JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING ,PULIVENDULA(AUTONOMUS)
PULIVENDULA -516390(A.P)India.
Engineering &Technology PG(M.Tech) Courses Proposed Course Structure

Semester-I							
S.No	Course Code	Course Name	Category	Hours per Week			Credits
				L	T	P	
1		**Core Course-I** (Advanced Data structures and algorithms)	PC	3	0	0	3
2		**Core Course-II** (Machine Learning)	PC	3	0	0	3
3		**Program Elective Course-I** 1.Distributeds operating systems 2. IOT 3. Foundations of block chain technology	PE	3	0	0	3
4		**Program Elective Course-II** 1. Data Science 2.Wireless Adhoc & sensor networks 3. Soft computing	PE	3	0	0	3
5		ADS Lab-I	PC	0	0	4	2
6		ML Lab-II	PC	0	0	4	2
7		Research Methodology and IPR	MC	2	0	0	2
8		**Audit Course-I(Pedagogy Studies)**	AC	2	0	0	0
Total							18

Semester-II							
S.No	**Course Code**	**Course Name**	**Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	
1		**Core Course-III** Artificial intelligence	PC	3	0	0	3
2		**Core Course-IV** Cyber security	PC	3	0	0	3
3		**Program Elective Course-III** 1. NLP 2.Video analytics 3.Deep learning	PE	3	0	0	3
4		**Program Elective Course-IV** 1.NOSQL Databases 2.Agile development 3.Robotic process automation	PE	3	0	0	3
5		Core Lab-III(AI lab)	PC	0	0	4	2
6		Core Lab-IV(Cs Lab)	PC	0	0	4	2
7		Seminar	MC	0	0	4	2
8		Audit Course-II(Disaster Management)	AC	2	0	0	0
Total							18

Semester-III							
S.No	Course Code	Course Name	Category	Hours per Week			Credits
				L	T	P	
1		Program Elective Course-V 1. Big data Technologies 2.Web Design and Development	PE	3	0	0	3
2		Open Elective-I 1. MAD 2.ADS	OE	3	0	0	3
3		Co-Curricular Activities		0	0	4	2
4		Dissertation Phase –I	PR	0	0	20	10
Total							18

Semester-IV							
S.No	Course Code	Course Name	Category	Hours per Week			Credits
				L	T	P	
1		Dissertation Phase –II	PR	0	0	32	16
Total							16

Audit Course 1 &2:

1. Disaster Management
2. Sanskrit for Technical Knowledge
3. Value Education
4. Constitution of India
5. Pedagogy Studies
6. Stress Management by Yoga
7. Personality Development through Life Enlightenment Skills

Course Code			**L**	**T**	**P**	**C**
Semester	**I**		**3**	**0**	**0**	**3**
Course Objectives:						

Course Outcomes:		
UNIT-I		**Lecture Hrs:**
UNIT-II		**Lecture Hrs:**
UNIT-III		**Lecture Hrs:**
UNIT-IV		**Lecture Hrs:**
UNIT-V		**Lecture Hrs:**
Text Books:		
Reference Books:		
Online Learning Resources:		

ADVANCED DATA STRUCTURES & ALGORITHMS

Course Code			L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

1. Understand and apply linear data structures-List, Stack and Queue. Understand the graph algorithms.
2. Learn different algorithms analysis techniques.
3. Apply data structures and algorithms in real time applications
4. Able to analyze the efficiency of algorithm.

Course Outcomes:

1. Ability to analyze algorithms and algorithm correctness.
2. Ability to summarize searching and sorting techniques
3. Ability to describe stack, queue and linked list operation.
4. Ability to have knowledge of tree and graphs concepts.

UNIT-I		Lecture Hrs: 9

LINEAR DATA STRUCTURES : Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of stack – Evaluating Arithmetic Expressions - Other Applications - Applications of Queue - Linked Lists - Singly Linked List - Circularly Linked List - Doubly Linked lists – Applications of linked list .

UNIT-II		Lecture Hrs: 12

NON-LINEAR TREE STRUCTURES : Binary Tree – expression trees – Binary tree traversals – applications of trees – Huffman Algorithm - Binary search tree - Balanced Trees - AVL Tree - B-Tree - Splay Trees – Heap, Heap operations- -Binomial Heaps - Fibonacci Heaps- Hashing.

UNIT-III		Lecture Hrs: 9

GRAPHS : Representation of graph - Graph Traversals - Depth-first and breadth-first traversal - Applications of graphs - Topological sort – shortest-path algorithms - Dijkstra‟s algorithm – Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms.

UNIT-IV		Lecture Hrs: 12

ALGORITHM DESIGN AND ANALYSIS : Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack Problem – Dynamic Programming – Optimal Binary Search Tree - Warshall‟s Algorithm for Finding Transitive Closure.

UNIT-V		Lecture Hrs: 12

ADVANCED ALGORITHM DESIGN AND ANALYSIS : Backtracking – N-Queen's Problem - Branch and Bound – Assignment Problem - P & NP problems – NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem- Amortized Analysis.

Text Books:

1. Anany Levitin “Introduction to the Design and Analysis of Algorithms” Pearson Education, 2015

2. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2007 3. E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms/C++", Second Edition,
Reference Books:
1. Gilles Brassard, "Fundamentals of Algorithms", Pearson Education 2015 **2.** Harsh Bhasin, "Algorithms Design and Analysis", Oxford University Press 2015 **3.** John R.Hubbard, "Data Structures with Java", Pearson Education, 2015 **4.** M. A. Weiss, "Data Structures and Algorithm Analysis in Java", Pearson Education Asia, 2013
Online Learning Resources:

Machine Learning

Course Code			L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

1. Understand and apply Supervised, Unsupervised Learning and Reinforcement learning algorithms.
2. Able to analyze the efficiency of algorithm.
3. To know how to design various applications.

Course Outcomes:

1. Design Multi-Layer neural network to solve Supervised Learning problem
2. Classify non-linear data like face recognition, disease prediction
3. Apply Genetic Algorithm for optimization problems
4. Design applications like games and agent-based controllers.

UNIT-I | **Lecture Hrs:10**

INTRODUCTION

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT-II | **Lecture Hrs:11**

NEURAL NETWORKS AND GENETIC ALGORITHMS

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evalution and Learning.

UNIT-III | **Lecture Hrs:10**

BAYESIAN AND COMPUTATIONAL LEARNING

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT-IV | **Lecture Hrs:12**

INSTANCE BASED LEARNING: K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

Unsupervised Learning : Grouping unlabeled items using k-means clustering, Association analysis with the Apriori algorithm,

UNIT-V | **Lecture Hrs:11**

ADVANCED LEARNING

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Text Books:

1. Tom Mitchel, Machine Learning, McGraw Hill. Harrington, Peter. Machine learning in action. Manning Publications Co., 2012.

Reference Books:
1. E them ALPAYDIN, Introduction to Machine Learning, The MIT Press, 2004. Bishop, C. M., 2.Pattern recognition and machine learning, New York: springer, 2007.

Program Elective Course-I

Distributed Operating Systems

Course Code			**L**	**T**	**P**	**C**
Semester	**I**		**3**	**0**	**0**	**3**

Course Objectives:

1. Emphasis would be to provide the knowledge of communication, synchronization, resource management and security aspect in distributed operating system.
2. To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.

Course Outcomes:

1. Gain knowledge of distributed operating system architecture (Knowledge)
2. Illustrate principles and importance of distributed operating system (Understand)
3. Implement distributed client server applications using remote method invocation (Apply)
4. Distinguish between centralized systems and distributed systems (Analyze)
5. Create stateful and state-less applications (Create)

UNIT-I		**Lecture Hrs:09**

Introduction: Introduction of Distributed Operating System (DOS), Functions of DOS, Basic concepts, goals & challenges of distributed systems, architectures of DOS. Revisit the inter process communication.

UNIT-II		**Lecture Hrs:11**

Communication in DOS :Study of case studies for distributed environment, Issues in communication, message-oriented communication, remote procedure call, remote method invocation, stream-oriented 09 Syllabus for Bachelor of Technology Computer Engineering communication, communication between processes, unstructured Vs structured communication, blocking Vs non-blocking communication.

UNIT-III		**Lecture Hrs:12**

Synchronization: Introduction of synchronization, Clocks, events, Time in distributed systems 1. Cristian's algorithm 2.The Berkeley Algorithm, 3. Network Time Protocol (NTP) 4.Logical time and logical clocks 5.Lamport logical clock 6.vector clock

UNIT-IV		**Lecture Hrs:11**

Transaction and Concurrency Control: Basic concurrency control mechanism in DOS mutual exclusion in distributed environment, Transactions and Concurrency Control in distributed environment, distributed deadlocks in distributed environment.

UNIT-V		**Lecture Hrs:11**

Distributed and Shared Memory Management(DSM): Basic fundamentals of shared memory in DOS, Architecture and algorithm of distributed shared memory, advantages & challenges of DSM, Memory coherence, consistency model, consistency with uniprocessor system, consistency with multiprocessing environment.

Text Books:

1. . Andrew S. Tanenbaum & Maarten van Steen, Distributed Systems: Principles and Paradigms, Prentice-Hall(2002) ISBN0-13-088893-1
2. D. L. Galli, Distributed Operating Systems, Prentice-Hall(2000) ISBN0-13-079843-6

Reference Books:

1. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez, Prentice Hall nternational
2. Distributed Operating Systems and Algorithms, Randy Chow, T. Johnson, Addison Wesley
3. Distributed Systems Concepts and Design, G. Coulouris, J. Dollimore, Addison Wesley

Program Elective Course-I

Foundations of Block Chain Technology

Course Code			**L**	**T**	**P**	**C**
Semester	**I**		**3**	**0**	**0**	**3**

Course Objectives:

Course Outcomes:

- Understand how Blockchain work, including private and public platforms
- Understand the technical underpinnings of Blockchain technology at sufficient depth to perform analysis.
- Apply various Blockchain concepts to analyze examples, proposals, case studies, and preliminary Blockchain system design discussions.
- Know and be able to apply the concepts, tools, and frameworks for building block chain decentralized applications. CO5 Design secure smart contract applications on Blockchain.

UNIT-I		**Lecture Hrs:10**

Introduction:
Anonymity, Decentralization, Issue with Trusted third party. Scalability Issues in Distributed systems.
Challenges in Current System: Single point of failure, DDOS, Trusted Obligations.

UNIT-II		**Lecture Hrs:09**

Concepts of Blockchain Systems: Cryptographic Primitives, Cryptographic Hash Functions, Digital Signatures,Aggregate Signature
Crypto and Security conpects: Merkel tree, DES, AES, Zero knowledge proofs.

UNIT-III		**Lecture Hrs:11**

Consensus Algorithms: Crash Faults, Byzantine Faults
Tolerance Algorithms: Consensus Protocols- The consensus problem- Byzantine Generals problem, Asynchronous Byzantine Agreement, PBFT, HOTSTUFF, Consensus mechanisms used in Bitcoin, Ethereum, Stellar.

UNIT-IV		**Lecture Hrs:12**

Applications: Crypto currency, BusinessApplications, Secure file storages, NFT, Tokens
Platforms: Permission less- Bitcoin: Transaction life cycle, Security of Transactions in Bitcoin,Privacy in Bitcoin, Attacks on Bitcoin, Double-spend attacks, Selfish mining
Ethereum:Smart contracts -App development in Ethereum network
Mining- Merkle Tree- Hardness of mining - Transaction verifiability
Permissioned:Hyperledger Fabric: Endorsement, Ordering, Commiting, Corda:Notary, Smart Contracts, UTXO.

UNIT-V		**Lecture Hrs:12**

Smart Contracts -Attacks, Applications & Use Cases
Blockchain (IoT):dvantages of integrating Blockchain to IoT, Trust Building, Cost Reduction, Accelerate Data Exchanges, Scaled Security for IoT.

Text Books:

1. Arvind Narayanan, “Bitcoin and Cryptocurrency Technologies- A Comprehensive

Introduction", Princeton University Press, 2016. 2. William Magnuson, "Blockchain Democracy-Technology, Law and the Rule of the Crowd", Cambridge University Press, 2020.
Reference Books:
1. Pethuru Raj, Kavita Saini, Chellammal Surianarayanan, "Blockchain Technology and Applications", CRC Press, 2021. 2. Chandramouli Subramanian, "Blockchain Technology", Universities Press, 2020. 3. Relevant Research Paper and While Papers.
Online Learning Resources:

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Program Elective Course-I

Advanced Internet of Things

Course Code			**L**	**T**	**P**	**C**
Semester	**I**		**3**	**0**	**0**	**3**

Course Objectives:

1. To introduce the terminology, technology and its applications.
2. To introduce the concept of M2M (machine to machine) with necessary protocols.
3. To introduce the Python Scripting Language which is used in many IoT devices.
4. To introduce the Raspberry PI platform, that is widely used in IoT applications.
5. To introduce the implementation of web based services on IoT devices.

Course Outcomes:

1. Interpret the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Compare and Contrast the use of Devices, Gateways and Data Management in IoT.
4. Implement state of the art architecture in IoT.
5. Illustrate the application of IoT in Industrial Automation and identify Real World Design.

UNIT-I		**Lecture Hrs:12**

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

UNIT-II		**Lecture Hrs:10**

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER .

UNIT-III		**Lecture Hrs:12**

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

UNIT-IV		**Lecture Hrs:10**

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT-V		**Lecture Hrs:10**

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

Text Books:

1.Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities

Press, 2015, ISBN: 9788173719547
Reference Books:
1.Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014

Program Elective Course-II

Data Science

Course Code			**L**	**T**	**P**	**C**
Semester	**I**		**3**	**0**	**0**	**3**

Course Objectives:

1. Introduce students the concept and challenge of big data (3 V's: volume, velocity, and variety).
2. Teach students in applying skills and tools to manage and analyze the big data.
3. The students should acquire knowledge on how to design BI solutions for different BI targets and users.

Course Outcomes:

1. Organizational and individual decision-making.
2. Key concepts and current practices of business intelligence.
3. The individual, organizational and societal impacts of BI systems.
4. Analytical techniques used in business intelligence systems.
5. Integration of business intelligence into decision-making processes.

UNIT-I		**Lecture Hrs:10**

Introduction: Overview of Random variables and distributions, data science model building life cycle, data acquisition. Statistical learning: Assessing model accuracy, Bias-Variance Trade-Off, Descriptive Statistics, Dependent and Independent events.

UNIT-II		**Lecture Hrs:11**

Linear Regression: Simple and multiple linear regressions, Comparison of Linear regression with K-nearest neighbors. Simple Hypothesis Testing, Student's t-test, paired t and U test, correlation and covariance, tests for association; association rules and correlations; PCA and SVD.

UNIT-III		**Lecture Hrs:12**

Classification: Linear and Logistic Regression, Bayesian Learning, LDA, QDA, K-Nearest Neigbhour, and comparison of classification methods.

UNIT-IV		**Lecture Hrs:11**

Data Visualization and Graphical Analysis: Visualized exploratory data Analysis, Histograms and frequency polygons, Box-plots, Quartiles, Scatter Plots, Heat Maps. Matrix visualization, Scientific Design Choices in Data Visualization, Higher-dimensional Displays and Special Structures, Visual data mining.

UNIT-V		**Lecture Hrs:10**

Data Wrangling: Data Acquisition, Data Formats, Imputation, split-apply-combine paradigm. Descriptive Analytics: Data Warehousing and OLAP, Data Summarization, Data deduplication, Data Visualization using CUBEs. Case-Study discussion

Text Books:

1. Gareth James Daniela Witten Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, February 11, 2013,

2. Mark Gardener, Beginning R The statistical Programming Language, Wiley,2015.
Reference Books: 1. Han , Kamber, and J Pei, Data Mining Concepts and Techniques, 3rd edition, Morgan Kaufman, 2012. (Chapter 2 and Chapter4) 2. Chun-houh Chen, Wolfgang Hardle, Antony Unwin, Handbook of Data Visualization, Springer, 2008
Online Learning Resources:

Program Elective Course-II

WIRELESS ADHOC AND SENSOR NETWORKS

Course Code			L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

1. To learn about the issues and challenges in the design of wireless ad hoc networks.
2. To understand the working of MAC and Routing Protocols for ad hoc and sensor networks.
3. To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
4. To understand various security issues in ad hoc and sensor networks and the corresponding solutions.

Course Outcomes:

1. Identify different issues in wireless ad hoc and sensor networks.
2. To analyze protocols developed for ad hoc and sensor networks.
3. To identify and understand security issues in ad hoc and sensor networks.

UNIT-I		Lecture Hrs:12

MAC & ROUTING IN AD HOC NETWORKS

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

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UNIT-II		Lecture Hrs:10

TRANSPORT & QOS IN AD HOC NETWORKS

TCP‟s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

UNIT-III		Lecture Hrs:11

MAC & ROUTING IN WIRELESS SENSOR NETWORKS

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention- Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols.

UNIT-IV		Lecture Hrs:11

TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor

networks – Examples

UNIT-V		Lecture Hrs:10

SECURITY IN AD HOC AND SENSOR NETWORKS

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

Text Books:

1. C.Siva Ram Murthy and B.S.Manoj, ―Ad Hoc Wireless Networks – Architectures and 2 Protocols‖, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, ―Protocols and Architectures for Wireless Sensor Networks‖, John Wiley & Sons, Inc., 2005.

Reference Books:

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, ―Ad Hoc Mobile Wireless Networks‖, Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, ―Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)‖, World Scientific Publishing, 2011.
3. Waltenegus Dargie, Christian Poellabauer, ―Fundamentals of Wireless Sensor Networks Theory and Practice‖, John Wiley and Sons, 2010
4. Xiang-Yang Li , "Wireless Ad Hoc and Sensor Networks: Theory and Applications‖, 1227 th edition, Cambridge university Press,2008.

Online Learning Resources:

Program Elective Course-II

Soft Computing

Course Code			L	T	P	C
Semester	I		3	0	0	3

Course Objectives:

The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities. Soft Computing is a consortia of methodologies which collectively provide a body of concepts and techniques for designing intelligent systems.

Course Outcomes:

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UNIT-I		Lecture Hrs:11

Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

UNIT-II		Lecture Hrs:10

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons , Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

UNIT-III		Lecture Hrs:11

Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

UNIT-IV		Lecture Hrs:12

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

UNIT-V		Lecture Hrs:10

Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

Text Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

2. Genetic Algorithms: Search and Optimization, E. Goldberg
Reference Books:
1. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI. 2. Build_Neural_Network_With_MS_Excel_sample by Joe choong.
Online Learning Resources:

ADVANCED DATA STRUCTURES & ALGORITHMSLAB

Course Code			L	T	P	C
Semester	I		0	0	4	2

1. Write a Java programs that use both recursive and non-recursive functions for implementing the following searching methods:
   a) Linear search b) Binary search
2. Write Java programs to implement the following using arrays and linked lists and List ADT
3. Write Java programs to implement the following using an array.
   a) Stack ADT b) Queue ADT
4. Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stacks ADT).
5. Write Java programs to implement the following using a singly linked list. a) Stack ADT b) Queue ADT
6. Write Java programs to implement the dequeue(double ended queue) ADT using a) Array b) Singly linked list c) Doubly linked list.
7. Write a Java program to implement priority queue ADT.
8. Write a Java program to perform the following operations:
9. Construct a binary search tree of elements.
10. Search for a key element in the above binary search tree.
11. Delete an element from the above binary search tree.
12. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
13. Write a Java program to implement Dijkstra's algorithm for Single source shortest path problem.
14. Write Java programs for the implementation of BFS and DFS for a given graph.
15. Write Java programs for implementing the following sorting methods:
    a)Bubble sort b) Insertion sort c) Quick sort
    d) Merge sort e) Heap sort f) Radix sort g) Binary tree sort

Machine Learning Lab

Course Code			L	T	P	C
Semester	I		0	0	4	2

1. Implement and demonstratethe FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

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

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

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

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

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

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

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

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

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

Research Methodology and IPR

Course Code			L	T	P	C
Semester	I		2	0	0	2

Course Objectives:

1. To understand the research problem.
2. To know the literature studies, plagiarism and ethics
3. To get the knowledge about technical report writing
4. To analyze the nature of intellectual property rights and new developments
5. To know the patent rights

Course Outcomes:

1. Understand research problem formulation. 1
2. Analyze research related information
3. Follow research ethics
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

UNIT-I		Lecture Hrs:07

Meaning of Research - objectives of Research - Types of Research - Research Approaches - Guidelines for Selecting and Defining a Research problem - research Design - Concepts related to Research Design.

UNIT-II		Lecture Hrs:08

Sampling Design - steps in Sampling Design -Characteristics of a Good Sample Design - Random Sampling Design.

Data collection Methods - Primary Data - Secondary data.

Correlation and Regression Analysis - Method of Least Squares - Regression vs Correlation - Correlation vs Determination - Types of correlations and their Applications.

UNIT-III		Lecture Hrs:08

Statistical Inference: Tests of Hypothesis - Parametric vs Non-parametric Tests - Hypothesis Testing Procedure - Sampling Theory - Sampling Distribution - Chi-square Test - Analysis of Variance and Co-variance - Multi-Variate Analysis.

UNIT-IV		Lecture Hrs:07

Introduction To intellectual Property:Types of Intellectual Property

Law of Copy Rights: Fundamental Of Copy Right Law, Rights of reproductions, Rights to perform the work publicly. Copy Right Registration.

Law of Patents: Foundation of Patent Law, Patent searching Law, Owner Ship Rights and Transfer.

UNIT-V		Lecture Hrs:06

Trade Marks: Purpose And Function of Trade Marks, Acquisition of Trade Mark Rights,

Protectable Matter, Selecting And Evaluating Trade Mark.

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets.

Text Books:

1. Research Methodology:Methods And Techniques - C.R.Kothari, 2nd Edition,New Age Intemational Publishers.
2. Intellectual Property Right, Deborah- E' Bouchoux, Cengage Learing.

Reference Books:

1. Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As pdf On Internet).
2. Intellectual Property nilnr-uteashmy T re Knowledge Economy, Prabuddha Ganguli' Tate Mc Graw Hill Publishing Company Ltd',

Online Learning Resources:

Audit Course-I

Pedagogy Studies

Course Code			L	T	P	C
Semester	I		2	0	0	0

Course Objectives:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.
5. Review existing evidence on the review topic to inform programme design and policy making
6. Identify critical evidence gaps to guide the development.

Course Outcomes:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I		**Lecture Hrs: 8**

Introduction and Methodology:Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education.Conceptual framework, Research questions. Overview of methodology and Searching.

UNIT-II		**Lecture Hrs: 7**

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III		**Lecture Hrs: 7**

Evidence on the effectiveness of pedagogical practices: Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school
Curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogicalpractices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV		**Lecture Hrs: 7**

Professional development: alignment with classroom practices and follow-up support Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

UNIT-V		**Lecture Hrs: 7**

Research gaps and future directions: Research design, Context Pedagogy, Teacher education, Curriculum and assessment.

Text Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31

(2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

Reference Books:

1. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
3. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

Online Learning Resources:

M.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

Artificial Intelligence

L	T	P	C
3	0	0	3

Course Objectives:

- This course is designed to:
- Define Artificial Intelligence and establish the cultural background for study
- Understand various learning algorithms
- Explore the searching and optimization techniques for problem solving
- Provide basic knowledge on Natural Language Processing and Robotics

UNIT – I:

What is AI, Foundations of AI, History of AI, The State of Art.

Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Learning Outcomes:

At the end of this unit, the student will be able to

• Recognize the importance of Artificial Intelligence	**L1**
• Identify how intelligent agent is related to its environment	**L2**
• Build an Intelligent agent	**L3**

UNIT – II

Solving Problems by searching: Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

Learning Outcomes:

At the end of this unit, the student will be able to

• Explain how an agent can formulate an appropriate view of the problem it faces.	**L2**
• Solve the problems by systematically generating new states	**L3**
• Derive new representations about the world using process of inference	**L5**

UNIT – III: **8hrs**

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL 10 Page Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

Learning Outcomes:

At the end of this unit, the student will be able to

• Examine how an agent can learn from success and failure, reward and punishment.	**L5**
• Develop programs that make queries to a database, extract information from texts, and retrieve relevant documents from a collection using Natural Language Processing.	**L6**

UNIT–IV:

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Develop programs that translate from one language to another, or recognize spoken words.	**L6**
• Explain the techniques that provide robust object recognition in restricted context.	**L2**
•	
UNIT – V:	
Robotics: Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Explain the role of Robot in various applications. .	**L2**
• List the main philosophical issues in AI.	**L1**
Text Books:	
1. Stuart J.Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2019.	
Reference Books:	
1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.	
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.	
Course Outcomes:	
At the end of this Course the student will be able to	
• Apply searching techniques for solving a problem (L3)	**L3**
• Design Intelligent Agents (L6)	**L6**
• Develop Natural Language Interface for Machines (L6)	**L6**
• Design mini robots (L6)	**L6**
• Summarize past, present and future of Artificial Intelligence (L5)	**L5**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

Cyber Security

L	T	P	C
3	0	0	3

Course Objectives:

This course is designed to:

- Understand essential building blocks and basic concepts of cyber security
- Explore Web security and Network security
- Explain the measures for securing the networks and cloud
- Understand privacy principles and policies
- Describe the legal issues and ethics in computer security

UNIT – I:

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography. Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes:

At the end of this unit, the student will be able to

• Explain Vulnerabilities, threats and. Counter measures for computer security	**L2**
• Interpret the design of the malicious code	**L2**

UNIT – II

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks. Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

Learning Outcomes:

At the end of this unit, the student will be able to

• Outline the attacks on browser, Web and email.	**L2**
• Explain the security aspects of Operating Systems.	**L3**

UNIT – III:

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection 209 Page and Prevention Systems, Network Management . Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes:

At the end of this unit, the student will be able to

• Identify the network security threats and attacks.	**L3**
• Design the Counter measures to defend the network security attacks.	**L6**

UNIT–IV:

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed. Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster.

Learning Outcomes:

At the end of this unit, the student will be able to

• Interpret the need for Privacy and its impacts of Emerging Technologies.	**L2**
• Explain how to handle incidents and deal with Disaster.	**L2**

UNIT – V:

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes:

At the end of this unit, the student will be able to

• Adapt legal issues and ethics in computer security.	**L6**
• Elaborate on the Emerging topics.	**L6**

Text Books:

1.Pfleeger, C.P., Security in Computing, Prentice Hall, 2010, 5th edition

2. Schneier, Bruce. Applied Cryptography, Second Edition, John Wiley & Sons, 1996.

Reference Books:

1. Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice, McGraw-Hill, 2013.

2. Whitman, Michael E. and Herbert J. Mattord. Roadmap to Information Security for IT and Infosec Managers. Boston, MA: Course Technology, 2011.

Course Outcomes:

At the end of this Course the student will be able to

• Illustrate the broad set of technical, social & political aspects of Cyber Securityand security management methods to maintain security protection	**L2**
• Assess the vulnerabilities and threats posed by criminals, terrorist and nation statesto 210 Page national infrastructure	**L5**
• Identify the nature of secure software development and operating systems	**L3**
• Demonstrate the role security management in cyber security defense	**L2**
• Adapt the legal and social issues at play in developing solutions.	**L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

PE-III- Video Analytics

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the need for video Analytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

UNIT – I: VIDEO ANALYTIC COMPONENTS

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction- classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features.

Learning Outcomes:

At the end of this unit, the student will be able to

• Explain Need for Video Analytics	**L2**
• Discuss about the Feature space of video analytics	**L2**

UNIT – II FOREGROUND EXTRACTION

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation- Tracking in a multiple camera environment

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the Image Segmentation.	**L2**
• Explain the Tracking in a multiple camera environment.	**L3**

UNIT – III: CLASSIFIERS

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier

Learning Outcomes:

At the end of this unit, the student will be able to

• Identify the back propagation.	**L3**
• Design the Fuzzy Classifier.	**L6**

UNIT–IV:VIDEO ANALYTICS FOR SECURITY

Abandoned object detection- human behavioral analysis -human action recognition- perimeter security- crowd analysis and prediction of crowd congestion.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand the human action recognition.	**L2**
• Explain perimeter security.	**L2**

UNIT – V: VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITIRING AND ASSISTANCE

Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

Learning Outcomes:

At the end of this unit, the student will be able to

• Explain the lane change warning.	**L6**
• Explain the traffic congestion identification for route planning.	**L6**

Text Books:

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2001.

2. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016

Reference Books:

1. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014.
2. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012.

Course Outcomes:

At the end of this Course the student will be able to

• Design video analytic algorithms for security applications	**L2**
• Design video analytic algorithms for business intelligence	**L5**
• Design custom made video analytics system for the given target applicatio	**L3**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

PE-III - NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Course Objectives:

- Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
- Discuss approaches to syntax and semantics in NLP.
- Examine current methods for statistical approaches to machine translation.
- Explore machine learning techniques used in NLP.

UNIT – I:

Introduction to Natural language The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

Learning Outcomes:

At the end of this unit, the student will be able to

• Classify various NLP Applications	**L2**
• Apply the logic by using Python Programming	**L3**
• List the AI Languages	**L1**
• Outline the Linguistic Background	**L2**

UNIT – II

Grammars and Parsing Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayees Rule, Shannon game, Entropy and Cross Entropy.

Learning Outcomes:

At the end of this unit, the student will be able to

• Demonstrate the Top- Down and Bottom-Up Parsing techniques .	**L2**
• Apply Bayes Rule, Shannon game, Entropy and Cross Entropy.	**L3**
• Develop game playing strategies using Shannon game.	**L3**

UNIT – III:

Grammars for Natural Language Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

Learning Outcomes:

At the end of this unit, the student will be able to

• Classify Grammars for Natural Language	**L2**
• Explain Hold Mechanisms in ATNs.	**L2**
• Explain Human Preferences in Parsing.	**L2**

UNIT–IV:

Semantic Interpretation Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts & embedded sentences, Defining semantics structure model theory.
Language Modeling Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling.

Learning Outcomes:

At the end of this unit, the student will be able to

• Distinguish Language model Evaluation	**L4**
• List the types of Language Models	**L1**

UNIT – V:

Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

Learning Outcomes:

At the end of this unit, the student will be able to

• Apply Machine Translation techniques.	**L3**
• Elaborate Multilingual Information Retrieval and Multilingual Automatic Summarization.	**L6**

Text Books:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications : From Theory To PracticeDaniel M.Bikel and Imed Zitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi,Vineet chaitanya,Prentice –Hall of India.

Reference Books:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Course Outcomes:

At the end of this Course the student will be able to

• Build NLP applications using Python.	**L6**
• Apply various Parsing techniques, Bayes Rule, Shannon game, Entropy and Cross Entropy.	**L3**
• Explain the fundamentals of CFG and parsers and mechanisms in ATN's.	**L2**
• Apply Semantic Interpretation and Language Modeling..	**L3**
• Interpret Machine Translation and multilingual Information Retrieval systems and Automatic Summarization.	**L2**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

PE-III- DEEP LEARNING

L	T	P	C
3	0	0	3

Course Objectives:

- Demonstrate the major technology trends driving Deep Learning
- Build, train and apply fully connected deep neural networks
- Implement efficient (vectorized) neural networks
- Analyze the key parameters and hyper parameters in a neural network's architecture

UNIT – I:

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis. Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

Learning Outcomes:

At the end of this unit, the student will be able to

• Understand linear algebra in the deep learning context	**L2**
• Utilize probability and information theory in machine/deep learning applications	**L3**

UNIT – II

Machine Learning: Basics and Underfitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feedforward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

Learning Outcomes:

At the end of this unit, the student will be able to

• Illustrate machine learning basics leads to deep learning	**L2**
• Contrast super and unsupervised learning	**L2**

UNIT – III:

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and MetaAlgorithms.

Learning Outcomes:	
At the end of this unit, the student will be able to	
• Evaluate Regularization Problems for Deep learning	**L5**
• Apply optimization for Training Deep Learning models	**L3**
UNIT – IV:	
Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Appraise Basic Convolution Functions	**L5**
• Develop Efficient Convolution Algorithms	**L3**
UNIT – V:	
Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Illustrate Recurrent and Recursive Neural Networks .	**L2**
• Apply Auto encoders and Deep Generative Models .	**L3**
Text Books:	
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.	
2. osh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.	
Reference Books:	
1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers, 2019.	
2. Deep learning Cook Book, Practical recipes to get started Quickly, Douwe Osinga, O'Reilly, Shroff Publishers, 2019.	
Course Outcomes:	
At the end of this Course the student will be able to	
• Apply linear algebra and probability theory in the deep learning applications.	**L3**
• Elaborate the challenges and motivations to Deep learning .	**L6**
• Elaborate the challenges and motivations to Deep learning .	**L6**
• Build a convolutional neural network .	**L6**
• Build and train RNN and LSTMs.	**L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

PE-IV- NOSQL Databases

L	T	P	C
3	0	0	3

Course Objectives:

- Understand the basics of NOSQL databases.
- Understand the NoSQL stores
- Explain the principles and practices of Structure of Data

UNIT – I:

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

Learning Outcomes:

At the end of this unit, the student will be able to

• Explain different types of NoSQL Databases.	**L1**
• Illustrate the Emergence of NoSQL.	**L2**
• Outline the application and Integration of NoSQL Databases.	**L2**

UNIT – II

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Replication and sharding, MapReduce on databases.

Learning Outcomes:

At the end of this unit, the student will be able to

• Compare Relational Database to NoSql stores	**L1**
• Explain the challenges of Nosql approach .	**L2**
• Explain Sharding and Replication.	**L2**

UNIT – III:

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

• Outline the features of key/Value databases.	**L2**
• Explain the Document-oriented NoSQL databases.	**L2**
• Illustrate E-commerce applications and different aggregate structures.	**L3**

UNIT – IV:

Column- oriented NoSQL databases using Apache HBASE, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

Learning Outcomes:	
At the end of this unit, the student will be able to	
• Define column oriented NoSql Database.	**L3**
• Explain the Column-Family Data Store Features.	**L3**
• Summarize Event Logging, Content Management Systems.	**L4**
UNIT – V:	
NoSQL Key/Value databases using Riak, Key-Value Databases,Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data,Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Explain NoSQL Key/Value databases using riak.	**L2**
• Apply Nosql Development tools with suitable usecase.	**L3**
• Explain the detailed architecture and performance tune of Graph NoSQL databases.	**L6**
Text Books:	
1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019.	
Reference Books:	
1. . https://www.ibm.com/cloud/learn/nosql-databases	
2. . https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp	
3. . https://www.geeksforgeeks.org/introduction-to-nosql/	
4. . https://www.javatpoint.com/nosql-databa	
Course Outcomes:	
At the end of this Course the student will be able to	
• Explain and compare different types of NoSQL Databases	**L1**
• Compare and contrast RDBMS with different NoSQL databases	**L2**
• Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.	**L3**
• Explain performance tune of Key-Value Pair NoSQL databases.	**L5**
• Apply Nosql development tools on different types of NoSQL Databases.	**L6**

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

PE-IV- AGILE METHODOLOGIES

L	T	P	C
3	0	0	3

Course Objectives:

- Master the art of agile development.
- Understand how an iterative, incremental development process leads to faster delivery of more useful software. Elucidate the essence of agile development methods
- Explain the principles and practices of extreme programming

UNIT – I:

Why Agile? , How to be Agile, Understanding XP, Values and Principles, Improve the Process, Eliminate Waste, Deliver Value.

Learning Outcomes:

At the end of this unit, the student will be able to

• Appraise the importance of Agile and the philosophy behind being Agile	**L5**
• Interpret the questions that helps to eliminate waste from the process and increase one's agility	**L2**

UNIT – II

Practicing XP-Thinking, Pair Programming, Energized Work, Informative Workspace, RootCause Analysis, Retrospectives, Collaborating, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting.

Learning Outcomes:

At the end of this unit, the student will be able to

• Apply practices to excel as mindful developers	**L3**
• Illustrate the eight practices to help a team and its stakeholders collaborate efficiently and effectively	**L2**

UNIT – III:

Releasing-Done Done, No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation.

Learning Outcomes:

At the end of this unit, the student will be able to

• Examine pushing software into production	**L4**
• Explain the importance of documentation in ensuring the long-term maintainability of the product at appropriate times.	**L2**

UNIT – IV:

Planning-Vision, Release Planning, Risk Management, Iteration Planning, Stories, Estimating.

Learning Outcomes:

At the end of this unit, the student will be able to

• List the eight practices that allows to control the chaos of endless possibility	**L1**

UNIT – V:

Developing-Incremental Requirements, Customer Tests, Test- Driven Development, Refactoring, Incremental Design and Architecture, Spike Solutions, Performance Optimization.

Learning Outcomes:

At the end of this unit, the student will be able to

• Outline the practices that keep the code clean and allow the entire team to contribute to development.	**L2**

Text Books:

2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.
3. osh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.

Reference Books:

5. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers, 2019.
6. Deep learning Cook Book, Practical recipes to get started Quickly, Douwe Osinga, O'Reilly, Shroff Publishers, 2019.

Course Outcomes:

At the end of this Course the student will be able to

• Adopt Extreme Programming	**L1**
• Create own agile method by customizing XP to a particular situation	**L6**

M.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

PE-IV- Software Testing

L	T	P	C
3	0	0	3

Course Objectives:

- Acquire knowledge on distinct types of testing methodologie.
- Describe the principles and procedures for designing test cases.
- Understand the stages of testing from Development to acceptance testing

UNIT – I:

Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. Flow graphs and Path testing: Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

Learning Outcomes:

At the end of this unit, the student will be able to

• Explain the purpose of Testing.	**L2**
• Interpret the need of testing	**L2**

UNIT – II

Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.

Learning Outcomes:

At the end of this unit, the student will be able to

• Apply data flow testing	**L3**
• Design Transaction flow testing	**L6**

UNIT – III:

Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.

Learning Outcomes:

At the end of this unit, the student will be able to

• Apply testing in various domains.	**L3**

UNIT – IV:

Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. Logic Based Testing: Overview, Decision Tables, Path Expressions, KV Charts, Specifications.

Learning Outcomes:

At the end of this unit, the student will be able to

• Analyze the paths in testing.	**L4**
• Design testing for checking the logic	**L6**

UNIT – V:

State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips. Graph Matrices and Application: Motivational Overview, Matrix of Graph, Relations, Power of a Matrix, Node Reduction Algorithm, Building Tools.

Learning Outcomes:

At the end of this unit, the student will be able to

• Use state graphs for testing.	**L3**
• Create algorithms for node reduction	**L6**

Text Books:

1. Boris Beizer, "Software testing techniques", Dreamtech, second edition, 2002.

Reference Books:

1. Brian Marick, "The craft of software testing", Pearson Education
2. Yogesh Singh, "Software Testing", Camebridge.
3. P.C. Jorgensen, "Software Testing" 3rd edition, Aurbach Publications (Dist.by SPD).
4. N.Chauhan, "Software Testing", Oxford University Press

Course Outcomes:

At the end of this Course the student will be able to

• Examine issues on data storing , accessing from MongoDB, Redis, HBase and query processing and can develop suitable solutions.	**L1**
• Able to apply the features of NoSQL tand analyze the datasets	**L6**
• Compare and Contrast NoSQL databases with Relational Database Systems	**L6**
• Critically analyze and evaluate variety of NoSQL databases	**L6**
• Able to design and implement advanced queries using MangoDB, Redis, and HBase	**L6**

M.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

PE IV- FUNDAMENTALS OF VR/AR/MR

L	T	P	C
3	0	0	3

Course Objectives:

- Explore the history of spatial computing and design interactions.
- Understand the foundational principles describing how hardware, computer vision
- algorithms function Learn Virtual reality animation and 3D Art optimization
- Demonstrate Virtual reality
- Introduce to the design of visualization tools

UNIT – I:

How Humans interact with Computers: Common term definition, introduction, modalities through the ages (pre- 20th century, through world war-II, post world war-II, the rise of personal computing, computer miniaturization), why did we just go over all of this?, types of common HCI modalities, new modalities, the current state of modalities for spatial computing devices, current controllers for immersive computing systems, a note on hand tracking and hand pose recognition. Designing for our Senses, Not our Devices: Envisioning a future, sensory technology explained, who are we building this future for?, sensory design, five sensory principles, Adobe's AR story.

Learning Outcomes:

At the end of this unit, the student will be able to

• Explain common modalities and their pros and cons.	**L2**
• Demonstrate Mapping modalities to current industry inputs	**L2**
• Explore the importance of design with spatial computing	**L5**

UNIT – II

Virtual Reality for Art: A more natural way of making 3D art, VR for animation. 3D art optimization: Introduction, draw calls, using VR tools for creating 3D art, acquiring 3D models vs making them from scratch. How the computer vision that makes augmented reality possible works: Who are we?, a brief history of AR, how and why to select an AR platform, mapping, platforms, other development considerations, the AR cloud.

Learning Outcomes:

At the end of this unit, the student will be able to

• Utilize VR tools for creating 3D Animations	**L3**
• Analyze how and why to Select an AR Platform	**L6**

UNIT – III:

Virtual reality and augmented reality: cross platform theory: Why cross platform? The role of game engines, understanding 3D graphics, portabiltity lessons from video game design, simplifying the controller input. Virtual reality toolkit: open source framework for the community: What is VRTK and why people use it?, the history of VRTK, welcome to the steam VR unity toolkit, VRTK v4, the future of VRTK, success of VRTK. Three virtual reality and augmented reality development practices: Developing for virtual reality and augmented reality, handling locomotion, effective use of audio, common interaction paradigms.

Learning Outcomes:

At the end of this unit, the student will be able to	
• Explain why the design approach should be considered at a holistic high level based on the goal of the experience.	**L2**
• Build VR solutions using Virtual reality toolkit	**L6**
• Interpret the development practices in three Virtual reality and Augmented reality development	**L2**
UNIT – IV:	
Data and machine learning visualization design and development in spatial computing: Introduction, understanding data visualization, principles for data and machine learning visualization design and development in spatial computing, why data and machine learning visualization works in spatial computing, 2D data visualization vs 3D data visualization in spatial computing, interactivity in data visualizations and in spatial computing, animation, failures in data visualization, good data visualization design optimize 3D spaces, data representations, info graphics, and interactions, defining distinctions in data visualization and big data for machine, how to create data visualization: data visualization creation pipeline, webXR, data visualization challenges in XR, data visualization industry use case examples of data visualization, 3D reconstruction and direct manipulation of real world data, data visualization is for everyone, hands on tutorials, how to create data visualization, resources.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Understand, define, and set data and machine visualization design and development principles in embodied reality	**L1**
• Demonstrate best practices, and practical tools to create beautiful and functional data visualizations.	**L2**
UNIT – V:	
Character AI and Behaviors: Introduction, behaviors, current practice: Reactive AI, more intelligence in the system, Deliberative AI, machine learning. The virtual and augmented reality health technology ecosystem: VR/AR health technology application design, standard UX isn't intuitive, tutorial: insight Parkinson's experiment, companies, case studies from leading Academic institutions.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• Design a behavioral AI system for a video game	**L6**
• Identify issues related to design of virtual reality (VR) and augmented reality (AR) experiences deployed in a health-care context	**L6**
• Explain the use of motion data from controllers to reduce the visible tremor of a Parkinson's patient in a virtual environment	**L2**
Text Books:	
1.Erin Pangilinan, Steve lukas, and Vasanth Mohan, "Creating Augmented & Virtual Realities", 1st edition, O'REILLY, 2019.	
Reference Books:	
1. Steve Aukstakalnis, "Practical Augmented Reality", Pearson Education, 2017.	
Course Outcomes:	
At the end of this Course the student will be able to	

• Explain how the humans interact with computers	**L2**
• Apply technical and creative approaches to make successful applications and experiences.	**L3**
• Design audio and video interaction paradigms	**L6**
• Design Data visualization tools	**L6**
• Apply VR/MR/AR in various fields in industry	**L3**

M.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

Audit Course-II- Disaster Management

L	T	P	C
3	0	0	3

Course Objectives:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
- Understand the 'relief system' and the 'disaster victim.'
- Describe the three planning strategies useful in mitigation.
- Identify the regulatory controls used in hazard management.
- Describe public awareness and economic incentive possibilities.
- Understand the tools of post-disaster management.

UNIT – I:

Natural Hazards And Disaster Management: Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

Learning Outcomes:

At the end of this unit, the student will be able to

• To know about the natural hazards and its management.	**L2**
• To understand about the global warming, cyclones and tsunamis	**L2**

UNIT – II

Man Made Disaster And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.

Learning Outcomes:

At the end of this unit, the student will be able to

• To know about the fire hazards and solid waste management	**L3**
• To understand about the emerging infectious diseases and aids their management.	**L6**

UNIT – III:

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes:

At the end of this unit, the student will be able to	
• To know about the regulations of building codes and land use planning related to risk and vulnerability	**L2**
• To understand about the financial management of disaster and related losses	**L6**
UNIT – IV:	
Role Of Technology In Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges-mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and trainingtransformable indigenous knowledge in disaster reduction.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• To know about the technological aspects of disaster management	**L1**
• To understand about the factors for disaster reduction	**L2**
UNIT – V:	
Education and Community Preparedness: Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resiliencebuilding community capacity for action.	
Learning Outcomes:	
At the end of this unit, the student will be able to	
• To impart the education related to risk reduction in schools and communities	**L6**
Text Books:	
1. Rajib shah & R R Krishnamurthy "Disaster Management" – Global Challenges and Local Solutions' Universities press. (2009),.	
2. Tushar Bhattacharya, "Disaster Science & Management" Tata McGraw Hill Education Pvt. Ltd., New Delhi.	
3. Jagbir Singh "Disaster Management" – Future Challenges and Opportunities' I K International Publishing House Pvt. Ltd. (2007),	
Reference Books:	
1. Harsh. K . Gupta "Disaster Management edited", Universities press, 2003.	
Course Outcomes:	
At the end of this Course the student will be able to	
• Affirm the usefulness of integrating management principles in disaster mitigation work	**L2**
• Distinguish between the different approaches needed to manage pre- during and postdisaster periods.	**L3**
• Explain the process of risk management	**L6**
• Relate to risk transfer	**L6**

M.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
3	0	0	3

Course Objectives:

- Explore the methods of implementing algorithms using artificial intelligence techniques
- Illustrate search algorithms
- Demonstrate building of intelligent agents

List of Experiments:

1.Write a program to implement DFS and BFS

2.Write a Program to find the solution for travelling salesman Problem

3.Write a program to implement Simulated Annealing Algorithm

4.Write a program to find the solution for wampus world problem

5.Write a program to implement 8 puzzle problem

6.Write a program to implement Towers of Hanoi problem

7.Write a program to implement A* Algorithm

8.Write a program to implement Hill Climbing Algorithm

9.Build a Chatbot using AWS Lex, Pandora bots.

10.Build a bot which provides all the information related to your college.

11.Build a virtual assistant for Wikipedia using Wolfram Alpha and Python

12.The following is a function that counts the number of times a string occurs in another string:

```
 # Count the number of times string s1 is found in string s2
def countsubstring(s1,s2):
count = 0
for i in range(0,len(s2)-len(s1)+1):
 if s1 == s2[i:i+len(s1)]:
count += 1
return count
```

For instance, countsubstring('ab','cabalaba') returns 2.

Write a recursive version of the above function. To get the rest of a string (i.e. everything but the first character).

13.Higher order functions. Write a higher-order function count that counts the number of elements in a list that satisfy a given test. For instance: count(lambda x: x>2, [1,2,3,4,5]) should return 3, as there are three elements in the list larger than 2. Solve this task without using any existing higher-order function.

14.Brute force solution to the Knapsack problem. Write a function that allows you to generate random problem instances for the knapsack program. This function should generate a list of items containing N items that each have a unique name, a random size in the range 1 ..... 5 and a random value in the range 1 ..... 10.

Next, you should perform performance measurements to see how long the given knapsack solver take to solve different problem sizes. You should peform atleast 10 runs with different randomly generated problem instances for the problem sizes 10,12,14,16,18,20 and 22. Use a backpack size of 2:5 x N for each value problem size N. Please note that the method used to generate random numbers can also affect performance, since different distributions of values can make the initial conditions of the problem slightly more or less demanding. How much longer time does it take to run this program when we increase the number of items? Does the backpack size affect the answer? Try running the above tests again with a backpack size of 1 x N and with 4:0 x N.

15.Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitly large).
Write a function layout(N,C,L) that can give a table placement (ie. a number from 0 : : :C -1) for each guest such that there will be no social mishaps.
For simplicity we assume that you have a unique number 0 .....N-1 for each guest and that the list of restrictions is of the form [(X,Y), ...] denoting guests X, Y that are not allowed to sit together. Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer False.

Reference Books:

1. 1.Tensorflow: https://www.tensorflow.org/
2. Pytorch: https://pytorch.org/ https://github.com/pytorch
3. Keras: https://keras.io/ https://github.com/keras-team
4. Theano: http://deeplearning.net/software/theano/ https://github.com/Theano/Theano
5. Cafee2: https://caffe2.ai/ https://github.com/caffe2
6. Deeplearning4j: https://deeplearning4j.org/
7. Scikit-learn:https://scikit-learn.org/stable/ https://github.com/scikit-learn/scikit-learn
8. Deep Learning.Ai: https://www.deeplearning.ai/
9. OpenCv: https://opencv.org/ https://github.com/qqwweee/keras-yolo3
10. YOLO: https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/ nVIDIA:CUDA https://developer.nvidia.com/cuda-math-library
11. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press, 2004.
12. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.
13. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.
14. Artificial Neural Networks, B. Yagna Narayana, PHI
15. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight, TMH.
16. Artificial Intelligence and Expert Systems, Patterson, PHI.

Course Outcomes:

At the end of this Course the student will be able to

• Implement search algorithms	**L3**
• Solve Artificial intelligence problems	**L3**

M.Tech I Year II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

Cyber Security Laboratory

L	T	P	C
3	0	0	3

List of Experiments:

1. TCP scanning using NMAP
2. Port scanning using NMAP
3. TCP / UDP connectivity using Netcat
4. Perform an experiment to demonstrate sniffing of router traffic by using the tool wireshark.
5. Perform an experiment how to use dumpsec.
6. Perform an experiment to sniff traffic using ARP Poisoning
7. Implementing the Secure Sockets Layer (SSL v2/v3) and Transport Layer Security (TLS v1) network protocols
8. Setup a honey pot and monitor the honey pot on network.

Course Outcomes:

At the end of this Course the student will be able to

• Implement the TCP	**L3**
• Solve TCP/UDP problems .	**L3**
• Solve the some security issues.	**L6**

II M.Tech I SEMESTER
JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA
BIG DATA ANALYTICS
(Program elective-V)

L	T	P	C
3	0	0	3

Course Objectives:
1. Master the concepts of HDFS and Map Reduce framework.
2. Understand Hadoop Architecture.
3. Setup Hadoop Cluster and write Complex Map Reduce programs.
4. Perform Data Analytics using Hive.
5. Implement HBase and Map Reduce Integration.
6. Implement best Practices for Hadoop Development.
7. They will understood about R analytics Based on big data.

UNIT – 1: Introduction to Big Data **8 Hrs**

What is Big Data. Why Big Data is Important. Meet Hadoop. Data. Data Storage and Analysis. Comparison with other systems. Grid Computing. A brief history of Hadoop. Apache hadoop and the Hadoop EcoSystem. Linux refresher; VMWare Installation of Hadoop.

Learning Outcomes:

At the end of this unit, the student will be able to

- Student will be able to know where the Big data is used and its importance. **L2**
- Students will be able to know how the Big data will be handled and its problems. **L2**

UNIT – II: The design of HDFS **8 Hrs**

HDFS concepts. Command line interface to HDFS.Hadoop File systems. Interfaces. Java Interface to Hadoop. Anatomy of a file read. Anatomy of a file writes. Replica placement and Coherency Model. Parallel copying with distcp, Keeping an HDFS cluster balanced.

Learning Outcomes:

At the end of this unit, the student will be able to

- Students will be able to learn the importance of Hadoop. **L2**
- Students will be able to know about Doug Cutting and how the Hadoop came into existence. **L2**

UNIT – III: **8 Hrs**

Introduction. Analyzing data with unix tools. Analyzing data with hadoop. Java MapReduce classes (new API). Data flow, combiner functions, Running a distributed MapReduce Job. Configuration API. Setting up the development environment. Managing configuration. Writing a unit test with MRUnit. Running a job in local job runner. Running on a cluster.Launching a job. The MapReduce WebUI.

Learning Outcomes:

At the end of this unit, the student will be able to

- Students will be able to know about Doug Cutting and how the Hadoop came into existence. **L3**
- Student will be able to know about HDFS, MapReduce and Hadoop releases. **L4**

UNIT – IV: **7 Hrs**

Classic Mapreduce. Job submission. Job Initialization. Task Assignment. Task execution .Progress and status updates. Job Completion. Shuffle and sort on Map and reducer side. Configuration tuning. Map Reduce Types. Input formats. Output formats, Sorting. Map side and Reduce side joins.

Learning Outcomes:

At the end of this unit, the student will be able to

- Student will be able to know about HDFS, MapReduce and Hadoop releases. **L3**
- Students will be able to know how to write a program in Hadoop **L4**

UNIT – V: The Hive Shell

Hive services. Hive clients. The meta store. Comparison with traditional databases. Hive Ql. Hbasics. Concepts. Implementation. Java and Map reduce clients. Loading data, web queries.

Learning Outcomes:

At the end of this unit, the student will be able to

- Students will be able to know how to write a program in Hadoop **L4**
- Students will be able to know how Map and Reduce done in Hadoop **L5**
- Students will be able to know how to view information about jobs in web browser **L5**

Text Books:

1. Tom White, Hadoop,"The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012.
2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch ,"Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH,2012.

Reference Books:

1. Hadoop for Dummies by Dirk deRoos ,Paul C.Zikopoulos,Roman B.MelnyK,Bruce Brown,Rafael Coss

Course Outcomes:

At the end of this Course the student will be able to

- Student will be able to know where the Big data is used and its importance. **L2**
- Students will be able to know how the Big data will be handled and its problems. **L3**
- Students will be able to learn the importance of Hadoop. **L3**
- Students will be able to know about Doug Cutting and how the Hadoop came into existence. **L4**
- Student will be able to know about HDFS, MapReduce and Hadoop releases. **L3**
- Students will be able to know how to write a program in Hadoop **L5**
- Students will be able to know how Map and Reduce done in Hadoop **L5**
- Students will be able to know how to view information about jobs in web browser **L6**

II M.Tech I SEMESTER
JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA
WEB DESIGN AND MANAGEMENT
(Program Elective-V)

L	T	P	C
3	0	0	3

Course Objectives:
This course is designed to:
• To Learn the basic concepts in HTML, CSS, JavaScript
• To Understand the responsive design and development
• To learn the web project management and maintenance process
• To Design a Website with HTML, JS, CSS / CMS - Word press

UNIT – 1: WEB DESIGN - HTML MARKUP FOR STRUCTURE **8 Hrs**
Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5.

Learning Outcomes:
At the end of this unit, the student will be able to
- Argue the importance and role of software architecture in large-scale software systems. **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

UNIT – II: CSS AND JAVASCRIPT **8 Hrs**
CSS - Formatting text - Colours and Background - Padding, Borders and Margins – Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation – JavaScript - Using Java Script.

. **Learning Outcomes:**
At the end of this unit, the student will be able to
- Design and motivate software architecture for large-scale software systems. **L3**
- Recognize major software architectural styles and frameworks. **L4**

UNIT – III: RESPONSIVE WEB DESIGN **8 Hrs**
Sass for Responsive Web Design - Marking Content with HTML5 - Mobile-First or DesktopFirst - CSS Grids, CSS Frameworks, UI Kits, and Flexbox for RWD - Designing small UIs by Large Finger - Images and Videos in Responsive Web Design - Meaningful Typography for Responsive Web Design.

Learning Outcomes:
At the end of this unit, the student will be able to
- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

UNIT – IV: WEB PROJECT MANAGEMENT **7 Hrs**
Project Life Cycle - Project Definition - Discovery and Requirements - Project Schedule and Budgeting - Running the project - Technical Documentation - Development, Communicaton, Documentation - QA and testing -Deployment - Support and operations.

Learning Outcomes:
At the end of this unit, the student will be able to
- Describe a software architecture using various documentation approaches and architectural description languages. **L5**
- Generate architectural alternatives for a problem and selection among them. **L3**

UNIT – V: PROJECT CASE STUDY

Using HTML, CSS, JS or using Opensource CMS like Word press, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project - Host and manage the project live in any public hosting.

Learning Outcomes:

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems. **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

Text Books:

1. Jennifer Niederst Robbins, "Learning Web Design", O'REILLY 4th Edition
2. Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015
3. Justin Emond, Chris Steins, "Pro Web Project Management", Apress,2011

Reference Books:

1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, edition 2014
2. Jon Duckett, Jack Moore, "JavaScript & JQuery: Interactive Front-End Web Development", John Wiley and Sons, edition 2014
3. Uttam K. Roy "Web Technologies" Oxford University Press, 13th impression, 2017 4. Word press - http://www.wpbeginner.com/category/wp-tutorials/

Course Outcomes:

Students will be able to:

1. Recognize the method of using layered approach for design . **L2**
2. Explain the functionality of each layer of a computer network. **L3**
3. Apply the knowledge of layered approach for the design of computer network software. **L4**
4. Analyze the performance of protocols of a computer network. **L4**
5. Recommend the protocols for different applications. **L5**
6. Propose new protocols for a computer networks. **L6**

II M.Tech I SEMESTER

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

MOBILE APPLICATION DEVELOPMENT

(Open Elective-I)

L	T	P	C
3	0	0	3

Course Objectives:

- Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle

UNIT – 1: 8 Hrs

Introduction Android Programming: What is Android, Activities, Linking Activities Using Intents, Fragments, Calling Built – in Applications using Intents, Displaying Notifications.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their understanding of the fundamentals of Android operating systems **L2**
- demonstrate their skills of using Android software development tools **L2**

UNIT – II: 8 Hrs

Android User Interface: Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar, Listening for UI Notifications.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to develop software with reasonable complexity on mobile platform **L3**
- demonstrate their ability to deploy software to mobile devices **L3**

UNIT – III: 8 Hrs

Designing User Interface with Views: Basic Views, Picker Views, Using List Views to Display Long Lists.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to debug programs running on mobile devices **L4**
- demonstrate their ability to deploy software to mobile devices **L4**

UNIT – IV: 7 Hrs

Displaying pictures and menus with views and Data Persistence: Views to Display pictures, menus with views, additional views, saving and loading user preferences, persisting data to files, creating and using databases.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their skills of using Android software development tools **L4**
- demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

UNIT – V: **08 Hrs**

Content Providers: Sharing data in android, using a content provider, creating your own content providers.

Messaging and Networking: SMS Messaging, Sending E-Mail, Networking

Location-Based Services: Displaying Maps, Getting Location Data.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate their ability to deploy software to mobile devices **L5**
- demonstrate their ability to debug programs running on mobile devices **L5**

Text Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India
2. Beginning Swift Programming, Wei-Meng Lee, December 2014, ISBN: 978-1-119-00931-3

Reference Books:

1. Enterprise J2ME: Developing Mobile Java Applications, Michael Juntao Yuan, Pearson Education, 2004.
2. Android Application Development for Java programming by James C. Sheusi, Cengage Learning
3. Android A Programmers Guide by Jerome DiMargio, TMH.

Course Outcomes:

At the end of this Course the student will be able to

- demonstrate their understanding of the fundamentals of Android operating systems **L3**
- demonstrate their skills of using Android software development tools **L4**
- demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

II M.Tech II Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

ADVANCED DATA STRUCTURES

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Course Objectives:

- Understand and apply linear data structures-List, Stack and Queue.
- Understand the graph algorithms.
- Learn different algorithms analysis techniques.
- Apply data structures and algorithms in real time applications.
- Able to analyze the efficiency of algorithm.

UNIT – I: Hashing –

General Idea, Hash Function, Separate Chaining, Hash Tables without linked lists: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Hash Tables in the Standard Library, Universal Hashing, Extendible Hashing.

Learning Outcomes:

At the end of this unit, the student will be able to

• Develop the model from the Hash Tables in the Standard Library.	**L1**
• Analyze and design the Extendible Hashing.	**L1**

UNIT – II: Priority Queues (Heaps) –

Priority Queues (Heaps) – Model, Simple implementations, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations.

Learning Outcomes:

At the end of this unit, the student will be able to

• Have an exposure for Binary Heap: Structure Property.	**L2**
• Apply, analyze, design and develop the Basic Heap Operations.	**L2**

UNIT – III: Trees – AVL

Single Rotation, Double Rotation, B-Trees, Multi-way Search Trees – 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree.

Learning Outcomes:

At the end of this unit, the student will be able to

• Design various estimation levels Multi-way Search Trees – 2-3 Trees	**L2**

UNIT – IV: Graphs Algorithms –

Graphs Algorithms – Elementary Graph Algorithms: Topological sort, Single Source Shortest Path Algorithms: Dijkstra's, Bellman-Ford, All-Pairs Shortest Paths: Floyd-Warshall's Algorithm.

Learning Outcomes:

At the end of this unit, the student will be able to

• Categorize various Topological sort	**L3**
• Sketch various artifacts sets for Floyd-Warshall's Algorithm.	**L4**

UNIT – V: Disjoint Sets –

Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm..

Learning Outcomes:

At the end of this unit, the student will be able to

• Identify and describe the , Basic Data Structure	**L4**
• Determine an Smart Union and Path compression algorithm.	**L5**

Text Books:

1.Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4 th Edition, 2014, Pearson.

2. Introduction to Algorithms, Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3 rd Edition, 2009, The MIT Press.

Reference Books:

1. Introduction to Algorithms, Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3 rd Edition, 2009, The MIT Press.
2. Advanced Data Structures, Reema Thareja, S. Rama Sree, Oxford University Press, 2018.

Course Outcomes:

At the end of this Course the student will be able to

• Understand the basic principles and operations of data structures.	**L2**
• Apply Hashing, Disjoint sets and String Matching techniques for solving problems effectively.	**L3**
• Apply the concepts of advanced Trees and Graphs for solving problems effectively.	**L3**
• Analyze the given scenario and choose appropriate Data Structure for solving problems.	**L4**