

Module II: Analyzing Architectures [9 Periods]
Comprehensive Approach: Architecture Evaluation, Architecture design decision making ATAM.
Quantitative Approach: Decision Making Context, Basics of CBAM, Implementing CBAM, Case Study.

Module III: Moving from one to many system [9 Periods]
A: Software Product Lines
Overview, Software Product Lines, Scoping, Building Systems from Off-the-Shelf Components.
B: Architecture
What Makes Software Product Lines Difficult? Software Architecture in Future.

Module IV: Design Pattern Catalog-1 [10 Periods]
Patterns: Pattern Description, Organizing catalogs, role in solving design problems, selection and usage.
Creational and Structural Patterns: Abstract factory builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight, Proxy.

Module V: Design Pattern Catalog-2 [10 Periods]
Behavioral Patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor. Case Studies: A-7E–A case study in utilizing architectural structures.

World Wide Web: A Case study in interoperability, Air Traffic Control-Case Study in designing for high availability, Celsius Tech – Case Study in product line development.

TEXT BOOKS

1. Len Bass, Paul Clements & Rick Kazman, "**Software Architecture in Practice**", Third Edition, Pearson Education, 2013.
2. Erich Gamma, "**Design Patterns**", Pearson Education, 1995.

REFERENCE BOOKS

1. Luke Hohmann, "**Beyond Software Architecture**", Addison Wesley, 2003.
2. Partha Kuchana, "**Software Architecture Design Patterns in Java**", Auerbach Publications; 1st Edition, 2004.

E-RESOURCES

1. http://disi.unal.edu.co/dacursci/sistemasycomputacion/docs/SWEBOK/Addison%20Wesley%20-%20Software%20Architecture%20In%20Practice%202nd%20Edition.pdf
2. https://goo.gl/XHf4Skr
3. http://handbookofsoftwarearchitecture.com
4. http://technav.ieee.org/tag/1570/software-architecture
5. http://www.springer.com/in/book/9783319658308#otherversion=9783319658315
6. http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVlXBW-YWRHK2WM4hGzyP-7P1EGjmLQteaTTfT9e5x3lNfo1dkNFKA2TH8BFRA34WT93f7vOClg
7. http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVlXBW-YWRHHjhOkwn-Nw1F1n-B5L9QQwwLxs5C_RQWWA-I82gWvUowtpyPjqm26fq2PVA1VaOg

Course Outcomes:

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

1. **Analyze** the Computer architecture and different processor architectures
2. **Explore** and analyze the architectures
3. **Illustrate** organization and operation of current generation parallel computer systems, including multiprocessor and multi-core systems
4. **Understand** patterns descriptions and solving problems and use of creational and structural patterns.
5. **Apply** design patterns, behavioral patterns and World Wide Web to case studies.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3					
CO2	2					
CO3			2			
CO4	2		3			
CO5	2			3		3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: A0H08	RESEARCH METHODOLOGY AND IPR	L	T	P
Credits: 2		2	-	-

PREREQUISITES: Nil

Course Objectives: The objective of the course is to make students familiar with the basics of research methodology and various types of Intellectual Properties, IPR legislations and policies.

Module I: Research Problem **[6 Periods]**

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

Module II: Technical Writing and Research Proposal **[7 Periods]**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Module III: Intellectual Property Rights **[6 Periods]**

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

Module IV: Patent Rights **[6 Periods]**

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

Module V: Case Studies **[7 Periods]**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCE BOOKS

1. Prabhuddha Ganguli: 'Intellectual Property Rights" Tata Mc-Graw –Hill, New Delhi
2. M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.
3. Carlos M.Correa- ''Intellectual property rights , The WTO and Developing countries"-Zed books
4. Law relating to patents, trademarks, copyright designs, Wadehra, B.L. & 2 ed. Universal Law Publishing 2000.
5. C.R. Kothari, "Research Methodology" New Age International Publishers, Fourth edition, 2018.

6. Donald Cooper & Pamela Schindler, "Business Research Methods", TMGH, 9th edition.
7. Alan Bryman & Emma Bell, "Business Research Methods", Oxford University Press.

E-RESOURCES:

1. https://www.wto.org/english/tratop_e/trips_e/trips_e.htm
2. https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm
3. http://nptel.ac.in/courses/110999906/
4. http://nptel.ac.in/courses/109105112/

Course Outcomes:

After completion of the course, students will be able to:

1. Comprehend the concepts of research methodology and its concepts.
2. Realize the concepts of literature review and developing a research proposal.
3. Understand the basic concepts of Intellectual property rights.
4. Understand the types of patents and their procedures.
5. Recognize the recent developments in IPR administration.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	3			3	3
CO2	3	3			3	3
CO3	3	3			3	3
CO4	3	3			3	3
CO5	3	3			3	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5109	ADVANCED DATA STRUCTURES LAB	L	T	P
Credits: 2		-	-	4

Prerequisites: Computer Programming

Course Objectives:
This objective of the course is to provide the students to implement the applications using Linear Data Structures, Non-linear Data Structures, Searching and Sorting techniques, and deploy the shortest path algorithms.

List of experiments:

1. Write Java programs to implement the following (using arrays and linked lists):
   a) List ADT, b) Stack ADT, c) Queue ADT
2. Write a Java program to read an infix expression and convert into postfix using stacks ADT.
3. Write a Java program to implement circular queue ADT using an array
4. Write a Java program using stack and queue to test the given string is a palindrome or not.
5. Write Java programs to implement the following using a singly linked list.
   a) Stack ADT, b) Queue ADT, c) priority queue ADT
6. Write Java programs to implement the deque (double ended queue) ADT using
   a) Array, b) Singly linked list, c) Doubly linked list.
7. Write a Java program to perform the following operations in binary search tree: a) Creation, b) Insert a key, c) Search for a key, c) Delete an element.
8. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
9. Write a Java program to implement the following:
   a) Dijkstra's algorithm for Single source shortest path problem.
   b) Kruskal's algorithm to generate minimum cost spanning tree.
   c) KMP algorithm for Pattern matching.
10. Write Java programs for the implementation of BFS and DFS for a given graph.
11. Write Java programs for implementing the following sorting methods:
    a) Bubble, b) Insertion, c) Quick, d) Merge, e) Heap, f) Radix, g) Binary Tree
12. Write a Java program to perform the following operations in B-tree: a) Insertion b) Searching.

REFERENCE BOOKS

1. S. Sahni, "**Data Structures Algorithms and Applications in Java**", Universities Press.
2. Clifford Shaffer, "**Data structures and Algorithm analysis in Java**", 3rd Edition, Courier Corporation.

Course Outcomes:
At the end of the course, students will be able to:
1. **Design** and analyze the implementation of linear data structures and applications.
2. **Apply** the concepts related to different searching techniques.

3. **Implement** the sorting techniques.
4. **Learn** and implement the concept of nonlinear data structures and applications.
5. **Study** and deploy the shortest path algorithms.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
Cos	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2		2			
CO2	2	3	2			
CO3	2		2	3		
CO4					2	3
CO5			2	3		1

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5110	BIG DATA ANALYTICS LAB	L	T	P
Credits: 2	(Professional Elective –I lab)	-	-	4

Prerequisites: Computer programming, Linux

Software Requirements: Hadoop, Linux, VMware

Course Objectives:

This objective of the course is to provide the students to study and understand the execute the experiments related to Big data using Hadoop.

List of Programs:

1. Installation of Hadoop
2. File Management tasks in Hadoop
3. Word Count Map Reduce program to understand Map Reduce Paradigm
4. Weather Report POC-Map Reduce Program to analyze time-temperature statistics and generate report with max/min temperature.
5. Implementing Matrix Multiplication with Hadoop Map Reduce
6. Pig Latin scripts to sort, group, join, project, and filter your data.
7. Hive Databases, Tables, Views, Functions and Indexes

BOOKS

1. Dr. M.S.Vijaya Dr. N.Radha V. Pream Sudha on Big Data Analytics Lab Manual: Step by Step Guide to Hadoop, Pig, Hive and MongoDB
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

REFERENCE BOOKS:

1. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011

Course Outcomes:

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

1. **Understand** the big data in Hadoop
2. **Explore** and analyze Files, Mapreduce programs.
2. **Implement** applications using Hadoop programs, POC Map Reduce, Matrix Multiplication
3. **Apply** the Pig Latin scripts using hadoop.
4. **Implement** and **explore** Hive Databases, tables, views, functions and indexes.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1		2	2	2
CO2	1					1
CO3	1			2	2	2
CO4				1		1
CO5	1	2		1		1

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5111	DATA SCIENCE LAB (Professional Elective-I Lab)	L	T	P
Credits: 2		-	-	4

Prerequisites: Computer Programming

Course Objectives:
To make students understand learn about a Data science – R Programming, way of solving problems and to teach students to write programs and solve problems.

List of experiments:

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.

Introduction to R Programming:

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 of data.
    (ii)Reading data from Excel files.

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

REFERENCE BOOKS

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

Suggested Links:

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

Course Outcomes:

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

1. **Design** and analyze the implementation of R programs.
2. **Apply** the data science and R concepts related to different problems using R studio.
3. **Implement** the searching techniques.
4. **Learn** and implement the concept of sorting, data structures, commands and applications.
5. **Study** and deploy the data sets and graphs

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
Cos	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3		2			
CO2	2	3	2			
CO3	2	2	2	3		
CO4					3	1
CO5			2	3	1	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5112	MACHINE LEARNING LAB	L	T	P
Credits: 2	(Professional Elective-I Lab)	-	-	4

Prerequisites: Computer Programming, Python

Course Objectives:
This objective of the course is to provide the students to implement the various supervised and unsupervised learning techniques along with the clustering and classification methods.

List of experiments:
1. Implement simple linear regression.
2. Implement the multivariate linear regression.
3. Implement simple logistic regression and multivariate logistics regression.
4. Implement decision trees.
5. Implement a classification algorithm.
6. Implement random forests algorithm
7. Implement K-means with example
8. Implement KNN algorithms with example.
9. Implement SVM on any applicable datasets.
10. Implement neural networks
11. Implement PCA.
12. Implement anomaly detection and recommendation.

REFERENCE BOOKS
1. Willi Richert, Luis Pedro Coelho, "Building Machine Learning with Python", Packt Publishing, 2013.

Course Outcomes:
At the end of the course, students will be able to:
1. **Study** of various statistical methods.
2. **Deploy** classification techniques for a real time data set.
3. **Implement** clustering algorithms for any data set.
4. **Explore** the dimensionality reduction procedures.
5. **Examine** the anomaly detection methods.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		3			
CO2	2		3			
CO3	1	1	1		2	2
CO4		1	1			1
CO5	1		1		2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A00A4	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P
Credits: Nil		2	-	-

Prerequisites: Nil

Course Objectives: The objective of the course is to provide the knowledge on structuring paragraphs, paraphrasing and preparation of research documents related to abstract, literature review, methods and results.

Module I **[6 Periods]**

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

Module II **[7 Periods]**

Clarifying Who Did What, Highlighting Your Findings, Hedging and criticising, paraphrasing and plagiarism, sections of a paper, abstracts. Introduction.

Module III **[6 Periods]**

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

Module IV **[6 Periods]**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module V **[7 Periods]**

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.

REFERENCE BOOKS

1. Goldbort R (2006) Writing for Science, Yale University Press.
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
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.

Course Outcomes:

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

1. **Structure** the sentences and paragraphs.
2. **Elaborate** the various sections of research papers.
3. **Explore** the check list in research documents.
4. **Apply** the key skills to coin the title, abstract, introduction and literature review.

5. **Inspect** the skills required for preparing experimental results and discussions.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		2			1	
CO2		2		1		
CO3		2				2
CO4		2			1	
CO5		2			1	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5113	ADVANCED COMPUTER NETWORKS	L	T	P
Credits: 3		3	-	-

Prerequisites: Operating Systems

Course Objectives:
This course makes the students to learn and understand the concepts of Linux and C programming, to study the Shell programming, file concepts and directory management in network programming for inter process communication using pipes, FIFOs, signals, semaphores, message queues and explain socket programming to design the client/server environment, to examine network Programming for performing TCP, and UDP connections.

Module I: Introduction to Linux and Shell Programming [9 Periods]
Introduction to Linux: Linux Utilities, File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking utilities, Filters, Text processing utilities, Backup utilities. Bourne again shell (bash).

Shell Programming: Introduction, Pipes and Redirection, Running a Shell Script, Shell as a Programming Language, Shell meta characters, File name substitution, Shell variables, Command substitution, Shell commands, Environment, Quoting, Test command, Control & Arithmetic structures, Shell script examples. Review of C Concepts: Arrays, Strings, Pointers, Function pointers, Structures, Unions.

Module II: Files and Directory Management [9 Periods]
Files: Files- File Concept, File types File System Structure, Inodes, File Attributes, file I/O in C using system calls, kernel support for files, file status information-stat family, file and record locking-lockf and fcntl functions, file permissions- chmod, fchmod, file ownership-chown, lchown, fchown, links-soft links and hard links – symlink, link, unlink.

Directory Management: File and Directory management, Directory contents, Scanning Directories, Directory file APIs. Process concept, Kernel support for process, Process Attributes, Control and Creation, Replacing a process image, Waiting for process, Process termination, Zombie process, Orphan process.

Module III: Signals and IPC [10 Periods]
A: Signals
Introduction to Signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise, alarm, pause, abort, sleep functions.

B: Interprocess Communication (IPC)
Introduction, Pipes creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs (Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Message queues, semaphores and shared memory. Message Queues, Kernel support, UNIX system V APIs for messages, client/server example. Semaphores-Kernel support for semaphores, UNIX system V APIs for semaphores.

Module IV: Shared Memory and Sockets [10 Periods]

Shared Memory: Shared Memory, Kernel support, UNIX system V APIs for Shared memory, Client/Server example.

Sockets: Network IPC, Introduction to Unix Sockets, IPC over a network, Client-Server model, Address formats, Socket system calls for Connection Oriented, Communication, Socket system calls for Connectionless, Communication, Example, Client/Server Programs, Single Server-Client connection, Multiple simultaneous clients, Socket options, Set sock opt, get sock opt, fcntl.

Module V: Network Programming and Remote Method Invocation [10 Periods]

Network Programming: Network Programming in Java, Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs to handle one and multiple connections (using multithreaded server).

RMI: Basic RMI Process, Implementation details-Client-Server Application.

TEXT BOOKS

1. T. Chan, "**Unix System Programming using C++**", PHI.
2. Sumitabha Das, "**Unix Concepts and Applications**", TMH, 4th Edition.

REFERENCE BOOKS

1. W.R.Stevens, "**Advanced Programming in the UNIX environment**", Pearson Education, 2nd Edition.
2. W. R. Stevens, Bill Fenner, A. M. Rudoff, "**Unix Network Programming The Sockets Networking API**", Pearson Education, Vol.-I.

E-RESOURCES

1. https://openlibrary.org/books/OL24607430M/UNIX_system_programming_using_C https://zimslifeintcs.files.wordpress.com/2011/12/sumitabahdas.pdf
2. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=414638
3. http://www.springer.com/in/book/9781447152538
4. http://nptel.ac.in/courses/117106113/
5. https://comptechdoc.org/

Course Outcomes:

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

1. **Learn** the basic set of commands and utilities in Linux/UNIX systems.
2. **Originate** file and directories in UNIX programming.
3. **Devise** the signals, Inter process communication systems.
4. **Make use of** socket to implement client/server environment.
5. **Explore** the Network Programming and RMI in detail.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		1			
CO2	1		1			
CO3			1		1	
CO4			1		2	1
CO5	1		1	1	2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5114	WEB SERVICES	L	T	P
Credits: 3		3	-	-

Prerequisites: Java Programming

Course Objectives:
This course enables the students to learn, understand the basic concepts of web services, implementation model, study the architecture and its standards, illustrate the concepts of XML documents, SOAP for registering and discovering services and discuss SOA services and its security.

Module I: Distributed Computing and Web Services [9 Periods]
Introduction Evolution and Emergence of Web Services, Evolution of distributed computing. Core distributed computing technologies–client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA).

Web Services: Introduction, Basic operational model of Web services, Tools and technologies enabling web services, Benefits and Challenges of using web Services.

Module II: Web Service Architecture and WSDL [10 Periods]
Web Services: Web Service Architecture –Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, and basic steps of implementing web services, Describing Web Services.

WSDL: WSDL introduction, nonfunctional service description, WSDL 1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

Module III: XML and SOAP [10 Periods]
A: XML
Brief overview of XML–XML Document structure, XML name spaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation.

B: Simple Object Access Protocol (SOAP)
Introduction, Inter-application communication and wire protocols, SOAP as a Messaging protocol, Structure of a SOAP message, SOAP Envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, Enterprise Service Bus, SOA Development Life Cycle, SOAP HTTP binding, Communication model, Error handling.

Module IV: Services and UDDI [10 Periods]
Registering and Discovering Services: Registering and Discovering Services: Role of Service Registries, Service discovery, Universal Description, Discovery and Integration.

UDDI: UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

Module V: Web Services and Service Management [9 Periods]

Web Services: SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, Semantic interoperability problem, Role of Meta Data, Service Meta Data.

Service Management: Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frame works, Web service management, Richer schema languages, WS-Meta data Exchange.

TEXT BOOKS

1. Michael P. Papazoglou, "**Web Services & SOA Principles and Technology**", Second Edition.
2. S. Chatterjee, J. Webber, "**Developing Enterprise Web Services**", Pearson Education.

REFERENCE BOOKS

1. S. Graham and others, "**Building web Services with Java**", Pearson Education,2nd Edition.
2. Sunil Mathew, Michael Stevens, Sameer Tyagi, James McGovern, "**Java web Services Architecture**", Elsevier Science, Morgan Kaufmann Publishers, 2005.

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1. https://www.abebooks.com/Web-Services-SOA-Principles-Technology-2nd/12698437230/bd
2. http://notes.specworld.in/web-services-notes-pdf-ws-notes-pdf/
3. http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=4629386
4. http://dl.acm.org/citation.cfm?id=1088876
5. https://www.coursera.org/learn/python-network-data/lecture/0CpCx/video-service-oriented-architectures
6. http://nptel.ac.in/courses/105102015/11

Course Outcomes:

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

1. **Understand** the fundamental theoretical concept related to web services such as Client server, CORBA, JAVA RMI, Microsoft DCOM, MOM and Service oriented architectures.
2. **Develop** a web application architectures characteristics and applying WSDL concept to develop a web application.
3. **Design** and develop a web application using SOAP protocol, XML and Inter communication protocols.
4. **Apply** the concepts for UDDI registries, addressing and notifications.
5. **Analyze** a secure web application using network security mechanisms like, .NET, J2EE and Richer schema languages.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		2			
CO2					3	2
CO3			1		1	
CO4					1	
CO5				3	1	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5115	ADVANCED DATABASES	L	T	P
Credits: 2		2	-	-

Prerequisites: Database Management Systems

Course Objectives:

This course enables the students to learn the modeling and design of databases, acquire knowledge on parallel and distributed databases and its applications, Study the usage and applications of Object Oriented database,and understand the principles of intelligent databases, usage of advanced data models, learn emerging databases such as XML, Cloud and Big Data and acquire inquisitive attitude towards research topics in databases.

Module I: Parallel And Distributed Databases [10 Periods]

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed query processing –case studies.

Module II : Object And Object Relational Databases [9 Periods]

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

Module III: Intelligent Databases [10 Periods]

A: Active Databases

Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases-TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion-Recursive Queries in SQL

B: Spatial Databases

Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

Module IV: Advanced Data Models [10 Periods]

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols - Multimedia Databases - Information Retrieval- Data Warehousing- Data Mining- Text Mining.

Module V: Emerging Technologies [9 Periods]

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages-Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases-Geographic Information Systems- Biological Data Management- Cloud Based Databases:

Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models-Query Languages- Introduction to Big Data-Storage-Analysis.

TEXT BOOKS

1. Thakare Jadhav Kedar**,** "**Advance Database Management**", **Technical Publications, 2008.**
2. S. K. Singh, "**Database Systems:** Concepts, Design and Applications", Pearson Education India, 2011.

REFERENCE BOOKS

1. R. Elmasri, S.B. Navathe, "**Fundamentals of Database Systems**", Fifth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, "**Database Systems, A Practical Approach to Design, Implementation and Management**", Third Edition, Pearson Education, 2007.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "**Database System Concepts**", Fifth Edition, McGraw Hill, 2006.
4. C.J.Date, A.Kannan and S.Swamynathan, **"An Introduction to Database Systems**", Eighth Edition, Pearson Education, 2006.
5. Raghu Ramakrishnan, Johannes Gehrke, "**Database Management Systems**", McGraw Hill, Third Edition 2004.

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1. https://books.google.co.in/books?id=qNCmBRufKBAC&dq=Parallel+Systems-+Distributed+Systems+%E2%80%93+Parallel+Databases:+I/O+Parallelism+%E2%80%93+Inter+and+Intra+Query+Parallelism&hl=en&sa=X&ved=0ahUKEwj83K-18bncAhUMLY8KHX2qCI8Q6AEIKDAA.
2. http://www.inf.ed.ac.uk/teaching/courses/adbs/slides/adbs.pdf
3. https://books.google.co.in/books?id=qNCmBRufKBAC&dq=Parallel+Systems-+Distributed+Systems+%E2%80%93+Parallel+Databases:+I/O+Parallelism+%E2%80%93+Inter+and+Intra+Query+Parallelism&hl=en&sa=X&ved=0ahUKEwj83K-18bncAhUMLY8KHX2qCI8Q6AEIKDAA.
4. http://nptel.ac.in/courses/106104135/

Course Outcomes:

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

1. **Select** the appropriate high-performance database like parallel and distributed database.
2. **Aware** of representing the model and real-world data using object-oriented database.
3. **Design** a semantic based database to meaningful data access
4. **Embed** the rule set in the database to implement intelligent databases
5. **Represent** the data using XML database for better interoperability and to solve the issues related to the data storage and retrieval.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1					
CO2	1		1		2	
CO3	1		1		1	
CO4	1		2		3	2
CO5	1		2		3	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5116	ADVANCED DATA MINING (Professional Elective - III)	L	T	P
Credits: 3		3	-	-

Prerequisites: Data Mining

Course Objectives:
This course aims the students to develop the abilities of critical analysis to data mining systems and applications, to implement practical and theoretical understanding of the technologies for data mining and to understand the strengths and limitations of various data mining models.

Module I: Data mining Overview and Advanced Pattern Mining [9 Periods]
Data mining tasks – mining frequent patterns, associations and correlations, classification Data mining tasks – mining frequent patterns, associations and correlations, classification Bayes method Naive Bayes ,KNN method, and regression for predictive analysis, cluster analysis , outlier analysis; advanced pattern mining in multilevel, multidimensional space – mining multilevel associations, mining multidimensional associations, mining quantitative association rules, mining rare patterns and negative patterns.

Module II: Advance Classification [10 Periods]
Classification by back propagation, support vector machines, classification using frequent patterns, other classification methods – genetic algorithms, back propagation, roughest approach, fuzzy set approach

Module III: Advance Clustering [10 Periods]
A: Density - based methods
DBSCAN, OPTICS, DENCLUE
B: Grid-Based methods
STING, CLIQUE; Exception – maximization algorithm; clustering High- Dimensional Data; Clustering Graph and Network Data.

Module IV: Web and Text Mining [9 Periods]
Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining – unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering

Module V: Temporal and Spatial Data Mining [10 Periods]
Introduction; Temporal Data Mining – Temporal Association Rules, Sequence Mining, GSP algorithm, SPADE, SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining – Spatial Mining Tasks, Spatial Clustering. Data Mining Applications.

TEXT BOOKS

1. Jiawei Hang Micheline Kamber, Jian pei, Morgan Kaufmannn, "**Data Mining Concepts and Techniques**.
2. Arun K Pujari, "**Data Mining Techniques**", Universities Press.

REFERENCE BOOKS

1. Pang-Ning Tan, Vipin kumar, "**Introduction to Data Mining**", Michael Steinbach, Pearson.
2. T.VSveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, "**Data Mining Principles & Applications**", Elsevier.

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1. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf.
2. https://books.google.co.in/books?id=O6F9iwsqZQwC&printsec=frontcover&dq=temporal+and+spatial+data+mining+%2Bpdf&hl=en&sa=X&ved=0ahUKEwimv9qA1LncAhWIr48KHTIfAK0Q6AEITzAF#v=onepage&q&f=false
3. http://nptel.ac.in/courses/106106093/35
4. https://freevideolectures.com/course/2280/database-design/35

Course Outcomes

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

1. **Understand** the fundamentals in data mining.
2. **Explore** various classification techniques.
3. **Implement** clustering techniques and to apply it on various datasets.
4. **Investigate** several web and text mining techniques.
5. **Describe** temporal and spatial data mining process.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			3			2
CO2		2				
CO3	2		2	2	2	
CO4	3		2			
CO5	2		2			2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5117	COMPUTER VISION	L	T	P
Credits: 3	(Professional Elective-III)	3	-	-

Pre-Requisites: Linear algebra, Vector calculus, Data Structures and Programming.

Course Objectives:

This course makes the students to understand both the theoretical and practical aspects of computing with images, study the foundation of image formation, measurement, and analysis, recognize the geometric relationships between 2D images and the 3D world and know the principles of state-of-the-art deep neural networks.

Module I: Introduction to Image Analysis and Matlab [9 periods]

A: Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

B: Matlab: Digital image Representation, displaying images, writing images, Image types, converting between classes, array indexing, control flow, operators, files, functions, data debugging, commands, and example programs

Module II: Processing of Image [9 periods]

Edge detection, Edge detection performance, Hough transform, corner detection

Module III: Introduction to Segmentation and Filtering [9 periods]

A: Segmentation- Active contours, Split and Merge, Mean shift and Mode finding, Normalized cuts, Graph cuts and Energy based methods, Morphological filtering

B: Fourier transform- Fourier Transform pairs, Two-dimensional Fourier transforms, Weiner filtering, Application: Sharpening, blur and noise removal.

Module IV: Introduction to Feature Extraction [9 periods]

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing

Module V: Pattern Analysis [12 periods]

Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised Classifiers: Bayes, KNN, ANN models;

Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods. Recent trends in Activity Recognition, computational photography, Biometrics

TEXT BOOKS

1. Martin A. Fischler, Oscar Firschein, "Readings in Computer vision: Issues, Problems, Principles, and Paradigms", Morgan Kaufmann,1987.
2. William K. Pratt, "Introduction to Digital Image Processing", CRC Press, 2013

REFERENCE BOOKS

1. Richard Szeliski," Computer Vision: Algorithms and Applications", Springer London, 05-Nov-2010.
2. S. Nagabhushana," Computer Vision and Image Processing", New Age International, 2005
3. Gonzales/ Woods/ Eddins, Digital Image Processing using MATLAB, 2nd edition, Gatesmark Publishing, ISBN 9780982085400
4. N.Efford, Digital Image Processing, Addison Wesley 2000, ISBN 0-201-59623-7
5. M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS 1999, ISBN 0-534-95393-
6. Pratt.W.K., Digital Image Processing, John Wiley and Sons, New York, 1978
7. MATLAB: The Language of Technical Computing, computation, visualization, programming using MATLAB, 2001

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1. http://web.itu.edu.tr/hulyayalcin/Signal_Processing_Books/2010_Szeliski_Computer Vision.pdf
2. https://web.stanford.edu/class/ee254/software/using_ml.pdf
3. http://www.cse.iitm.ac.in/~vplab/courses/CV_DIP/PDF/LECT_EDGE_DET.pdf
4. http://nptel.ac.in/courses/112101098/25
5. http://imageprocessingplace.com/downloads_V3/dipum2e_downloads/dipum2e_sample_book_material_downloads/DIPUM2E_Chapter02_Pgs_13-50.pdf
6. https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf

Course Outcomes:

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

1. **Understand** the concepts in Image Analysis. and matlab concepts.
2. **Explore** the processing techniques in Image.
3. **Investigate** several techniques in segmentation and filtering.
4. **Comprehend** and apply feature extraction techniques.
5. **Developed** the practical skills necessary to build computer vision applications

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2		1	1		
CO2			1		1	
CO3	1		2		2	3
CO4	1	1	2	1	3	1
CO5	2		2	2	3	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5118	SOFT COMPUTING (Professional Elective –III)	L	T	P
Credits: 3		3	-	-

Pre-Requisites Basic knowledge of mathematics

Course Objectives:
This course makes the students to learn soft computing concepts and techniques, foster their abilities in designing appropriate technique for a given scenario, implement soft computing based solutions for real-world problems, give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms and to provide student a hand-on experience on MATLAB to implement various strategies.

Module I: Introduction to Soft Computing and Neural Networks [8 Periods]
Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics, Linear Saturating Function, Art Model

Module II: Fuzzy Logic [8 Periods]
Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Module III: Neural Networks and Advanced Learning Techniques [10 Periods]
A: Neural Networks
Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks Back Propagation Algorithm, Error Back Propagation Algorithm (EBPA), Radial Basis Function Networks, CPN (Counter propagation network), Convolutional neural network

B: Reinforcement Learning
Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

Module IV: Genetic Algorithms [7 Periods]
Introduction to Genetic Algorithms (GA), Genetic Algorithm, analysis of Fuzzy Vs Crisp Logic, perceptron Training Algorithm , Applications of GA in Machine Learning, Machine Learning Approach to Knowledge Acquisition, Hebb's Rule, Delta Rule

Module V: Matlab/Python Lib & Deep Learning [15 Periods]
Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

TEXT BOOKS

1. S. N. Sivanandam&S.N.Deepa, "**PRINCIPLES OF SOFT COMPUTING**", John Wiley & Sons, 2007.
2. N. P. Padhy, S. P. Simon, **"Soft Computing:** With MATLAB Programming" Oxford University Press, 2015.

REFERENCE BOOKS

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, "**Neuro:Fuzzy and Soft Computing**" , Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, "**Fuzzy Sets and Fuzzy Logic: Theory and Applications**" , Prentice Hall, 1995. 3. MATLAB Toolkit Manual

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1. https://bookboon.com/en/introduction-to-soft-computing-ebook
2. http://www.vssut.ac.in/lecture_notes/lecture1423723637.pdf
3. https://onlinecourses.nptel.ac.in/noc18_cs13/preview
4. https://lecturenotes.in/subject/124/soft-computing-sc
5. https://bharadwajakumar.files.wordpress.com/2019/06/soft-computing-ebook.pdf
6. http://instalzonetrak.weebly.com/blog/sn-sivanandam-and-sn-deepa-principles-of-soft-computing-wiley-india-2007-pdf

Course Outcomes:

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

1. **Identify** and describe soft computing techniques and their roles in building intelligent machines
2. **Implement** fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
3. **Employ** genetic algorithms to combinatorial optimization problems.
4. **Evaluate** and compare solutions by various soft computing approaches for a given problem.
5. **Investigate** recent trends in deep learning.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	1	1	1	1
CO2	1		1		2	
CO3	2		2		3	
CO4	2	1	2		3	1
CO5	1	1	1		2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5119	SOFTWARE ENGINEERING AND MODELING (Professional Elective – IV)	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Software Engineering

Course Objectives:
This course provides the students to understand the importance of process models, learn about project management, phases in software process, make them to know about the different organization structures and study about several project management tools.

Module I: Software Process Models [10 Periods]
Software Process Maturity: Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models: Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP. **Classical Modeling Techniques example.**

Module II: Project Management [10 Periods]
Software Project Management Renaissance: Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.
Life-Cycle Phases and Process artifacts: Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

Module III: Workflows and Planning [10 Periods]
A: Workflows
Workflows and Checkpoints of process: Software process workflows, Iteration workflows, Major milestones, Minor milestones, Periodic status assessments.
B: Process Planning
Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

Module IV: Project Organization [10 Periods]
Project Organizations: Line-of- business organizations, project organizations, evolution of organizations, process automation.
Project Control and process instrumentation: The seven core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, and metrics automation.

Module V: Case Study [8 Periods]
CCPDS-R Case Study and Future Software Project Management Practices: Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS:

1. Watts S. Humphrey, "**Managing the Software Process**", Pearson Education.
2. Walker Royce, "**Software Project Management**", Pearson Education.

REFERENCE BOOKS

1. Robert Wysocki," **Effective Project Management: Traditional, Agile, Extreme**", Sixth edition, Wiley India, reprint 2011.
2. Watts S. Humphrey, "**An Introduction to the Team Software Process**", Pearson Education, 2000
3. James R. Persse," **Process Improvement essentials**", O'Reilly, 2006
4. Bob Hughes & Mike Cotterell," **Software Project Management**", fourth edition, TMH, 2006
5. Andrew Stellman& Jennifer Greene,"**Applied Software Project Management**", O'Reilly, 2006.
6. Scott Berkun ," **The Art of Project Management**" , SPD, O'Reilly, 2011.
7. Andrew Stellman& Jennifer Greene," **Applied Software Project Management**", SPD, O'Reilly, reprint 2011.
8. Jim Highsmith," **Agile Project Management**", Pearson education, 2004.

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1. http://moosehead.cis.umassd.edu/cis365/reading/Defining-the-Software-Process.pdf.
2. www.philadelphia.edu.jo/.../pdf/file3840fd5c6eab47be9d52c06c2e974886.pdf
3. http://index-f.co.uk/Engineering/Introduction%20to%20Software%20Engineering.pdf
4. http://160592857366.free.fr/joe/ebooks/ShareData/Software%20Engineering%20-%20Principles%20and%20Practice%20By%20Hans%20van%20Vliet%20-%20Wiley%202007.pdf
3. http://nptel.ac.in/courses/106101061/29.

Course Outcomes:

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

1. **Describe** and determine the purpose and importance of project management
2. **Analyze** the project management methods.
3. **Design** checkpoints and planning process.
4. **Compare** and **differentiate** organization structures and project structures.
5. **Implement** a project to manage project schedule, expenses and resources with the application of suitable project management tools.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	2	2		
CO2	1	1	1	2	2	2
CO3	1	1	1	2	2	2
CO4	1		1	2	2	2
CO5	1	1	1	2	2	2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5120	SOFTWARE QUALITY ASSURANCE AND TESTING (Professional Elective-IV)	L	T	P
Credits: 3		3	-	-

Prerequisites: Software Engineering

Course Objectives:

This course provides the students to learn, describe and determine the purpose, importance of Software Quality Assurance (SQA) Framework and its Standards, state the metrics, measurements and methodology in quality assurance, study the Standards, metrics, methodologies, establishing policies, SDLC process, techniques and software testing tools like automated testing tools, Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, J Meter testing, assessing, project management in Client / Server and web applications by providing security.

Module I: SQA Framework and Quality Standards [10 Periods]

SQA Framework and Standards: What is Quality in SQA, Components, SQA Plan, Steps to develop and implement a SQA Plan.

Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma and 6 Sigma.

Module II: Metrics and Methodologies [10 Periods]

SQA Metrics and Measurement Software Quality Metrics: Product Quality metrics, In-Process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs

Software Quality Metrics methodology: Establish Quality Requirements, Identify Software quality metrics, Implement software quality metrics, Analyze software metrics results, Validate Software Quality Metrics, Software Quality Indicators, Fundamentals in Measurement theory.

Module III: Software Testing Methodologies [9 Periods]

A: Software Testing Strategy and Environment

Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing.

B: Software Testing Methodology

Verification and validation, functional and structural testing, work bench concept, eight considerations in developing testing methodologies, testing tactics checklist.

Module IV: Techniques and Tools [10 Periods]

Software Testing Techniques: Black-Box, Boundary value, Bottom-up, Branch coverage, Cause-Effect graphing, CRUD, Database, Exception, Gray-Box, Histograms, Inspections, JADs, Pareto Analysis, Prototyping, Random Testing, Risk-based Testing, Regression Testing, Structured Walkthroughs, Thread Testing, Performance Testing, White-Box Testing.

Software Testing Tools: Taxonomy of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, J Meter, J MODULE and Cactus.

MODULE V: Testing Process and Applications [9 Periods]

Testing Process: Eleven Step Testing Process: Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report test results, testing software installation, Test software changes, Evaluate Test Effectiveness.

Testing Specialized Systems and Applications: Testing Client/Server and Web applications, testing off the Shelf Components, Testing Security, Testing a data Warehouse.

TEXT BOOKS

1. William E. Perry, "**Effective Methods for Software Testing**", Wiley India, 2nd Edition, 2006.
2. Mordechai Ben-Menachem Garry S. Mar Liss, "**Software Quality**", Thomson Learning Publication, 1997.
3. K.V.K.K. Prasad, "**Software Testing Tools**", Dream Tech Publishers, Third Edition 2009.

REFERENCE BOOKS

1. BoriesBeizer, "**Software Testing Techniques**", 2nd Edition, Dream Tech Press.
2. G.Gord on Schulmeyer, James I. Mc Manus, "**Hand book of Software Quality Assurance**", International Thomson Computer Press, 2nd Edition.

E-RESOURCES

1. https://hientl.files.wordpress.com/2011/12/effective-methods-for-software-testing2.pdf
2. http://www.softwaretestinggenius.com/download/EMFST.pdf
3. https://www.adturtle.biz/LP_TA/index.cfm?T=436379
4. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=32
5. http://dl.acm.org/citation.cfm?id=2597724
6. http://nptel.ac.in/courses/106101061/18
7. http://ndl.iitkgp.ac.in/document/zyMnqgZQXCJME6wgSqrU87VCGcelOw5mZ-5ybmrhKB j79VQPP0_ZQHLqcOopPDoaFWhZybCrPg_joTbBU8ZpGA

Course Outcomes:

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

1. **Define** state-of-the-art, and apply their findings to framework for software testing and quality assurance.
2. **Analyze** different approaches to software testing and quality assurance, metrics measurement, and select optimal solutions for different situations and projects.
3. **Demonstrate** software testing & quality assurance and apply that knowledge in SDLC, functional, structural testing, other testing methods their future research & its practice.
4. **Evaluate** different testing tools and techniques
5. **Justify** the testing process and its applications in quality assurance for client/server, web applications with security.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1				
CO2	1		1		3	1
CO3	1		2		2	
CO4	1		2	1	2	1
CO5	1		2	2	2	1

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5121	STORAGE AREA NETWORKS	L	T	P
Credits: 3	(Professional Elective-IV)	3	-	-

Prerequisites: Computer Networks

Course Objectives:

This course makes to study and understand storage area networks, fundamentals of data creation, storage, architecture, components, data protection, storage methods, information availability, and monitoring and management of data centers. Further, policies, backup recovery techniques, storage virtualization, security management are discussed in detail using case studies and concern applications.

Module I: Introduction to Information Storage and Management [9 Periods]

Introduction: Review data creation, Amount of data being created and understand the value of data to a business, Challenges in data storage and data management.

Data Centre Infrastructure: Solutions available for data storage, Core elements of a data center infrastructure, Role of each element in supporting business activities.

Module II: Storage Systems Architecture [10 Periods]

Physical Components: Hardware and Software Components of Host Environment, Key protocols and concepts used by each component, Physical and Logical components of connectivity environment, Physical components of a Disk Drive and function, Logical Constructs of a Physical Disk, Access characteristics, and Performance Implications.

Data Protection: Different RAID levels and their suitability for different application environments: RAID 0, 1, 3, 4, 5, RAID 0+1, 1+0, 6, Compare and contrast integrated and modular storage systems, High-level architecture and working of an intelligent storage system.

Module III: Introduction to Networked Storage [9 Periods]

A: Evolution of networked storage

Architecture, Components, Topologies of FC-SAN, NAS, and IPSAN, Benefits of different networked storage options.

B: Storage Methods

Need for long-term archiving solutions, CAS fulfills the need, Different networked storage options for different application environments.

Module IV: Information Availability, Monitoring & Managing Datacenter [10 Periods]

Business Continuity and Disaster Recovery: Planned/unplanned outages and impact of downtime, Impact of downtime, Business Continuity Vs Disaster Recovery, RTO and RPO, Identify single points of failure in storage infrastructure, Solutions to mitigate failures.

Backup/Recovery Topologies: Replication technologies, Business Continuity, Remote Replication technologies, Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor different components in a storage infrastructure, Key management tasks in a data center.

Module V: Storage Virtualization and Case Studies [10Periods]

Securing Storage and Storage Virtualization: Information security, Critical security attributes for information systems, Storage security domains, List and analyzes common threats in each domain, Virtualization technologies, Block-level and File level virtualization technologies and processes.

Case Studies: Technologies described in course are reinforced with EMC examples of actual solutions. Realistic case studies enable participant to design most appropriate solution for given sets of criteria.

TEXT BOOKS

1. G. Somasundaram, Alok Shrivastava, "**Information Storage and Managemen**t", Wiley, 2010.
2. Meeta Gupta, "**Storage Area Network Fundamentals**", Pearson Education Limited, 2002.

REFERENCE BOOKS

1. Robert Spalding, "Storage **Networks: The Complete References**", Tata McGraw Hill, 2003.
2. Marc Farley, "**Building Storage Networks**", Tata McGraw Hill, 2001.

E RESOURCES:

1. https://www.mikeownage.com/mike/ebooks/Information%20Storage%20and%20Management.pdf
2. https://books.google.co.in/books?isbn=158705065X
3. https://books.google.co.in/books?isbn=158705065X
4. http://ndl.iitkgp.ac.in/document/uT7ohQ3kN8pP8OwteoNZ9LnctkAcqauU6wfPkbQYZW6tW3GrMe8ltD4hlD7okN1Oxl_e6yKh2APw_XypNAE6qg
5. http://ieeexplore.ieee.org/document/5386862/?reload=true
6. http://www.lazysystemadmin.com/2010/04/storage-area-network-san-video-tutorial.html

Course Outcomes:

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

1. **Identify** and describe the functions to build data center networking for switch network.
2. **Describe** different components of a storage infrastructure, types of RAID implementations and data protection.
3. **Evolution of** Network storage and storage methods for application environments.
4. **Demonstrate** Information Availability, Monitoring & Managing Datacenter and list solutions for failures and recovery
5. **Apply** the Secure storage virtualization and case studies and applications.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		1			
CO2	1		1		1	
CO3	1				1	
CO4	1	1	1	1	2	2
CO5	2	2	1	1	3	2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5122	WEB SERVICES LAB	L	T	P
Credits: 2		-	-	4

Prerequisites: Java Programming
Software Requirements: JDK

Course Objectives:
This objective of the course is to provide the students to implement WSDL Services, web-based applications with request and response operations and applications using database connectivity.

List of Programs:
1. Write a program to implement WSDL Service (Hello Service, WSDL File)
2. Write a program the service provider can implement a single getprice(), static bind() and getproduct operation.
3. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and, pwd4 respectively. Write a servlet for doing the following.
   a. Create a Cookie and add these four user id's and passwords to this Cookie.
   b. Read the user id and passwords entered in the Login form and authenticate with the values (user id and passwords) available in the cookies. If he is a valid user(i.e., user-name and password match) you should welcome him by name(user-name) else you should display " You are not an authenticated user ".
4. Write a program to implement the operation can receive request and will return a response in One-Way operation.
5. Write a program to implement the operation can receive request and will return a response in Request – Response operations
6. Write a program to implement to create a simple web service that converts the temperature from Fahrenheit to Celsius (using HTTP Post Protocol).
7. Write a program to implement business UDDI Registry entry.
8. Write a program to implement a Web based service consumer.
9. Write a program to implement a Windows application based web service consumer.
10. Install a database (Mysql or Oracle) and explore the basic commands.
11. Create a table which should contain at least the following fields: name, password, email-id, phone number (these should hold the data from the registration form). Practice 'JDBC' connectivity. Write a java program/servlet/JSP to connect to that database and extract data from the tables and display them. Experiment with various SQL queries. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
12. Beans Assignment – Automobile the Traffic Light.

REFERENCE BOOKS
1. Michael P. Papazoglou, "**Web Services & SOA Principles and Technology**", Second Edition

Course Outcomes:
At the end of the course, students will be able to:
1. Design and implement web services for single and multiuser applications.

2. Develop the responsive services using HTTP.
3. Implement the web based services for customer operations.
4. Deploy the web services with the database connectivity.
5. Apply the web basedconcepts in real time applications.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			1		1	
CO2			1		2	1
CO3	1		1	2	1	2
CO4		1			1	
CO5			1			3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech I Sem		
Code: A5123	ADVANCED DATA MINING LAB	L	T	P
Credits: 2	(Professional Elective-I Lab)	-	-	4

Prerequisites: Computer Programming, Python

Course Objective:

The objective of this lab is to get an overview of the various data mining techniques and can able to demonstrate them using python.

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 the probability 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 using python
3. Implement k-nearest neighbors classification using python
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	CLASS
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	football	banking	single	thirties	yes ->lowRisk
high	flying	media	married	fifties	yes ->highRisk
low	football	security	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 using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

REFERENCE BOOKS

1. Machine Learning – Tom M. Mitchell, MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.
3. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

Course Outcomes: After the completion of the "**Advanced Data Mining**" lab, the student can able to:

1. **Analyze and** Understand complexity of Data mining and machine Learning algorithms and their limitations;
2. **Understand and Apply** modern notions in data analysis-oriented computing;
3. **Implement** of confidently applying common Machine Learning algorithms in practice and implementing their own;
4. **Learn and apply** of performing experiments in Machine Learning using real-world data.
5. **Study and Implement** Algorithms/ methods using Programming

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	1	3			
CO2	3		3			
CO3	1	1	1	2	2	2
CO4		1	1		1	1
CO5	1		1		2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5124	COMPUTER VISION LAB	L	T	P
Credits: 2	(Professional Elective –III lab)	-	-	4

Prerequisites: Computer programming, Python

Software Requirements: Python, or equivalent software

Course Objectives:
This objective of the course is to provide the students to study and understand the execute the experiments related to computer vision, Image processing applications using Python.

List of Programs:

1. Installation of
2. Python operations and the image processing toolbox
   i) Image enhancement ii) Image compression iii) color image processing, iv) image morphology Python
3. Basic image processing operations and histograms algorithms
   i) Resizing (scaling) and rotation ii) Quantization iii) Histogram
4. Image filtering in spatial and in frequency domain using Python commands
5. Observe the following
   i. shift
   ii. Linearity
   iii. Scaling
   iv. rotation
   v. Exchange between magnitude and phase
6. Image Restoration
7. Image compression
8. Video tracking

BOOKS

1. Hands-On Image Processing with Python, Sandipan Dey, Pact publishing 1st edition 2018.
2. Python 3 Image Processing, Ashwin pajankar, BPB publications, 2019.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, IncDigital Image Processing Second Edition

e-resources:

1. https://www.tau.ac.il/~bilevich/Image_Processing/Lab_Manual_Image_Processing.pdf
2. http://imageprocessingplace.com/downloads_V3/dipum2e_downloads/dipum2e_sample_book_material_downloads/DIPUM2E_Chapter02_Pgs_13-50.pdf

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

1. **Explore** Python and its operations.
2. **Explore** and analyze image processing operations,
3. **Implement** Python functions in Image processing applications

4. **Apply** the Image enhancement using Python
5. **Implement** and **explore** video tracking using Python

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1			1	1
CO2	1	3	2	3	3	2
CO3				2	2	
CO4	2	2				2
CO5	1					1

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A5125	SOFT COMPUTING LAB	L	T	P
Credits: 2	(Professional Elective –III lab)	-	-	4

Prerequisites: Basics of Neural Networks

Software Requirements: JDK / Python

Course Objectives:
This objective of the course is to provide the students to study and analyze the fuzzy logic concepts, back propagation algorithms, with the analysis of CPN, GA and crisp logics. Further, explore the implementation of Hebb's rule, delta rule and classification.

List of Programs:
1. Write a program for implementing Linear Saturating Function.
2. Study and analysis of Art Model.
3. To perform Union, Intersection and Complement operations.
4. Write a program for Back Propagation Algorithm.
5. Write a program for Error Back Propagation Algorithm (EBPA) Learning.
6. Study and analysis of CPN.
7. Study and analysis of Genetic Algorithm Life Cycle.
8. Study and analysis of Fuzzy Vs Crisp Logic.
9. Write a program of perceptron Training Algorithm.
10. Write a program to implement Hebb's Rule.
11. Write a program to implement of Delta Rule.
12. Write a program for implementing any one classifier.

REFERENCE BOOKS

1. S.N. Shivnandam, "**Principle of soft computing**", Wiley Publication.
2. S. Rajshekaran and G.A.V. Pai, "Neural Network, Fuzzy logic And Genetic Algorithm", PHI.
3. Jack M. Zurada, "Introduction to Artificial Neural Network System" Jaico Publication.
4. Simon Haykins, "Neural Network- A Comprehensive Foundation".

E-resources:
https://lecturenotes.in/subject/124/soft-computing-sc
https://bharadwajakumar.files.wordpress.com/2019/06/soft-computing-ebook.pdf

Cours*e Outcomes:
At the end of the course, students will be able to:
1. **Understand** the in-depth concepts of various network models.
2. **Explore** and analyze evolutionary algorithms.
3. **Implement** applications using neural networks.
4. **Apply** the Hebb's rule and Delta rule.
5. **Implement** and **explore** classification algorithms.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	1	3	1	2
CO2	2					
CO3		3	1	2	2	1
CO4	2			1		
CO5	1				1	1

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech II Sem		
Code: A00A5	VALUE EDUCATION	L	T	P
Credits: Nil		2	-	-

Prerequisites: Nil

Course Objectives: The course deals about value of education and self- development, Imbibe good values in students and know about the importance of character.

Module I **[6Periods]**

Values and self-development -Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Module II **[7 Periods]**

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism. Love for nature, Discipline.

Module III **[6 Periods]**

A: Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking. Integrity and discipline, Punctuality,
B: Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour.

Module IV **[7 Periods]**

Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

Module V **[6 Periods]**

Character and Competence -Holy books vs Blind faith, Self-management and Good health Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.

REFERENCE BOOKS

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course Outcomes:

After completion of the course, students should be able to:

1. **Understand** self-development and moral values
2. **Explore** the importance of character and cultivation of values
3. **Apply** the personality development methods
4. **Analyze** the association and cooperation principles
5. **Elaborate** the principles of religions and good health science.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1					2	2
CO2					2	2
CO3					2	3
CO4					2	2
CO5					2	2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: A5126	PARALLEL AND DISTRIBUTED ALGORITHMS	L	T	P
Credits: 3	(Professional Elective-V)	3	-	-

Prerequisites: Computer Architecture

Course Objectives:

This course provides the students to learn and understand the basic of parallel and distributed algorithms, message passing, Partitioning, Divide and Conquer strategies. The use of Pipelined Computations Synchronization and Programming with shared memory. Apply these algorithms in Distributed shared memory systems and programming to solve problems in distributed, internet, and various other applications.

Module I: Parallel Computers [10 Periods]

Basic Techniques: Parallel Computers for increase Computation speed, Types of Parallel Computers.

Cluster Computing: Interconnected Computers as a computing platform, Cluster Configurations, Setting up a dedicated Beowulf style cluster.

Module II: Message-Passing Computing [9 Periods]

Message Passing: Basics, Evaluating Parallel programs, Debugging and evaluating parallel programs empirically.

Partitioning and Divide and Conquer strategies: Introduction to Partitioning Strategies, Partitioning and Divide and Conquer with Examples.

Module III: Pipelined Computations [10 Periods]

A: Pipelining

Pipeline Techniques, Computing platform for pipelined applications.

B: Pipeline Programs

Examples, Adding numbers, Sorting numbers, Prime number generation, Solving a system of linear equations.

Module IV: Synchronization and Programming with shared memory [9 Periods]

Synchronization: Synchronous Computations, load balancing, distributed termination examples.

Programming with Shared memory: Shared memory multiprocessor constructs for specifying parallel list sharing data parallel programming languages and constructs, open MP.

Module V: Distributed shared memory systems and Programming [10 Periods]

Distributed shared memory systems: Distributed shared memory, achieving constant memory distributed shared memory programming primitives.

Algorithms: Sorting algorithms, Compare and Exchange sorting algorithms, Sorting on specific networks, Other sorting algorithms, Numerical algorithms, Matrix multiplication, Solving a system of linear equations.

TEXT BOOKS

1. Barry Wilkinson, Michael Allen, "**Parallel Programming**", Pearson Education, 2nd Edition.
2. B. Chapman, G. Jost, and Ruud van der Pas, "**Using OpenMP**", MIT Press, 2008.

REFERENCE BOOKS

1. Peter S. Pacheco, "**An introduction to parallel programming**", Morgan Kaufmann, 2011.
2. Quinn, "**Parallel programming in C with MPI and OpenMP**", Tata McGraw Hill, 2003.

E-RESOURCES

1. https://goo.gl/JvM3fU
2. http://hermes.survey.ntua.gr/web/FreeBooks/Parallel_and_Distributed_Computing.pdf
3. https://www.dagstuhl.de/Reports/99/99291.pdf
4. http://reports-archive.adm.cs.cmu.edu/anon/ml2011/CMU-ML-12-111.pdf
5. http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY724XlqQGV2Msy4QUygyrM_d5Yo_yAP0nDWoQalPSovkEPXdPMMJMRXx5-x16kZcErg
6. http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVlXBW-YWREHSqJNXZ5-IVmA63e1fa_-0_8cKDQQ5jyqonM7KTHNTudziB4dzdyILzljXhs6BWw

Course Outcomes:

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

1. **Understand** the basic concepts related to parallel and distributed computing, use of parallel computers for enhance performance with cluster computing.
2. **Illustrate** message passing parallel algorithms of Portioning and Divide and Conquer strategies.
3. **Design** and develop applications with use of pipelined computations and pipeline programs
4. **Use of** Synchronization and Programming with shared memory in parallel programming languages like Open MP.
5. **Explore** various parallel algorithms and programming concepts for solving the problems to achieve constant distributed shared memory.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		1			
CO2	1		1			
CO3	1		1		1	
CO4	1		1		1	1
CO5	1		1	2	1	2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: A5127	WIRELESS SENSOR NETWORKS	L	T	P
Credits: 3	(Professional Elective-V)	3	-	-

Prerequisites: Computer Networks

Course objectives:

This course makes to understand and gain a broad coverage of challenges and latest concepts results related to the design and management of wireless sensor networks, design models, network architectures, node discovery and localization, analyze deployment strategies, node coverage, routing protocols , the systems with power management, protocols with medium access arbitration, fault-tolerance, network security, IoT and applications

Module I: Applications and Design Model [10 Periods]

Applications: Introduction: Examples of Sensor nodes, Sample Sensor Networks Applications.

Design Issues: Design Challenges and Models, Contemporary network architectures, Operational and computational models Performance metrics, Software and hardware setups.

Module II: Network Bootstrapping [10 Periods]

Deployment: Sensor deployment mechanisms, Issues of coverage, Node discovery protocols

Localization: Localization and control: Localization schemes, Network clustering.

Module III: Data Dissemination and Routing [9 Periods]

A: Data-centric and Content-based Networking

Query models, In-network data aggregation.

B: Routing Protocols Robust route setup, coping with energy constraints.

Module IV: Physical and Link layers [9 Periods]

Energy and Power: Radio energy consumption model, Power management.

Protocols: MAC protocols: Medium access arbitration, Optimization mechanisms.

Module V: Dependability Issues and IoT [10 Periods]

Security Issues: Security and synchronization-Security challenges, Threat and attack models, Quality of service provisioning, fault tolerance.

IoT: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols

Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The6LoWPAN and Security aspects in IoT.

TEXT BOOKS

1. Holger Karl, Andreeas Willig "**Protocols and Architectures for Wireless Sensor Networks**", Wiley, ISBN: 0-470-09510-5, June 2005.
2. Cauligi S. Raghavendra, Krishna Sivalingam, and Taieb M. Znati "**Wireless Sensor Networks**", Springer, 2005

3. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers

REFERENCE BOOKS

1. Waltenegus Dargie, Christian Poellabauer , "Fundamentals of Wireless Sensor Networks: Theory and Practice", John Wiley & Sons 2010.
2. Abbas Jamalipour Jun Zheng," Wireless **Sensor Networks: A Networking Perspective",** Wiley 1st Edition,2014.

E-RESOURCES

1. http://profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf
2. https://ia800207.us.archive.org/5/items/springer_10.1007-b117506/10.1007-b117506.pdf
3. http://www.mforum.ru/arc/iot-book_compressed_MForum.pdf
4. https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf
5. ceng.usc.edu/~bkrishna/teaching/SensorNetBib.html
6. nesl.ee.ucla.edu/
7. www.intel.com/content/www/us/en/research/intel-research.html
8. www.libelium.com/
9. https://www.youtube.com/watch?v=e7jmXVxqS8s&t=1414s
10. https://www.youtube.com/watch?v=ipnrZUMHfpM

Course Outcomes:

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

1. **Understand** the wireless sensor networks for various applications and design models.
2. **Explore** coverage of Networking, planning, nodedeployment and localization control.
3. **Devise** appropriate data dissemination protocols and model links cost.
4. **Determine** suitable medium access protocols and radio energy consumption models.
5. **Implement** quality of service, fault-tolerance, security and other dependability requirements in wireless sensor networks and IoT.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1					
CO2	1	1	1			
CO3	1	1	1		1	1
CO4	1		1		1	
CO5	1	1	1	2	2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: A5128	INFORMATION RETRIEVAL TECHNIQUES	L	T	P
Credits: 3	(Professional Elective-V)	3	-	-

Prerequisites: Data Base Management Systems

Course Objectives:

This course enables the students to gain knowledge in different Information Retrieval (IR), fundamental concepts, Retrieval and Information Search techniques in various application areas, apply IR and Classification methods, Machine Learning techniques, SVM, Clustering and Classification methods. These principles are used to locate relevant information large collections of data, to analyze performance of retrieval systems when dealing with unmanaged data sources, and implement retrieval systems for web search tasks.

Module I: Information System Capabilities & Retrieval Techniques [9 Periods]

Retrieval Techniques-I: Boolean Retrieval, Term Vocabulary, Postings Lists, Indexing Techniques

Retrieval Techniques-II: Dictionaries and tolerant retrieval, Index Construction and Compression.

Module II: Information Search Techniques [10 Periods]

Score Computation: Scoring, Term Weighting and Vector Space Model, Computing scores in Complete search system, Information System Evolution.

Evaluation: Evaluation in information retrieval, Relevance feedback and query expansion.

Module III: Retrieval and classification techniques [10 Periods]

A: Retrieval Techniques

XML retrieval, Probabilistic information retrieval, Language models for information retrieval.

B: Classification Techniques

Text classification, Vector space classification.

Module IV: Machine Learning Retrievals [9 Periods]

Support Vector Machines and machine learning on documents: Support Vector Machines, Extensions to SVM model-Issues in classification of Text documents-Machine Learning methods in Adhoc Information Retrieval, deep learning.

Clustering Techniques: Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.

Module V: Web Search Linking [10 Periods]

Web Search Basics: Web characteristics- Advertising as the Economic Model- Search user experience-Index size and estimation-Near-duplicates and Shingling.

Web crawling and indexes: Overview, Crawling, Distributing Indexes, Connectivity Servers, Link analysis, Web as a graph, Page Rank, Hubs and authorities.

TEXT BOOKS

1. Kowalski, Gerald J. Maybury, Mark T, "**Information Storage and Retrieval systems Theory and Implementation**", Second Edition, 2000.
2. Christopher D. Manning and Prabhakar, Raghavan and Hinrich Schütze, "**Introduction to Information Retrieva**l", Cambridge University Press, 2008.
3. Ricardo Baeza Yate, "**Modern Information Retrieval**", Pearson Education, 2007.

REFERENCE BOOKS

1. David A Grossman and Ophir Frider, "**Information Retrieval: Algorithms and Heuristics**", 2nd Edition, Springer.
2. Robert Korfhage, "**Information Storage & Retrieval**", John Wiley & Sons.

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1. www.unistmo.edu.mx/~daniel.garcia/.../Librorecuperacioninformacion.pdf
2. https://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf
3. www.sciencedirect.com/science/article/pii/S1877050916000739
4. http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY71DYMut02wjKcXilXOeS46dDWYndV38tDO50i_mnMwZjXcF6XgqkVglL9ordVB7VBQ

Course Outcomes:

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

1. **Understand the** Information retrieval techniques.
2. **Explore and Analyze** Information search techniques like Vector Space Model, and Probabilistic Model, system evaluation methods.
3. **Identify and Apply** Classification Methods and classification techniques used various applications
4. **Describe and apply** Machine learning retrieval methods like SVM and clustering techniques.
5. **Illustrate** web search technique in Information Retrieval system used in web search, crawling and indexes.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	1			
CO2	2	1	1	1	2	2
CO3	2	1	1	1	2	2
CO4	3	1	1	1	2	3
CO5	3	1	1	1	2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code:A5129	BUSINESS ANALYTICS (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives:
This course provides the students to learn and understand the role of business analytics within an organization, Analyze data using statistical and data mining techniques Also to gain an understanding of how managers use business analytics to formulate and solve, business problems.

Module I: **Business analytics and Statistical Tools [9 Periods]**
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business, Analytics Process and organization, competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

Module II: Trendiness and Regression Analysis [9 Periods]
Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Module III: Organization Structures and Analytics [10 Periods]
A: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.
B: Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

Module IV: **Forecasting Techniques [10 Periods]**
Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.
Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Module V: Decision Analysis [10 Periods]
Formulating Decision Problems, Decision Strategies with the without outcome Probabilities, Decision Trees, Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey,"**Business analytics Principles, Concepts, and Applications**"**,** Pearson FT Press.
2. James Evans, "Business **Analytics**"**,** Persons Education.

REFERENCE BOOKS

1. James Cadle, Donald Yeates, James Cadle, Malcolm Eva, Keith Hindle, Debra Paul, Craig Rollason, Paul Turner, Donald Yeates Debra Paul, "**Business Analysis**"**,** BCS, The Chartered Institute for IT; Revised edition, 2014.
2. Erik Larson and, Clifford Gray**, "Project Management: The Managerial Process**", McGraw Hill Education; Sixth Edition, 2017.

Course Outcomes:

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

1. **Understand** the knowledge and need for data analytics.
2. **Demonstrate** the ability of think critically in making decisions based on data and deep analytics.
3. **Explore** the technical skills in predicative and prescriptive modeling to support business decision-making.
4. **Acquire** the ability to translate data into clear, actionable insights.
5. **Analyze** the problems and use various decision strategies.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
Cos	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	1			
CO2	2			1	2	2
CO3	2	1	1			2
CO4	1	1	1	1	1	3
CO5	1	1	1		2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. III Semester		
Code: A0B22	ADVANCED OPTIMIZATION TECHNIQUES (Open Elective)	L	T	P
Credits: 3		3	-	-

Pre-requisite: Nil

Course Objectives:
To understand extremely important topics under the broad umbrella of optimization, this is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

Module I: Linear Programming **[10 Periods]**
Introduction and formulation of models; convexity; graphical &simplex method; Big-M Method, Two phase method; degeneracy, non-existent and unbounded solutions; duality in L.P. Dual simplex method, sensitivity analysis for cost and requirement vector; Revised simplex method; Transportation and Assignment problems.

Module II: Integer Linear Programming **[10 Periods]**
Gomory's cutting plane method; branch and bound algorithm; traveling salesman problem; knapsack problem; linear C-1 problem.

Module III: Dynamic Programming, CPM & PERT **[9 Periods]**
A: Belman's Principle of optimality; recursive relations; Solution of L.P. Problem; simple examples.
B: CPM & PERT

Module IV: Non-Linear Programming **[9 Periods]**
Classical optimization methods; equality and inequality constraints; Lagrange multipliers; Kuhn-tucker conditions; quadratic forms; quadratic programming and Beale's methods.

Module V: Search Methods **[10 Period]**
One dimensional optimization; Fibonacci search; multi dimensional search methods; uni-variate search; gradient methods; steepest descent/ascent methods; conjugate gradient method; Fletcher- reeves method; penalty function approach.

TEXT BOOKS
1. J.K. Sharma, "**Operations Resarach Theory & Applications**", 4th Edition, Mc.Millan Publications
2. S.S.Rao, "**Engineering Optimization theory and Practice**", 4th Edition, J Wiley & Sons, Newjersey

REFERENCE BOOKS
1. K.V.Mital , **"Optimization methods in operations research and system analysis**", 3rd Edition, Newage International (P) Ltd., publishers.
2. H.A Taha "**Operations Research: An Introduction**" Prentice Hall Edition, 2016

Reprint.
3. Raul Poler et.al "**Operations Research Problems Statement and Solutions**" Springer, 2014.

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1. http://www.mhhe.com/engcs/industrial/hillier/etext/PDF/chap03.pdf (LPP)
2. http://ocw.nctu.edu.tw/upload/classbfs121001503719748.pdf (Transportation Problems)
3. http://shodhganga.inflibnet.ac.in/bitstream/10603/19544/12/7_chapter%201.pdf (Replacement Models)
4. https://www.math.ucla.edu/~tom/GameTheory/mat.pdf (Game Theory)
5. http://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf (Inventory Models)

Course Outcomes

After completion of the course, students will be able to:

1. Find feasible solution to LPP by various methods.
2. Minimize the cost and time by using Travelling salesmen Problem.
3. Understand various methods Dynamic programming.
4. Understand the various concepts on Non-Linear programming.
5. Understand the various concepts of Search methods.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1			3		
CO2		1		2		
CO3	2			3		
CO4	3		1			
CO5			1			

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech III Sem		
Code: A5130	BLOCK CHAIN TECHNOLOGY AND ITS APPLICATIONS (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives:
The blockchain technology course allows the students to explore the driving force behind the cryptocurrency Bitcoin. Along with the Decentralization, Cryptography, Bitcoins with its alternative coins, Smart contracts and outside of currencies.

Module I: Introduction to Blockchain [9 Periods]
Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Module II: Decentralization and Cryptography [10 Periods]
Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.
Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys

Module III: Bitcoin and Alternative Coins [10 Periods]
A: Bitcoin
Transactions, Blockchain, Bitcoin payments
B: Alternative Coins
Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

MODULE IV: Smart Contracts [10 Periods]
Definition, Ricardian contracts: Smart contract templates, Deploying smart contracts on a blockchain.

MODULE V: Blockchain-Outside of Currencies [9 Periods]
Internet of Things, Government, Health, Finance, Media

TEXT BOOKS
1. Imran Bashir, "**Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained**", Packt Publishing Ltd., Second Edition, ISBN 978-1-78712-544-5, 2017.

REFERENCE BOOKS
1. Daniel Drescher, "**Blockchain Basics: A Non-Technical Introduction in 25 Steps**", Apress, First Edition, 2017.
2. Andreas M. Antonopoulos, "**Mastering Bitcoin: Unlocking Digital Cryptocurrencies**", O'Reilly Media, First Edition, 2014.

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1. http://nptel.ac.in/courses/106106168/27

2. https://www.edx.org/learn/blockchain-cryptography
3. https://www.class-central.com/tag/blockchain
4. https://cognitiveclass.ai/courses/blockchain-course/
5. https://www.skillshare.com/browse/blockchain

Course Outcomes:

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

1. **Understand** the types, benefits and limitation of blockchain.
2. **Explore** the block chain decentralization and cryptography concepts.
3. **Enumerate** the Bitcoin features and its alternative options.
4. **Describe** and deploy the smart contracts
5. **Summarize** the blockchain features outside of currencies.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		1			
CO2	1	1	1	1	2	1
CO3	1	1	1	1	2	2
CO4	2	1	1	1	2	3
CO5	2		1	1	2	2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)			M.Tech III Sem
Code: A5131	SEMINAR	L	T	P
Credits: 2		-	-	4

Course Objectives: To promote deeper understanding the basic concepts, physical mechanism behind the processes, participate in scientific analysis and comprehensive of scientific writing of verbal presentation. This course is to introduce post graduate student to ideas, methods and techniques that can improve the content and presentation of scientific seminars.

Course Outcomes:

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

1. Write technical documents to the standards
2. Give oral presentation on technical and general topics
3. Express ideas clearly with examples
4. Identify the research opportunities related to their area.
5. Communicate effectively.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1					1
CO2					2	
CO3			2			
CO4	2					1
CO5			1		2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)			M.Tech III Sem
Code: A5132	PROJECT / DISSERTATION PHASE - I	L	T	P
Credits: 8		-	-	16

Course Objectives: To utilize basic knowledge and advance techniques to make product/process using experimentation and/or simulation and expose to others as document and oral presentation.

Course Outcomes:

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

1. Summarize the work completed in the form of technical documents
2. Specify the techniques implemented or to be implemented
3. Explain the results obtained in Project Phase I
4. Summarize the ultimate finding of the project
5. Detailed presentation of work carried out.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	3	3	
CO2					2	1
CO3		2	3	3		
CO4	2					1
CO5			2		2	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)			M.Tech IV Sem
Code: A5133	PROJECT / DISSERTATION PHASE - II	L	T	P
Credits: 16		-	-	32

Course Objectives: To utilize science and engineering to make product/process using innovative techniques, predict the results and prepare technical documents.

Course Outcomes:

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

1. Identify project goals, constraints, deliverables, performance criteria, control needs and requirements.
2. Implement concepts, tools and techniques to do quality projects.
3. Adapt projects in response to issues that arise internally and externally.
4. Interact with team and stakeholders in a professional manner, respecting differences, to ensure a collaborative project environment.
5. Utilize technology tools for communication, collaboration, information management, and decision support.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	3	3	
CO2					2	1
CO3		2	3	3		
CO4	2					1
CO5			2		2	