JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
COURSE STRUCTURE AND SYLLBI FOR
M.Tech Artificial Intelligence & Machine Learning
w.e.f. 2020-21 Admitted Batch onwards

M.Tech I Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D58101	Advanced Data Structures and Algorithms	4	-	-	4
2.	17D97101	Python programming	4	-	-	4
3.	17D97102	Artificial Intelligence & Machine Learning	4	-	-	4
4.	 17D97103 17D97104 17D97105 17D97106	Elective-I a. Mathematics for Machine Learning b. Digital image processing c. Knowledge Representation and Reasoning d. Robotics & Automation	4	-	-	4
5.	 17D58106 17D97107 17D97108 17D58109	Elective-II a. Neural Networks b. Pattern Recognition c. Expert Systems d. Multicore Architecture & Programming	4	-	-	4
6.	17D58110	Advanced Data Structures and Algorithms Lab	-		4	2
7.	17D97109	Python Programming Lab	-		4	2
8.	17D97110	Artificial Intelligence & ML Lab	-		4	2
		Total	**20**		**12**	**26**

M.Tech II Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D97201	Advanced Machine Learning	4	-	-	4
2.	17D97202	Big Data Engineering	4	-	-	4
3.	17D97203	Applications of AI & ML	4	-	-	4
4.	 17D58208 17D97204 17D97205 17D58207	Elective-III a.Natural Language Processing b.Genetic Algorithms & Applications c.Computational Intelligence d. Cloud Computing	4	-	-	4
5.	 17D97206 17D97207 17D97208 17D97209	Elective-IV a. Intelligent systems b. Cognitive Science c. Reinforcement Learning d. Intelligent Information Retrieval	4	-	-	4
6.	17D97210	Advanced Machine Learning Lab	-	-	4	2
7.	17D97211	Big Data Engineering Lab	-	-	4	2
8.	17D97212	Mini Project on Applications of AI & ML	-	-	4	2
		Total	**20**		**12**	**26**

M.Tech III Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D20301 17D20302 17D20303	Elective-V (Open Elective) 1.Research Methodology 2.Human Values & Professional Ethics 3.Intellectual Property Rights	4	-	-	4
2.	17D97301	Elective-VI (MOOCs)	-	-	-	-
3.	17D97302	Comprehensive Viva-Voice	-	-	-	2
4.	17D97303	Seminar	-	-	-	2
5.	17D97304	Teaching Assignment	-	-	-	2
6.	17D97305	Project work Phase-I	-	-	-	4
		Total	**04**	**-**	**-**	**14**

M.Tech IV Semester

S.No.	Subject Code	Subject	L	T	P	C
1.	17D97401	Project work Phase - II	-		-	12
		Total	-		-	**12**

Project Viva Voce Grades:

A: Satisfactory
B: Not Satisfactory

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M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D58101) ADVANCED DATA STRUCTURES AND ALGORITHMS

UNIT I : Overview of Data Structures - Arrays, Stacks, Queues, linked lists , Linked stacks and Linked queues, Applications

Algorithm Analysis - Efficiency of algorithms, Asymptotic Notations, Time complexity of an algorithm using O notation, Polynomial Vs Exponential Algorithms, Average, Best, and Worst Case Complexities, Analyzing Recursive Programs.

UNIT II: Trees and Graphs – Basics of trees and binary trees, Representation of trees and Binary trees, Binary tree Traversals, Threaded binary trees, Graphs, representation and traversals.

Binary Search Trees, AVL Trees and B Trees - Binary Search Trees: Definition, Operations and applications. AVL Trees: Definition, Operations and applications. B Trees: Definition, Operations and applications.

UNIT III: Red – Black Trees, Splay Trees and Hash Tables - Red–Black Trees, Splay Trees and their applications, Hash Tables, Hash Functions and various applications, File Organizations.

UNIT IV: Divide – and – Conquer & Greedy Method - General Method, Binary Search, Finding Maximum and Minimum, Quick Sort, Merge sort, Strassen's Matrix Multiplication, Greedy Method-General Method, Minimum Cost Spanning Trees, Single Source Shortest Path.

Back Tracking and Branch – and – Bound - General Method, 8 – Queen's Problem, Graph Coloring. Branch – and – Bound: The Method, LC Search, Control Abstraction, Bounding, 0 / 1 Knapsack Problem.

UNIT V: Dynamic Programming - General Method, All Pairs Shortest Path, Single Source Shortest Path, 0 /1 Knapsack problem, Reliability Design, Traveling Sales Person's Problem.

Text Books:

1. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, 2nd edition, University Press.

References:

1. Data Structures and Algorithms Using C++ by Ananda Rao Akepogu and Radhika Raju Palagiri, Pearson Education, 2010.
2. Classic Data Structures by D. Samanta, 2005, PHI
3. Data Structures and Algorithms by G.A.V. Pai, 2009, TMH.
4. Design and Analysis of Computer Algorithms by Aho, Hopcraft, Ullman 1998, PEA.
5. Introduction to the Design and Analysis of Algorithms by Goodman, Hedetniemi, TMG
6. Design and Analysis of Algorithms by E. Horowitz, S. Sahani, 3rd Edition, Galgotia.
7. Data Structures and Algorithms in C++ by Drozdek 2nd Edition, Thomson.

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M.Tech I semester (AI & ML) **L T P C**

4 0 0 4

(17D97101) PYTHON PROGRAMMING

Unit – I

Introduction: What is a program, Running python, Arithmetic operators, Value and Types.
Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.
Functions: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

Unit – II

Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring.
Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input.
Fruitful Functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of Faith, Checking types,

Unit - III

Iteration: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms.
Strings: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison.
Case Study: Reading word lists, Search, Looping with indices.
Lists: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

Unit – IV

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables.
Tuples: Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences.
Files: Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.
Classes and Objects: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.
Classes and Functions:

Unit – V

Introduction to NumPy, Pandas, Matplotlib.

Exploratory Data Analysis (EDA), Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA. Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps etc.

Text books:

1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.
2. Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from the Frontline. O'Reilly, 2013.

Reference Books:

1. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
2. Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015.
3. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D97102) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Unit-1: **Foundations of AI**: Introduction to Artificial Intelligence: Definition, foundations and history, some application areas); Agents: Intelligence agents, agents and evironments, structure of agents)

Unit-2: **Problem solving**: Problem solving agents, Sample problems, Searching for solutions, search strategies; Knowledge representation: ontological engineering, categories and objects, reasoning systems for categories

Unit-3: **Introduction to Machine Learning.** Defn of Machine learning (Tom Mitchel's), patterns, features, pattern representation, concept learning and inductive bias

Unit-4: **Learning from data**: Supervised, Unsupervised, Semi-supervised and self-supervised learning. Concepts of Classification and Regression.Supervised classification – logistic regression, perceptron, support vector machines, nearest neighbor classifier, decision trees. Clustering – K-means, DBSCAN, BIRCH

Unit-5: **Learning probabilistic models**: Statistical learning, Learning with Complete data, learning with hidden variables, EM algorithm; Bayesian models.

Text Books:

1. "Artificial Intelligence – A modern Approach". Stuart J. Russel and Peter Norvig. Pearson.
2. "Machine Learning", Tom Mitchel

References:

1. "Pattern Recognition", V. Susheela Devi, M.N.Murty. Universities Press.
2. Bill Franks, Taming the big Data tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.
3. Glenn J. Myatt, Making Sense of Data , John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
4. Jiawei Han, MichelineKamber, Data Mining Concepts and Techniques, Second Edition.

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M.Tech I semester (AI&ML)

L	T	P	C
4	0	0	4

(17D97103) MATHEMATICS FOR MACHINE LEARNING

UNIT I: Statistics - Measures of location- arithmetic, geometric and harmonic means, median, mode, measures of spread – range, variance and standard deviation, mean deviation, concept of skewness – positively and negatively skewed data, kurtosis, covariance.
Probability - Probability axioms, classical and frequency approaches, geometric probability, conditional probability, independence of events, Bayes theorem, applications

UNIT II: Random Variables - Introduction to random variables, Probability mass functions, distribution and density functions, Discrete distributions– Binomial, Poisson, geometric and negative binomial distributions, Continuous distributions – exponential, Gamma, Normal distribution, T, and F distributions, mathematical expectation of random variables, probability generating function, moment generating function, characteristic function.

UNIT III: Matrix Decomposition, Linear Algebra Fundamentals, Vector Spaces. Basic computational methods such as Eigen values and Eigen vectors, sparse matrices

UNIT IV: Methods for convex optimization - Unconstrained optimization, Linear optimization, convex quadratic optimization, second order cone optimization, semi-definite optimization, convex composite optimization.

UNIT V: Gradient descent models - Gradient descent methods, Newton method, interior point methods, active set, proximity methods, accelerated gradient methods, coordinate descent, cutting planes, stochastic gradient descent.
Dimensionality reduction - Discriminant analysis, Principal component analysis, Factor analysis, k means.

Text Book(s):

1. Matrix Methods in Data Mining and Pattern Recognition, Lars Elden.(2016).
2. Introduction to Applied Linear Algebra – Vectors, Matrices, and Least Squares, Stephen Boyd and Lieven Vandenberghe, Cambridge U Press(2018).

Reference Books:

1. Probability and Statistics for Engineers and Scientists, Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye, (9th Edition), Pearson Education(2015)
2. Pattern Recognition and Machine Learning, ChristopherBishop,Springer,(2010)
3. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Flach, Cambridge University Press (2015)
4. Elementary Linear Algebra, Enton Howard, Wiley India(2016)
5. Introduction to Linear Algebra, Gilbert Strang, 5th ed., Cengage Learning,2015

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M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D97104) DIGITAL IMAGE PROCESSING

Unit - I : **Digital Image Fundamentals:** What is Digital Image Processing, examples of fields that use digital image processing, fundamental Steps in Digital Image Processing, Components of an Image processing system, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

Unit – II: **Image Enhancement**: Image Enhancement in the spatial domain: some basic gray level transformations, histogram processing, enhancement using arithmetic and logic operations, basics of spatial filters, smoothening and sharpening spatial filters, combining spatial enhancement methods.

Unit – III : **Segmentation:** Thresholding, Edge Based Segmentation: Edge Image Thresholding, Region Based Segmentation, Matching, **Representation and Description**: Representation , Boundary Descriptors, Regional Descriptors.

Unit – IV : **Image Compression:** Fundamentals, image compression models, elements of information theory, error-free compression, lossy compression,Image Compression Standards.

Unit – V : **Morphological Image Processing:** Preliminaries, dilation, erosion, open and closing, hit transformation, basic morphologic algorithms.
Color Image Processing: Color fundamentals, Color Models and basics of full-color image processing

Text Books :

1. "Digital Image Processing", Rafael C.Gonzalez and Richard E. Woods, Third Edition, Pearson Education, 2007
2. Digital Image Processing", S.Sridhar, Oxford University Press

Reference Books :

1. "Fundamentals of Digital Image Processing" , S. Annadurai, Pearson Edun, 2001.
2. "Digital Image Processing and Analysis", B. Chanda and D. Dutta Majumdar, PHI, 2003.
3. "Image Processing" , Analysis and Machine Vision , Milan Sonka, Vaclav Hlavac and Roger Boyle, 2nd Edition, Thomson Learning, 2001.
4. "Digital Image Processing" Vipula Singh, Elsevier

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M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D97105) KNOWLEDGE REPRESENTATIONS AND REASONING

UNIT I: The Key Concepts: Knowledge, Representation, Reasoning, Why knowledge representation and reasoning, Role of logic
Logic: Historical background, Representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity Amidst diversity

UNIT II: Ontology: Ontological categories, Philosophical background, Top-level categories, Describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time

UNIT III: Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation

UNIT IV: Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change
Contexts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.

UNIT V: Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic, Fuzzy logic, Nonmonotonic Logic, Theories, Models and the world, Semiotics
Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, Accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition

Text Books:

1. Knowledge Representation *logical, Philosophical, and Computational Foundations* by John F. Sowa, Thomson Learning.
2. Knowledge Representation and Reasoning by Ronald J. Brachman, Hector J. Levesque, Elsevier.

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M.Tech I semester (AI&ML) **L T P C**

5 0 0 4

(17D97106) ROBOTICS & AUTOMATION

UNIT I: Introduction - Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems

UNIT II: End Effectors And Robot Controls - Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot- Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT- Motion Interpolations-Adaptive control.

UNIT III: Robot Transformations and Sensors - Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

UNIT IV-Robot Cell Design And Applications - Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applicationsMaterial handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.

UNIT V-Micro/Nano Robotics System - Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach- Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system

Textbooks:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.

References:

1. Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.
2. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., “Robotics control, sensing, vision and intelligence”, McGraw Hill Book co, 1987
3. Craig. J. J. “Introduction to Robotics mechanics and control”, Addison- Wesley, 1999.
4. Ray Asfahl. C., “Robots and Manufacturing Automation”, John Wiley & Sons Inc.,1985.

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M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D58106) NEURAL NETWORKS

UNIT I : BASICS OF ARTIFICIAL NEURAL NETWORKS: Characteristics of Neural Networks, Historical Development of Neural Network Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws

UNIT II: ACTIVATION AND SYNAPTIC DYNAMICS: Activation Dynamics Models, Synaptic Dynamics Models, Learning Methods, Stability and Convergence, Recall in Neural Networks.

UNIT III: FUNCTIONAL UNITS OF ANN FOR PATTERN RECOGNITION TASKs: Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units: Pattern Recognition Tasks by Feed forward Neural Networks, Pattern Recognition Tasks by Feedback Neural Networks, Pattern Recognition Tasks by Competitive Learning Neural Networks

UNIT IV: FEEDFORWARD NEURAL NETWORKS: Analysis of Pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of Pattern Mapping Networks

UNIT V: FEEDBACK NEURAL NETWORKS: Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks, Stochastic Networks and Simulated Annealing, Boltzmann Machine

Text Books:

1. "Artificial Neural Networks", B. Yegnanarayana – PHI Publications
2. S.N.Sivanandam ,S.N.Deepa, "Introduction to Neural Networks using MATLAB 6.0", TATA MCGraw- Hill publications.
3. J .M. Zurada ,"Introduction to Artificial neural systems" –Jaico publishing.

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M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D97107) PATTERN RECOGNITION

Unit - I : **Introduction to Pattern Recognition:** Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition,

Pattern Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature, Feature Selection, Evaluation of Classifiers, Evaluation of Clustering

Unit – II: **Nearest Neighbour Based Classifiers:** Nearest Neighbour Algorithm, Variants of the NN Algorithm , Use of the Nearest Neighbour Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection,

Bayes Classifier: Bayes Theorem, Minimum error rate classifier, Estimation of Probabilities, Comparison with the NNC, Naive Bayes Classifier, Bayesian Belief Network.

Unit – III : **Hidden Markov Models:** Markov Models for Classification, Hidden Markov Models, Classification Using HMMs, Classification of Test Patterns.

Decision Trees: Introduction, Decision Trees for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Over fitting and Pruning, Example of Decision Tree Induction.

Unit – IV : **Support Vector Machines:** Introduction, Linear Discriminant Functions, Learning the Linear Discriminant Function, Neural Networks, SVM for Classification, Linearly Separable Case, Non-linearly Separable Case.

Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers, Evaluation of Classifiers, Evaluation of Clustering

Unit – V :

Clustering: Clustering and its Importance, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets, An Application to Handwritten Digit Recognition: Description of the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns.

Text Books :

1. Pattern Recognition an Introduction, V. Susheela Devi M. Narasimha Murty, University Press.
2. Pattern Recognition, Segrios Theodoridis,Konstantinos Koutroumbas, Fourth Edition, Elsevier

Reference Books :

1. Pattern Recognition and Image Analysis, Earl Gose, Richard John Baugh, Steve Jost, PHI 2004.
2. C. M. Bishop, 'Neural Networks for Pattern Recognition', Oxford University Press, Indian Edition, 2003.
3. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, Johy Wiley, 2002

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M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D97108) EXPERT SYSYTEMS

UNIT I: Overview of Artificial Intelligence: Definition & Importance of AI.

Knowledge: General Concepts: Introduction, Definition and Importance of Knowledge, Knowledge-Based Systems, And Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, And Acquisition of Knowledge.

UNIT II: Knowledge Representation: Introduction, Syntax and Semantics for Propositional logic, Syntax and Semantics for FOPL, Properties of Wffs, Conversion to Clausal Form, Inference Rules, The Resolution Principle, No deductive Inference Methods, Representations Using Rules.

UNIT III:

Dealing with Inconsistencies and Uncertainties: Introduction, Truth Maintenance Systems, Default Reasoning and the Closed World Assumption, Predicate Completion and Circumscription, Modal and Temporal Logics.

Probabilistic Reasoning: Introduction, Bayesian Probabilistic Inference, Possible World Representations, Dumpster-Shafer Theory, Ad-Hoc Methods.

UNIT IV:

Structured Knowledge: Graphs, Frames and Related Structures: Introduction, Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.

Object-Oriented Representations: Introduction, Overview of Objects, Classes, Messages and Methods, Simulation Example using an OOS Program.

UNIT V

Knowledge Organization and Management: Introduction, Indexing and Retrieval Techniques, Integrating Knowledge in Memory, Memory Organization Systems.

Expert Systems Architectures: Introduction, Rule Based System Architecture, Non-Production System Architecture, Dealing with uncertainty, Knowledge Acquisition and Validation, Knowledge System Building Tools.

Text Book:

1. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

Reference Books:

1. E. Rich & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2005.
2. P.H. Winston - Artificial Intelligence, 3/e, Pearson Edition, New Delhi, 2006.
3. D.W. Rolston,- Principles of AI & Expert System Development, TMH, New Delhi.

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M.Tech I semester (AI&ML) **L T P C**

4 0 0 4

(17D58109) MULTI-CORE ARCHITECTURES & PROGRAMMING

UNIT – I:

Fundamentals of SuperScalar Processor Design, Introduction to Multicore Architecture – Chip Multiprocessing, homogeneous Vs heterogeneous design - SMP – Multicore Vs Multithreading. Shared memory architectures– synchronization – Memory organization – Cache Memory – Cache Coherency Protocols - Design of Levels of Caches.

UNIT - II

Multicore programming Model – Shared memory model, message passing model, transaction model – OpenMP and MPI Programming. PowerPC architecture – RISC design, PowerPC ISA, PowerPC Memory Management - Power 5 Multicore architecture design, Power 6 Architecture.

UNIT - III

Cell Broad band engine architecture, PPE (Power Processor Element), SPE (Synergistic processing element), Cell Software Development Kit, Programming for Multicore architecture.

UNIT - IV

PRAM Model – PRAM Algorithms – Parallel Reduction – Prefix Sums – List Ranking – Preorder Tree Traversal – Merging Two Sorted Lists – Graph Coloring – Reducing Number of Processors – NC Class. Classifying MIMD Algorithms – Hypercube SIMD Model – Shuffle Exchange SIMD Model – 2D Mesh SIMD Model – UMA Multiprocessor Model – Broadcase – Prefix Sums. Enumeration Sort – Lower Bound on Parallel Sorting – Odd-Even Transposition Sort –Bitonic Merge – Parallel Quick Sort – Complexity of Parallel Search – Searching on Multiprocessors.

UNIT - V

P-Depth Search – Breadth Death Search – Breadth First Search – Connected Components – All pair Shortest Path – Single Source Shortest Path – Minimum Cost Spanning Tree. Matrix Multiplication on 2-D Mesh, Hypercube and Shuffle Exchange SIMD Models – Algorithms for Multiprocessors – Algorithms for Multicomputers – Mapping Data to Processors.

REFERENCES

1. Hennessey and Pateterson, “Computer Architecture A Quantitative Approach”, Harcourt Asia, Morgan Kaufmann, 1999.
2. Joseph JaJa, “Introduction to Parallel Algorithms”, Addison-Wesley, 1992.
3. Kai Hwang, “Advanced Computer Architecture: Parallelism, Scalability and Programmability” McGraw-Hill, 1993.

4. Richard Y. Kain, “Advanced Computer Architecture: A System Design Approach”, PHI, 1999.
5. Rohit Chandra, Ramesh Menon, Leo Dagum, and David Kohr, “Parallel Programming in OpenMP”, Morgan Kaufmann, 2000.
6. Michael J. Quinn, “Parallel Computing: Theory & Practice”, Tata McGraw Hill Edition, 2003.
7. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, “Introduction to
8. Parallel Computing”, 2nd Edition, Addison Wesley, 2003.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (AI & ML)

L	T	P	C
0	0	4	2

(17D58110) ADVANCED DATA STRUCTURES AND ALGORITHMS LAB

1. Write C++ programs to implement the following using an array.
   a) Stack ADT b) Queue ADT
2. Write C++ programs to implement the following using a singly linked list.
   a) Stack ADT b) Queue ADT
3. Write C++ programs to implement the deque (double ended queue) ADT using a doubly linked list and an array.
4. Write a C++ program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
5. Write C++ programs that use recursive functions to traverse the given binary tree in
   a) Preorder b) inorder and c) postorder.
6. Write C++ programs that use non-recursive functions to traverse the given binary tree in
   b) Preorder b) inorder and c) postorder.
7. Write C++ programs for the implementation of bfs and dfs for a given graph.
8. Write C++ programs for implementing the following sorting methods:
   a) Merge sort b) Heap sort
9. Write a C++ program to perform the following operations
   a) Insertion into a B-tree b) Deletion from a B-tree
10. Write a C++ program to perform the following operation
    a) Insertion into an AVL-tree
11. Write a C++ program to implement all the functions of a dictionary (ADT) using hashing.
12. Write a C++ program for implementing Knuth-Morris- Pratt pattern matching algorithm.

(Note: Use Class Templates in the above Programs**)**

References::

1. Data Structures and Algorithms Using C++ by Ananda Rao Akepogu and Radhika Raju Palagiri, Pearson Education, 2010.
2. Classic Data Structures by D. Samanta, 2005, PHI
3. Data Structures and Algorithms by G.A.V. Pai, 2009, TMH.
4. Design and Analysis of Computer Algorithms by Aho, Hopcraft, Ullman 1998, PEA.
5. Introduction to the Design and Analysis of Algorithms by Goodman, Hedetniemi, TMG
6. Design and Analysis of Algorithms by E. Horowitz, S. Sahani, 3rd Edition, Galgotia.
7. Data Structures and Algorithms in C++ by Drozdek 2nd Edition, Thomson.
8. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, 2nd edition, University Press

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M.Tech I semester (AI&ML)

L	T	P	C
0	0	4	2

(17D97109) PYTHON PROGRAMMING LAB

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all the operations present in a Scientific Calculator

2. Write a function that draws a grid like the following:

```
+ - - - - + - - - +
|         |       |
|         |       |
|         |       |
|         |       |
+ - - - - + - - - +
|         |       |
|         |       |
|         |       |
|         |       |
+ - - - - + - - - +
```

3. Write a function that draws a Pyramid with # symbols

```
          #
        # # #
      # # # # #
    # # # # # # #
          .
          .
          .
```

Up to 15 hashes at the bottom

4. Using turtles concept draw a wheel of your choice
5. Write a program that draws Archimedean Spiral
6. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least Ten letters of the alphabet.

7. The time module provides a function, also named time that returns the current Greenwich Mean Time in “the epoch”, which is an arbitrary time used as a reference point. On UNIX systems, the epoch is 1 January 1970.

```
>>> import time
>>> time.time()
1437746094.5735958
```

Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.

8. Given n+r+1 <= 2^r . n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above.
9. Write a program that evaluates Ackermann function
10. The mathematician Srinivasa Ramanujan found an infinite series that can be used to generate a numerical approximation of 1/ π :
    Write a function called estimate_pi that uses this formula to compute and return an estimate of π.

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{k=0}^{\infty} \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

It should use a while loop to compute terms of the summation until the last term is smaller than 1e-15 (which is Python notation for 10^{-15}). You can check the result by comparing it to math.pi.

11. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.
12. Given a text of characters, Write a program which counts number of vowels, consonants and special characters.
13. Given a word which is a string of characters. Given an integer say 'n', Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.
14. Given rows of text, write it in the form of columns.
15. Given a page of text. Count the number of occurrences of each latter (Assume case insensitivity and don't consider special characters). Draw a histogram to represent the same
16. Write program which performs the following operations on list's. Don't use built-in functions
    a) Updating elements of a list
    b) Concatenation of list's
    c) Check for member in the list
    d) Insert into the list
    e) Sum the elements of the list
    f) Push and pop element of list
    g) Sorting of list
    h) Finding biggest and smallest elements in the list
    i) Finding common elements in the list

18. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.

19. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Read the book you downloaded, skip over the header information at the beginning of the file, and process the rest of the words as before. Then modify the program to count the total number of words in the book, and the number of times each word is used. Print the number of different words used in the book. Compare different books by different authors, written in different eras.

20. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Write a program that allows you to replace words, insert words and delete words from the file.

21. Consider all the files on your PC. Write a program which checks for duplicate files in your PC and displays their location. Hint: If two files have the same checksum, they probably have the same contents.

22. Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.

23. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
24. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.

Reference Books:

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition, Available at http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016
3. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (AI&ML)

L	T	P	C
0	0	4	2

(17D97110) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING LAB

1. Ontological representation of knowledge
2. Given an iris data set (https://archive.ics.uci.edu/ml/datasets/iris), or any other data set, carry out the following by using R or Python
    1. Measures of central tendency (Mean, median, mode)
    2. Measures of dispersion (Mean deviation from mean, standard deviation/variance, range)
    3. Graphical representation of data : scatter diagram, Pie, Histograms, and box-plot
    4. Clustering using k-means with different k
    5. Clustering using BIRCH
    6. Clustering using DBSCAN
    7. Classification using SVM
    8. Classification using kNNC for different values of k
    9. Classification using Logistric regression.
    10. Implementation of EM algorithm

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97201) ADVANCE MACHINE LEARNING

Unit-1: **Data Mining**: Introduction and challenges. Association rule mining – apriori algorithm.FP Growth algorithm.

Unit-2: **Mining massive datasets**: MapReduce (distributed file systems, complexity theory for mapreduce), Finding similar items – LSH, Link Analysis – Concept of Pagerank, Efficient computation of page rank.

Unit-3: **Recommender Systems**: Review of linear algebra: eigen values, eigen vectors, SVD. Concept, Content based recommendations. Collaborative Filtering. Awareness of theNetflix Change.

Unit-4: **Mining Social Network Graphs**: Concept. Graph clustering. Graph partitionaling. Simrank.

Unit-5: **Dimensionality Reduction**: Principal component analysis. concepts of feature selection and reduction. Introduction to Deep Learning.

Text Books:

1. "Data Mining: Concepts and Techniques". Wiley. 2nd or 3rd Edition
2. "Mining of Massive Datasets". J. Leskovec, A. Rajaraman, J.D. Ullman. 3rd Edition. Cambridge University Press.
3. "Deep Learning". Ian Goodfellow and YoshuaBengio and Aaron Courville. https://www.deeplearningbook.org/

References

1. "Introduction to Data Mining". P.N. Tan, Vipin Kumar. Michael Steibach. Pearson.
2. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI & ML) **L T P C**

4 0 0 4

(17D97202) BIG DATA ENGINEERING

UNIT-I: Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional System – Intelligent data analysis – Nature of Data – Analytic Processes and Tool – Analysis vs Reporting – Modern Data Analytic Tool – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Prediction Error.

UNIT- II: Mining Data Streams: Introduction To Stream Concepts – Stream Data Model and Architecture - Stream Computing – Sampling Data in a Stream – Filtering Stream – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) Applications – Case Studies – Real Time Sentiment Analysis, Stock Market Predictions.

UNIT – III: Hadoop: History of Hadoop- The Hadoop Distributed File System – Components of Hadoop – Analyzing the Data with Hadoop – Scaling Out – Hadoop Streaming – Design of HDFS- Java interfaces to HDFSBasics- Developing a Map Reduce Application – How Map Reduce Works – Anatomy of a Map Reduce Job run – Failures – Job Scheduling – Shuffle and Sort – Task Execution – Map Reduce Types and Formats – Map Reduce Features.

UNIT – IV: Hadoop Environment: Setting up a Hadoop Cluster – Cluster specification – Cluster Setup and Installation –Hadoop Configuration – Security in Hadoop – Administering Hadoop – HDFS – Monitoring – Maintence – Hadoop Benchmarks – Hadoop in the Cloud.

UNIT –V: Frameworks: Applications on Big Data Using Pig and Hive – Data Processing operators in Pig – Hive Services – HiveQL – Querying Data in Hive – fundamentals of HBase and Zookeeper – IBM Info Sphere Big Insights and Streams. Visualization - Visual data analysis techniques, interaction techniques; Systems and applications.

Text Books:

1. Michael Berthold, David J.Hand, Intelligent Data Analysis, Spingers, 2007.
2. Tom White, Hadoop: The Definitive Guide Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, Uderstanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data, McGrawHill Publishing, 2012.
4. AnandRajaraman and Jeffrey David UIIman, Mining of Massive Datasets Cambridge University Press, 2012.

Reference Books:

1. Bill Franks, Taming the big Data tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data , John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
3. Jiawei Han, MichelineKamber, Data Mining Concepts and Techniques, Second Edition.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97203) APPLICATIONS OF AI & ML

Unit 1: Overview of Machine Learning in Healthcare, Overview of Machine Learning in Retail, Overview of Machine Learning in Finance

Unit 2: Key Technological advancements in Healthcare, How to Implement Machine Learning in Healthcare, Pitfalls to Avoid with Machine Learning in Healthcare

Unit 3: Key Technological Advancements in Retail, How to Implement Machine Learning in Retail, Pitfalls to Avoid With Machine Learning in Retail,

Unit4: Key Technological Advancements in Finance, How to Implement Machine Learning in Finance, Pitfalls to Avoid with Machine Learning in Finance

Unit5: Case Studies in Healthcare AI, Case Studies in Retail AI, Case Studies in Finance AI

Textbook:

1. **Puneet Mathur, "**Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance", Apress, 2018

References:

1. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva, "Artificial Intelligence (AI) Recent Trends and Applications", CRC Press, 2021

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D58208) NATURAL LANGUAGE PROCESSING

UNIT – I

Introduction to Natural Language, Applications of NLP, Corpora and Corpus Analysis, Lexicon and Morphology , Syntax and Semantics.

UNIT II

Language Modeling: Introduction, n-gram models, Smoothing: Interpolation and Backoff.

UNIT III

Introduction to Machine Translation: History, Rule Based MT, Direct Transfer & INTERLINGUA Approaches, MT Evaluation.

UNIT IV

Statistical MT: Parallel Corpus and Alignment, Lexical Translation Model, Decoding Algorithms.

UNIT V

Applications: Automatic Text Categorization, Text Summarization, Information Extraction, Sentiment Analysis.

Text Books:

1. "Natural Language Processing: An Information Access Perspective", Ess Ess Publications, Kavi Narayana Murthy, 2006.
2. "Foundations of Statistical Natural Language Processing", Christopher Manning, MIT Press, 1999.

Reference Books:

1. James A.. Natural language Understanding 2e, Pearson Education, 1994
2. Bharati A., Sangal R., Chaitanya V.. Natural language processing: a Paninian perspective, PHI, 2000
3. Siddiqui T., Tiwary U. S.. Natural language processing and Information retrieval, OUP, 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97204) GENETIC ALGORITHMS & APPLICATIONS

UNIT- I INTRODUCTION TO GENETIC ALGORITHM

Introduction to Genetic Algorithm – Robustness of Traditional Optimization and Search methods – Goals of optimization-GA versus Traditional methods – Simple GA – GA at work – Similarity templates (Schemata) – Learning the lingo - **Mathematical foundations:** The fundamental theorem - Schema processing at work. – The 2-armed & k-armed Bandit problem. – The building Block Hypothesis. – Minimal deceptive problem.

UNIT – II GA OPERATORS

Data structures – Reproduction- Roulette-wheel Selection – Boltzman Selection – Tournament Selection-Rank Selection – Steady –state selection –Crossover mutation – A time to reproduce, a time to cross. – Get with the Main program. – How well does it work. – Mapping objective functions to fitness forum. – Fitness scaling. Coding – A Multi parameter, Mapped, Fixed – point coding – Discretization – constraints

UNIT – III APPLICATIONS OF GA

The rise of GA – GA application of Historical Interaction. – Dejung & Function optimization – Current applications of GA -**Advanced operators & techniques in genetic search :**Dominance, Diploidy & abeyance – Inversion & other reordering operators. – other mine-operators – Niche & Speciation – Multi objective optimization – Knowledge-Based Techniques. – GA & parallel processes – Real life problem

UNIT – IV INTRODUCTION TO GENETICS-BASED MACHINE LEARNING

Genetics – Based Machine learning – Classifier system – Rule & Message system – Apportionment of credit: The bucket brigade – Genetic Algorithm – A simple classifier system in Pascal. – Results using the simple classifier system.

UNIT –V APPLICATIONS OF GENETICS-BASED MACHINE LEARNING

The Rise of GBMC – Development of CS-1, the first classifier system. – Smitch's Poker player.

– Other Early GBMC efforts. –Current Applications.

TEXT BOOKS

1. David E. Gold Berg, "Genetic Algorithms in Search, Optimization & Machine Learning", Pearson Education, 2001
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, " Neural Networks, Fuzzy Logic and Genetic Algorithms ", PHI , 2003 (Chapters 8 and 9)

REFERENCE BOOK

1. Kalyanmoy Deb, "Optimization for Engineering Design, algorithms and examples", PHI 1995
2. An Introduction to Genetic Algorithm by Melanie Mitchell
3. The Simple Genetic Algorithm Foundation & Theores by Michael P. Vosk

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97205) COMPUTATIONAL INTELLIGENCE

UNIT I

Introduction: Background and history of evolutionary computation, Behavioral Motivations for Fuzzy Logic, Myths and Applications areas of Computational Intelligence. Adaption, Self organization and Evolution, Historical Views of Computational Intelligence, Adaption and Self organization for Computational Intelligence, Ability to Generalize, Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing.

UNIT II

Review of evolutionary computation theory and concepts: History of Evolutionary Computation, Evolution Computation Overview, Genetic algorithms, Evolutionary programming, Evolution strategies, genetic programming, and particle swarm optimization.

UNIT III

Review of basic neural network theory and concepts: Neural Network History, What Neural Networks are and Why they are useful, Neural Networks Components and Terminology, Neural Networks Topology, Neural Network Adaption, Comparing Neural Networks and Other information Processing Methods, Preprocessing and Post Processing.

UNIT IV:

Fuzzy Systems Concepts and Paradigms: Fuzzy sets and Fuzzy Logic, Theory of Fuzzy sets , Approximate Reasoning , Fuzzy Systems Implementations , Fuzzy Rule System Implementation.

UNIT V:

Computational Intelligence Implementations: Implementation Issues, Fuzzy Evolutionary Fuzzy Rule System Implementation, Best tools, Applying Computational Intelligence to Data Mining.

Performance Metrics: General Issues, Percent Correct, Average Sum-squared Error.

Textbooks:

1. Computational Intelligence - Concepts to Implementations by Eberhart & Shi

References:

1. Introduction to Genetic Algorithms by Melanie Mitchell
2. Handbook of Genetic Algorithms by Davis
3. Machine Learning by Tom Mitchell

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D58207) CLOUD COMPUTING

UNIT-I

Introduction to cloud computing – The Evolution of cloud computing – Hardware Evolution- Internet Software Evolution – Server Virtualization – Web Services Deliver from the cloud– Communication-as-a-service–Infrastructure-as-a-service–Monitoring-as-a-service–Platform-as-a-Service - Software-as-a-service – Building Cloud Network.

UNIT-II

Federation in the cloud – presence in the cloud – Privacy and its Relation to cloud-Based Information Systems– Security in the cloud – Common Standards in the cloud-End-User Access to the cloud Computing.

UNIT-III

Introduction – Advancing towards a Utility Model – Evolving IT infrastructure – Evolving Software Applications – Continuum of Utilities- Standards and Working Groups- Standards Bodies and Working Groups- Service Oriented Architecture- Business Process Execution Language- Interoperability Standards for Data Center Management – Utility Computing Technology- Virtualization – Hyper Threading – Blade Servers- Automated Provisioning- Policy Based Automation- Application Management – Evaluating Utility Management Technology – Virtual Test and development Environment – Data Center Challenges and Solutions – Automating the Data Center.

UNIT-IV

Software Utility Application Architecture – Characteristics of a SaaS – Software Utility Applications – Cost Versus Value – Software Application Services Framework – Common Enablers – Conceptual view to Reality – Business profits – Implementing Database System for Multitenant Architecture.

UNIT-V

Other Design Consideration – Design of a Web Services Metering Interface – Application Monitoring Implementation – A Design for an update and Notification Policy – Transforming to Software as a Service – Application Transformation Program – Business Model Scenarios – Virtual Services for Organizations – The Future.

Text Books:

1. Guy Bunker and Darren Thomson, Delivering utiliy Computing, John Wiley & Sons Ltd, 2012.

References Books:

1. John W. Rittinghouse and Ames F. Ransome, Cloud Computing Implementation , Management and security, CRC press & Francis Group, Boca Raton London New York. 2010.

2. Alfredo Mendroza, Utility Computing Technologies, Standards, and Strategies Artech House INC, 2007.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97206) INTELLIGENT SYSTEMS

UNIT I: Knowledge Representation:

Data and knowledge: Data representation and data items in traditional databases, Data representation and data items in relational databases. Rules: Logical operations, Syntax and semantics of rules, Data log rule sets, the dependence graph of data log rule sets, Objects,Frames ,Semantic nets, Solving problems by reasoning: The structure of the knowledge base, The reasoning algorithm, Conflict resolution, Explanation of the reasoning.

Unit II: Rule Based Systems:

Forward reasoning: The method of forward reasoning, A simple case study of forward reasoning. Backward reasoning: Solving problems by reduction, The method of backward reasoning, A simple case study of backward reasoning, Bidirectional reasoning. Search Methods: Depth-first search, Breadth-first search, Hill climbing search, A* search. Contradiction freeness: The notion of contradiction freeness, Testing contradiction freeness, The search problem of contradiction freeness.

Completeness: The notion of completeness, Testing completeness, the search problem of completeness.Decomposition of knowledge bases: Strict decomposition, Heuristic decomposition

UNIT III: Tools for Representation and Reasoning:

The Lisp programming language: The fundamental data types in Lisp, Expressions and their evaluation, Some useful Lisp primitives, Some simple examples in Lisp, The Prolog programming language: The elements of Prolog programs, The execution of Prolog programs, Built-in predicates, and Some simple examples in Prolog. Expert system shells: Components of an expert system shell, Basic functions and services in an expert system shell.

UNIT IV: Real-Time Expert Systems:

The architecture of real-time expert systems: The real-time subsystem, The intelligent subsystem Synchronization and communication between real-time and intelligent subsystems: Synchronization and communication primitives, Priority handling and time-out. Data exchange between the real-time and the intelligent subsystems: Loose data exchange, The blackboard architecture. Software engineering of real-time expert systems: The software lifecycle of real- time expert systems, Special steps and tool, An Example of a Real-Time expert System.

UNIT V: Qualitative Reasoning and Petri Nets:

Sign and interval calculus, Qualitative simulation: Constraint type qualitative differential equations, The solution of QDEs: the qualitative simulation algorithm: Initial data for the simulation, Steps of the simulation algorithm, Simulation results. Qualitative physics, Signed directed graph (SDG) models, The Notion of Petri nets, The firing of transitions, Special cases and extensions, The state-space of Petri nets. The use of Petri nets for intelligent control, The analysis of Petri nets: Analysis Problems for Petri Nets, Analysis techniques.

TEXT BOOKS:

1. Intelligent Control Systems-An Introduction with Examples by Katalin M. Hangos, Rozália Lakner , Miklós Gerzson, **Kluwer AcademicPublishers.2001**

REFERENCES BOOKS:

1. IntelligentSystemsandControl:PrinciplesandApplicationsPaperback– **12Nov2009**by Laxmidhar Behera, Indrani KarbyOXFORD.
2. Intelligent Systems and Technologies Methods and Applications by Springer publications.
3. *Intelligent Systems - Modeling, Optimization and Control*, by Yung C. Shin and Chengying Xu, CRC Press, Taylor & Francis Group,2009

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97207) COGNITIVE SCIENCE

UNIT-1: Introduction to Cognitive Science:

Fundamental Concepts of cognitive science – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation, semantic networks, frames, conceptual dependency, scripts, Ontology- Understanding, Common Sense Reasoning.

UNIT-2: **Planning and Learning Methods:**

Planning – Situation Logic- Learning in Cognitive Systems- Rote Learning – Learning by Examples - Incremental Concept Learning – Inductive Learning - Classification Techniques – Statistical Reasoning- Bayesian Classification- Bayesian Networks- Concept Learning- Version Spaces - Discrimination Trees.

UNIT-3: **Reasoning methods:**

Reasoning by analogy – Explanation based reasoning – Case based reasoning- Constraint Satisfaction- Constraint Propagation- Temporal reasoning – Temporal Constraint Networks- Spatial reasoning- Visual Spatial reasoning- Meta reasoning – Learning by correcting mistakes-

AI ethics

UNIT-4: **Cognitive Modeling:**

Declarative/ logic-based computational cognitive modelling - connectionist models of cognition – Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory - modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding - modelling the interaction of language, memory and learning.

UNIT-5: **Modeling Paradigm:**

Modelling Select Aspects of Cognition Classical models of rationality - symbolic reasoning and decision making under uncertainty - Formal models of inductive generalization causality - Categorization and similarity analysis.

Cognitive Development:

Child concept acquisition - Child language learning - Acquisition of arithmetic skills – Distributed Cognition and Learning- Simple and Complex Decision Making – Reasoning Under Uncertainty – Natural Language Understanding – Natural Language Processing – Automated

Text Book(s):

1. José Luis Bermúdez, “Cognitive Science: An Introduction to the Science of the Mind”, Cambridge University Press, New York, 2014.
2. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing”, IGI Global Publishers, 2019.
3. Elaine Rich,Kevin Knight, Shivashankar B. Nair, “Artificial Intellegence”, 3rd Edition, TMS, third edirion.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97208) REINFORCEMENT LEARNING

UNIT-1: Reinforcement Learning Primitives:

Introduction and Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms, Random Variables, Probability Mass Function, Probability Density Function, Cumulative Distribution Function and Expectation. Introduction to Agents, Intelligent Agents – Problem Solving – Searching, Logical Agents.

UNIT-2: Markov Decision Process and Dynamic Programming:

Markov Property, Markov Chains, Markov Reward Process (MRP), Bellman Equations for MRP, Dynamic Programming: Polices (Evaluation, Improvement, Iteration, Value Iteration),Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

UNIT-3: Monte Carlo Methods and Temporal Difference Learning:

Monte Carlo: Prediction, Estimation of Action Values, Control and Control without Exploring Starts, Off-Policy Control, Temporal Difference Prediction:TD(0), SARSA: On-Policy TD control, Q-Learning: Off-Policy TD control, Games, Afterstates, and Other Special Cases.

UNIT-4: Deep Reinforcement Learning

Deep Q-Networks, Double Deep-Q Networks(DQN, DDQN, Dueling DQN, Prioritized Experience Replay).

Policy Optimization in RL

Introduction to Policy-based Methods, Vanilla Policy Gradient, REINFORCE Algorithm and Stochastic Policy Search, AsynchronousActor-Critic and Asynchronous Advantage Actor-Critic (A2C, A3C), Advanced Policy Gradient (PPO, TRPO, DDPG).

UNIT-5: Multi Agent in RL

Multi-Agent Learning, Meta-learning, Partially Observable Markov Decision Process, Ethics in RL, Applying RL for Real-World Problems

Text Book(s):

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson Education Limited, 2016.

Michael Wooldridge, “An Introduction to Multi Agent Systems”, John Wiley, 2002.

Reference Books:

1. Ian Goodfellow, YoshuaBengio, and Aaron Courville. "Deep learning." MIT press, 2017.
2. Marco Wiering, Martijn van Otterlo(Ed),"Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series, ALO, volume 12, Springer, 2012.
3. Keng, Wah Loon, Graesser, Laura, "Foundations of Deep Reinforcement Learning: Theory and Practice in Python", Addison Wesley Data & Analytics Series, 2020.
4. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.

RagavVenkatesan, Baoxin Li, “Convolutional Neural Networks in Visual Computing”, CRC Press, 2018

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

4 0 0 4

(17D97209) INTELLIGENT INFORMATION RETRIEVAL

UNIT-1: Fundamentals of IR Systems, Models and Indexing:

Overview of IR Systems,Information retrieval using the Boolean model, The dictionary and postings lists, Tolerant retrieval, Automatic Indexing, Index construction and compression, Scoring, Vector space model and term weighting

UNIT-2: Document Representation and Analysis:

Statistical Characteristics of Text, Regular Expressions, Text Normalization, Edit Distance, N- Gram Language Models, Naive Bayes and Sentiment Classification-Logistic Regression for Document Analysis

Query Processing and Evaluation:

Basic Query Processing,Data Structure and File Organization for IR, Evaluation in information retrieval-Relevance feedback, User Profiles, Collaborative Filtering and query expansion

UNIT-3: Retrieval Models:

Similarity Measures and Ranking, Boolean Matching, Vector Space Models, Probabilistic Models,XML Retrieval, Language models for information retrieval.

Text Classification and Clustering:

Text classification-vector space classification-support vector machines and machine learning on documents-Clustering-flat clustering- hierarchical clustering- Matrix decompositions and Latent semantic indexing

UNIT-4: Web Search Analysis:

Web search basics. web characteristics-index size and estimation- near duplicates and shingling-web crawling-distributing indexes- connectivity servers-link analysis-web as a graph-PageRank- Hubs and authoritative pages- summarization-question answering

UNIT-5: Web Mining and Online IR Systems:

Web mining and its applications-Mining Twitter, Facebook, Instagram, Linkedin, Mailboxes and GitHub.Online IR systems- online public access catalogs-digital libraries-architectural issues- document models -representations and access protocols

Text Book(s):

1. C. D. Manning, P. Raghavan, and H. Schutze, Introduction to Information Retrieval, Cambridge University Press (2008)
2. Ricardo Baezce Yates, Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search (2ndEd, 2010)
3. Mikhail Klassen, Matthew A. Russell, Mining the Social Web,O'Reilly Media, Inc., 3rd Edition (2019)

Reference Books:

1. Ceri, S., Bozzon, A., Brambilla, M., Della Valle, E., Fraternali, P. and Quarteroni, S., 2013. Web information retrieval. Springer Science & Business Media.
2. D. Jurafsky, and J. Martin, Speech and language processing : an introduction to natural language processing, computational linguistics, and speech recognition, Pearson Prentice Hall, Second Edition (2013)
3. Giles, Mark Smith, John Yen, Advances in Social Network Mining and Analysis ,Springer, 2010
4. Bruce Croft, Donald Metzler and Trevor Strohma, Search Engines: Information Retrieval in Practice (1st Ed 2009)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (AI&ML) **L T P C**

0 0 4 2

(17D97210) ADVANCE MACHINE LEARNING LAB

1. Implementation of Apriori rule mining algoirhm
2. Implementation of FP growth algorithm
3. Implementing MapReduce
4. Implemntation of LSH
5. Implementation of Page Rank
6. Implementing collaborative filtering algorithm on a sample dataset
7. Implmenting graph clustering
8. Dimensionality reduction using PCA
9. Write a program to implement AND OR gates using Perceptron.
10. Train a Deep learning model to classify a given image using pre trained model

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M.Tech II semester (AI&ML) **L T P C**

0 0 4 2

(17D97211) BIG DATA ENGINEERING LAB

1. Installation of R
   Installing R in windows, R Console (R window to edit and execute R Commands), Commands and Syntax (R commands and R syntax), Packages and Libraries (Install and load a package in R), Help In R, Workspace in R.
2. Implement the data structures using R Programming
   Introduction to Data Types (Why Data Structures?, Types of Data Structures in R), Vectors, Matrices, Arrays, Lists, Factors, Data Frames, Importing and Exporting Data.
3. Implement the Graphical Analysis using R
   Creating a simple graph (Using plot() command), Modifying the points and lines of a graph (Using type, pch, font, cex, lty, lwd, col arguments in plot() command), Modifying Title and Subtitle of graph (Using main, sub, col.main, col.sub, cex.main, cex.sub, font.main, font.sub arguments in plot() command), Modifying Axes of a Graph (Using xlab, ylab, col.lab, cex.lab, font.lab, xlim, ylim, col.axis, cex.axis, font.axis arguments and axis() command), Adding Additional Elements to a Graph (Using points(), text(), abline(), curve() commands), Adding Legend on a Graph (Using legend() command), Special Graphs (Using pie(), barplot(), hist() commands), Multiple Plots (Using mfrow or mfcol arguments in par() command and layout command).
4. Implement the Descriptive Statistics using R.
   Measure of Central Tendency (Mean, Median and Mode), Measure of Positions (Quartiles, Deciles, Percentiles and Quantiles), Measure of Dispersion (Range, Median, Absolute deviation about median, Variance and Standard deviation), Measure of Distribution (Skewness and Kurtosis), Box and Whisker Plot (Box Plot and its parts, Using Box Plots to compare distribution).
5. **In memory Data Analytics**: Window and text functions in SQL; Advanced SQL functions
6. **MongoDB**: Installation of MongoDB, Features of MongoDB: CRUD operations; import and export functions, indexes, aggregate functions, dealing with Nulls, count, limit, skip and sort functions and cursors
7. **Experiments on Hive and Pig**
   Data Wrangling using R
   Open refine tool for handling messy data

8. (i)Perform setting up and Installing Hadoop in its two operating modes: Pseudo distributed,• Fully distributed.•
   (ii) Use web based tools to monitor your Hadoop setup.

9. (i) Implement the following file management tasks in Hadoop: Adding files and directories• Retrieving files• Deleting files•

ii) Benchmark and stress test an Apache Hadoop cluster

10. . Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm. Find the number of occurrence of each word appearing in the input file(s)• Performing a MapReduce Job for word search count (look for specific keywords• in a file)

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M.Tech III semester (AI&SE) **L T P C**

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(17D20301) RESEARCH METHODOLOGY

UNIT I

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 – Basic Principles of Experimental Design.

UNIT II

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

Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation.

Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

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 V

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Text Books:

1. Research Methodology:Methods And Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.
2. Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As Pdf On Internet)
3. Research Methodology And Statistical Tools – P.Narayana Reddy And G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.

REFERENCES:

1. Scientists Must Write - Robert Barrass (Available As Pdf On Internet)

2. Crafting Your Research Future –Charles X. Ling And Quiang Yang (Available As Pdf On Internet)

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(17D20302) HUMAN VALUES AND PROFESSIONAL ETHICS

Unit I:

HUMAN VALUES:Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

Unit II:

ENGINEERING ETHICS: Senses of Engineering Ethics- Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg‟s theory- Gilligan‟s theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

Unit III :

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

UNIT IV:

ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing riskSafety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

UINIT V:

GLOBAL ISSUES: Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics .

Text Books :

1. “Engineering Ethics includes Human Values” by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.

2. “Engineering Ethics” by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

3. “Ethics in Engineering” by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.

4. “Professional Ethics and Morals” by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.

5. “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran , Laxmi Publications.

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M.Tech III semester (AI&ML)

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(17D20303) INTELLECTUAL PROPERTY RIGHTS

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

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

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Development Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.

International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Right, Deborah. E. Bouchoux, Cengage Learing.

2. Intellectual Property Right – Nleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,