



Course Structure for Master of Technology (Artificial Intelligence)

I Year I Semester

Code	Subject	L	T/P/D	C
1MTAI01	Advances in Artificial Intelligence	4	0	4
1MTAI02	Problem Solving Methods	4	0	4
1MTAI03	Knowledge Representation and Reasoning	4	0	4
1MTAI04	Machine Learning	4	0	4
	Elective- I	4	0	4
1MTAI05	1. Digital Image Processing			
1MTAI06	2. Pattern Recognition			
1MTAI07	3. Robotics & Automation			
	Elective –II	4	0	4
1MTAI08	1. Logic Programming using Prolog & Lisp			
1MTAI09	2. Expert Systems			
1MTAI10	3. Intelligent systems			
1MTAI11	Artificial Intelligence & Functional Programming Lab	0	4	2
	Total	24	4	26

I Year II Semester

Code	Subject	L	T/P/D	C
2MTAI01	Artificial Neural Networks	4	0	4
2MTAI02	Speech Processing	4	0	4
2MTAI02	Natural Language Processing	4	0	4
2MTAI03	Genetic Algorithms & Applications	4	0	4
	Elective –III	4	0	4
2MTAI04	1. Advanced Data Mining			
2MTAI06	2. Big Data Analytics			
2MTAI07	3. Computational Intelligence			
	Elective –IV	4	0	4
2MTAI08	1. Text Processing			
2MTAI08	2. Geographical Information System & Spatial Decision Support System			
2MTAI09	3. Logic and Engineering			
2MTAI10	Research Methodology (Audit Course)			
2MTAI11	Natural Language Processing & Genetic Algorithms Lab	0	4	2
	Total	24	4	26

II YEAR & III Semester

Code	Subject	L	P	C
3MTAI01	III Semester Seminar - I	0	4	2
3MTAI02	III & IV Semester Project Work	--	--	44
	Total	0	8	48

Note: All End Examinations (Theory and Practical) are of three hours duration.

T- Tutorial L- Theory

II YEAR & IV Semester

Code	Subject	L	P	C
4MTAI01	IV Semester Seminar - II	0	4	2
	Total	0	8	48

Note: All End Examinations (Theory and Practical) are of three hours duration.

T- Tutorial L- Theory P- Practical/Drawing C - Credits

P- Practical/Drawing C - Credits

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI01: Advances in Artificial Intelligence

Objectives:

- To learn the difference between optimal reasoning Vs human like reasoning
- To understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities
- To learn different knowledge representation techniques
- To understand the applications of AI: namely Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

UNIT-I

Introduction: What is AI? Foundations of AI, History of AI, Agents and environments, The nature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies

UNIT-II

Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Propositional logic, First-order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining

UNIT-III

Learning: Learning from observations, Forms of Learning, Inductive Learning, Learning decision trees, why learning works, Learning in Neural and Belief networks

UNIT-IV

Practical Natural Language Processing: Practical applications, Efficient parsing, Scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception, Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis

UNIT-V

Robotics: Introduction, Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Introduction to AI based programming Tools

TEXT BOOKS

1. Stuart Russell, Peter Norvig: “Artificial Intelligence: A Modern Approach”, 2nd Edition, Pearson Education, 2007

REFERENCES

1. Artificial Neural Networks B. Yagna Narayana, PHI
2. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).
3. Artificial Intelligence and Expert Systems – Patterson PHI.
4. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.
5. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.
6. Neural Networks Simon Haykin PHI

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI02: Problem Solving Methods

Objectives:

- To explain problem solving and reasoning strategies in AI systems
- To enable students to analyze a problem so that appropriate problem solving techniques may be applied
- To recognize the importance of dealing with the cause of a problem, rather than just dealing with the effect of a problem
- To learn how to generate alternative solutions, using creative thinking and brainstorming
- To learn the different stages of the decision making process and understand the importance of each stage in ensuring effective decisions are made
- To enable students to apply problem solving and decision making models to the workplace.

UNIT I

General introduction of AI: What is AI?, The foundations of AI, The history of AI, The state of the art.

Intelligent agents: Agents and environments, Good behavior: The concept of reality, The nature of environments, The structure of agents, AI applications.

UNIT II

Solving problems by searching: Problem-solving agents, Example problems, Searching for solutions, Uninformed search strategies, Avoiding repeated states, Searching with partial information.

Informed search and exploration: Informed search strategies, Heuristic functions, Local search algorithms and optimization problems, Local search in continuous spaces, Online search agents and unknown environments.

UNIT III

Constraint satisfaction problems: Backtracking search for CSPs, Local search for constraint satisfaction problems, The structure of problems.

Adversarial search: Games, Optimal decisions in games, Alpha-beta pruning, Imperfect real-time decisions, Games that include an element of chance, State-of-the-art game programs.

UNIT IV

Formalized symbolic logics: Introduction, Syntax and semantics for propositional logic, Syntax and semantics for first order propositional logic, Properties of WFFS, Connection to clausal

form, Inference rules, The resolution principle, Non-deductive inference methods, Representations using rules.

Resolution refutation systems: Production systems for resolution refutations, Control strategies for resolution methods, Simplification strategies, Extracting answers from resolution refutations.

UNIT V

The Planning problem: Planning with state-space search, Partial-order planning, Planning graphs, Planning with propositional logic, Analysis of planning approaches.

Planning and acting in the real world: Time, schedules, and resources, Hierarchical task network planning, planning and acting in nondeterministic domains, Conditional planning, Execution monitoring and replanning, Continuous planning, Multi-agent planning.

AI system architectures, Knowledge acquisition, Representational formalisms.

Text Books:

1. D. W. Patterson: Introduction to AI & Expert System, PHI.
2. S. Russell and P. Norvig. AI: A Modern Approach, 2nd Edn., McGraw-Hill, 2003.

Reference Books:

1. J. Siekmann, R. Goebel, and W. Wahlster: Problem Solving Methods, Springer, 2000 edition
2. N.J.Nilsson: Principles of Artificial Intelligence, Narosa Publications.

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI 03: Knowledge Representations and Reasoning

Objectives:

- To investigate the key concepts of knowledge representation (KR) techniques and different notations.
- To integrate the KR view as a knowledge engineering approach to model organizational knowledge.
- To introduce the study of ontologies as a KR paradigm and applications of ontologies.
- To understand various KR techniques.
- To understand process, knowledge acquisition and sharing of ontology.

Course Outcomes:

- Analyze and design knowledge based systems intended for computer implementation.
- Acquire theoretical knowledge about principles for logic-based representation and reasoning.
- Ability to understand *knowledge*-engineering process
- Ability to implement production systems, frames, inheritance systems and approaches to handle uncertain or incomplete knowledge.

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.

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI 04: Machine Learning

Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes:

- Ability to understand what is learning and why it is essential to the design of intelligent machines.
- Ability to design and implement various machine learning algorithms in a wide range of real-world applications.
- Acquire knowledge deep learning and be able to implement deep learning models for language, vision, speech, decision making, and more

UNIT I 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 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 Evaluation and Learning.

UNIT III 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 INSTANT BASED LEARNING

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

UNIT V 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. Machine Learning – Tom M. Mitchell, - MGH

REFERENCE BOOKS

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

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI 05: DIGITAL IMAGE PROCESSING

Elective-I

Objectives:

- Develop an overview of the field of image processing.
- Understand the Image segmentation, enhancement, compression etc., approaches and how to implement them.
- Prepare to read the current image processing research literature.
- Gain experience in applying image processing algorithms to real problems
- Analyze general terminology of 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 Stanadrds.

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

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI 06: PATTERN RECOGNITION
Elective-I

Objectives:

- Understand the fundamental pattern recognition and machine learning theories
- Able to design and implement certain important pattern recognition techniques
- Capable of applying the pattern recognition theories to applications of interest.

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

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI 07: Robotics & Automation

(Elective - I)

Course Outcomes:

- Acquire basic Knowledge on Robots
- Ability to process end effectors and robotic controls.
- Analyze Robot Transformations and Sensors
- Able to understand Robot cell design and applications

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.

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI 08: Logic Programming using Prolog & Lisp
(Elective -II)

Objectives:

Students will become familiar with:

- the basic syntax of Prolog language.
- giving a declarative and procedural reading of a Prolog program.
- pursuing any course that makes use of predicate calculus or Prolog.
- how to better utilize recursion through functional programming
- how to write common Lisp programs as groups of functions and definitions
- how to use the common Lisp programming environment including the debugger
- what symbolic computing is and some common AI problems and Lisp-based solutions
- Programming concepts like variable binding, memory allocation and deallocation, scope, the run-time stack. etc.

UNIT I

Prolog Representation: Introduction, Logic-Based Representation, Prolog Syntax, Creating, Changing, and Tracing a Prolog Computation, Lists and Recursion in Prolog.

Structured Representation and Inheritance Search: Abstract Data Types and Search, Using cut, Control Search in prolog, Abstract Data Types (ADTs) in Prolog.

UNIT II

Depth-First, Breadth-First and Best-First Search: Production System Search, Designing Alternative Search Strategies.

Meta-Linguistic Abstraction, Types and Meta-Interpreters: Meta-Interpreters, Types, and Unification, Types in prolog, Unification, Variable Binding, and Evaluation.

UNIT III

Machine Learning Algorithms in Prolog: Machine Learning: Version Space Search, Explanation Based Learning in Prolog.

Programming in Lisp: S-Expressions, Syntax of LISP, Lists and Recursive Search, Variables, Datatypes, High Order Functions, Logic Programming in LISP, Lisp-Shell.

UNIT IV

Semantic Networks, Inheritance and Machine Learning: Sematic Nets, Inheritance, Object-

Oriented Lisp, Learning ID3 Algorithm, Implementing ID3 Algorithm.

UNIT V

Java, Representation and Object-Oriented Programming, Problem Spaces and Search, A Logic-Based Reasoning System, An Expert System Shell

TEXT BOOKS

1. George F. Luger, William A. Stubblefield, Pearson Publishers, AI Algorithms, Data Structures, and Idioms in Prolog, Lisp and Java 6th Edition

REFERENCES

1. Logic, Programming and Prolog by Ulf Nilsson, Jan Maluszynski. Wiley; 2 edition (August 1995)
2. The Art of Prolog: Advanced Programming Techniques (Mit Press Series in Logic Programming) by Leon Sterling and Ehud Shapiro (Oct 1986)
3. Prolog Programming for Artificial Intelligence (4th Edition) (International Computer Science Series) by Ivan Bratko (Aug 31, 2011)
4. Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp by Peter Norvig (Oct 15, 1991)
5. Common LISP: The Language by Guy L. Steele (Mar 16, 1984)
6. Lisp 3rd Edition, Bertbold Klaus Paul Horn, Patrick Henry Winston
7. Artificial Intelligence Common LISP 1st Edition (Hardcover) by Noyes, James S. Noyer, James L. Noyes

M.Tech. I– I Sem (AI)

T	P	C
4	0	4

1MTAI 09: Expert Systems

(Elective - II)

Course Outcomes:

- Acquire knowledge on fundamentals of knowledge representation
- Analyze Probabilistic Reasoning for knowledge
- Able to understand expert systems architecture

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.

1MTAI 10: Intelligent Systems(Elective - II)

Objectives:

- One of the major challenges of Intelligent Systems is to make the computer systems on which we rely so much more “intelligent”. There are two ways in which a system can be taken to act intelligently.
- Artificial intelligence covers a whole range of methods, from logical, symbol manipulation methods with attached semantics to statistical and heuristic techniques.
- Knowledge is mainly statistical: the aim is not to understand the fine structure or deeper origin of knowledge, but to generate intelligent behavior on the basis of statistical evidence.

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 Academic Publishers.**

REFERENCES BOOKS:

- 1. Intelligent Systems and Control: Principles and Applications Paperback – 12 Nov 2009**
by Laxmidhar Behera, Indrani Kar by OXFORD.
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

M.Tech I Sem. (AI)

T	P	C
0	3	2

1MTAI 11: Artificial Intelligence and Functional Programming

LabCourse Objective

1. To provide students with a theoretical and practical base in Artificial Intelligence.
2. Students will be able pursue their study in advanced functional programming.
3. Students will able to Design, Implement, and Analyze simple problem solving technique.
4. Students will able to identify, formulate, and solve problems.

Course Outcomes:

1. Able to understanding of the major areas and challenges of AI
2. Ability to apply basic AI algorithms to solve problems
3. Able to describe search strategies and solve problems by applying a suitable search method.
4. Able to describe and apply knowledge representation.

List of Experiments:

Week 1

1. Write a program to implementation of DFS
2. Write a program to implementation of BFS

Week 2

1. Write a Program to find the solution for traveling salesman Problem

Week 3

1. Write a program to implement Simulated Annealing Algorithm
2. Write a program to find the solution for wampus world problem

Week 4

1. Write a program to implement 8 puzzle problem

Week 5

1. Write a program to implement Tower of Hanoi problem

Week 6

1. Write a program to implement A* Algorithm

Week 7

1. Write a program to implement Hill Climbing Algorithm

Week 8

1. To Study JESS expert system

Week 9

1. To Study RVD expert system

Week 10

1. Write a Program to Perform Fibonacci Series
2. Write a Program to Check Sides of a Triangle

Week 11

1. Write a Program to Perform Length of List
2. Write a Program to Perform Reverse in List.

Week 12

1. Write a Prolog program to perform Arithmetic Mean.
2. Write a Program to Check Vowels or Not.

SunRise University

2MTAI 01: Artificial Neural Networks

Objectives:

- To Survey of attractive applications of Artificial Neural Networks.
- To practical approach for using Artificial Neural Networks in various technical, organizational and economic applications

UNIT I: INTRODUCTION: History Of Neural Networks, Structure And Functions Of Biological And Artificial Neuron, Neural Network Architectures, Characteristics Of ANN, Basic Learning Laws and Methods.

UNIT II: SUPERVISED LEARNING: Single Layer Neural Network and architecture, McCulloch-Pitts Neuron Model, Learning Rules, Perceptron Model, Perceptron Convergence Theorem, Delta learning rule, ADALINE, Multi-Layer Neural Network and architecture, MADALINE, Back Propagation learning, Back Propagation Algorithm.

UNIT III: UNSUPERVISED LEARNING-1: Outstar Learning, Kohonen Self Organization Networks, Hamming Network And MAXNET, Learning Vector Quantization, Mexican hat.

UNIT IV: UNSUPERVISED LEARNING-2: Counter Propagation Network -Full Counter Propagation network, Forward Only Counter Propagation Network, Adaptive Resonance Theory (ART) -Architecture, Algorithms.

UNIT V : ASSOCIATIVE MEMORY NETWORKS : Introduction, Auto Associative Memory ,Hetero Associative Memory, Bidirectional Associative Memory(BAM) -Theory And Architecture, BAM Training Algorithm, Hopfield Network: Introduction, Architecture Of Hopfield Network.

TEXT BOOKS:

1. B.Yegnanarayana” Artificial neural networks” PHI ,NewDelhi.
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.

REFERENCE BOOKS:

1. S.Rajasekaran and G.A.Vijayalakshmi pai “Neural Networks.Fuzzy Logic and genetic Algorithms”.
3. James A Freeman and Davis Skapura” Neural Networks Algorithm, applications and programming Techniques ”, Pearson Education, 2002.
4. Simon Hakins “Neural Networks “ Pearson Education.

SunRise University

1MTAI 02: Speech Processing

Objectives:

- To analyze a speech signal in terms of its frequency content.
- To understand the basics of human speech production mechanism.
- To understand which speech coding methods are used for what reasons.
- To implement LPC Analysis.

UNIT I

FUNDAMENTALS OF DIGITAL SPEECH PROCESSING: Anatomy & physiology of speech organs, The process of speech production, The acoustic theory of speech production, Digital models for speech signals.

UNIT II

TIME DOMAIN MODELS FOR SPEECH PROCESSING: Introduction- Window considerations, Short time energy and average magnitude short time average zero crossing rate, Speech Vs Silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT III

LINEAR PREDICTIVE CODING (LPC) ANALYSIS: Basic principles of linear predictive analysis: The Autocorrelation method, The covariance method, solution of LPC equations: Cholesky Decomposition, solution for covariance method, Durbin's recursive solution for the Autocorrelation equations, Comparison between the methods of solution of the LPC parameters, Formant analysis using LPC parameters.

HOMOMORPHIC SPEECH PROCESSING: Introduction, Homomorphic systems for convolution: Properties of the complex cepstrum, computational considerations, The complex cepstrum of speech, pitch detection, Formant estimation, The homomorphic vocoder.

SPEECH SYNTHESIS

Formant Speech Synthesis –Concatenative Speech Synthesis – Prosodic Modification of Speech– Source Filter Models For Prosody Modification

UNIT IV

AUTOMATIC SPEECH RECOGNITION: Basic pattern recognition approaches, parametric representation of speech, Evaluating the similarity of speech patterns, isolated digit recognition system, continuous digit recognition system.

HIDDEN MARKOV MODEL (HMM) FOR SPEECH: Hidden markov model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS, Adapting to variability in speech, Language models.

UNIT V

SPEAKER RECOGNITION: Recognition techniques, Features that distinguish speakers, speaker recognition systems: speaker verification system, Speaker identification system.

SPEECH ENHANCEMENT: Nature of interfering sounds, speech enhancement techniques, spectral subtraction, Enhancement by re-synthesis.

TEXT BOOKS:

1. L.R.Rabiner and S.W.Schafer. Digital processing of speech signals,Pearson.
2. Douglas. O. Shaughnessy, speech communication, second edition Oxford university press,2000.
3. Fundamentals of speech recognition- L.R. Rabinar and B.H.Juang

REFERENCES:

1. Discrete Time Speech Signal Processing-Thomas F. Quateri 1/e,Pearson.
2. Speech & Audio signal processing- Ben Gold & Nelson Morgan,1/e,Wiley.

2MTAI02: Natural Language Processing

Objectives:

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

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.

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.

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.

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.

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.

Multilingual Information Retrieval

Introduction, Document Preprocessing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Multilingual Automatic Summarization

Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

TEXT BOOKS:

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

REFERENCES 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.

M.Tech. I– II Sem (AI)

T	P	C
4	0	4

2MTAI03: Genetic Algorithms & Applications

Objectives:

- To understand the search methods in the genetic algorithms
- To implement the reproduction concepts.
- To design the techniques of dominance in genetic algorithms.

Course Outcomes:

- An ability to understand and the fundamental concepts of Genetic algorithms
- Understand the consequence of applying various genetic operators
- Ability to analyze GA operators and implement them to solve different types of GA problems
- Creating and understanding about the way the GA is used and the domain of application

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

2MTAI 04: Advanced Data Mining(Elective-III)

Objectives:

- To develop the abilities of critical analysis to data mining systems and applications.
- To implement practical and theoretical understanding of the technologies for data mining
- To understand the strengths and limitations of various data mining models.

UNIT-I

Introduction about data mining, Need of data mining, Business data mining, data mining tools, Data Mining Process: CRISP Data Mining, Business Understanding, data understanding and data preparation, modeling, evaluation and deployment, SEMMAS Process, Data mining applications, comparison of CRISP & SEMMA.

UNIT-II

Memory-Based Reasoning Methods, Matching ,Weighted Matching, Distance Minimization Data Mining Methods As Tools X Contents, Association Rules in Knowledge Discovery, Market-Basket Analysis, Market Basket Analysis Benefits Demonstration on Small Set of Data, Real Market Basket Data The Counting Method Without Software.

UNIT-III

Fuzzy Sets in Data Mining, Fuzzy Sets and Decision Trees, Fuzzy Sets and Ordinal Classification, Fuzzy Association Rules, Demonstration Model, Computational Results, Testing Inferences.

Rough Sets :Theory of Rough Sets , Information System, Decision Table, Applications of Rough Sets, Rough Sets Software Tools, The Process of Conducting Rough Sets Analysis, Data Pre-Processing, Data Partitioning, Discretization, Reduct Generation, Rule Generation and Rule Filtering, Apply the Discretization Cuts to Test Dataset, Score the Test Dataset on Generated Rule set , Deploying the Rules in a Production System.

UNIT-IV

Support Vector Machines, Formal Explanation of SVM, Primal Form, Dual Form, Soft Margin, Non-linear Classification, Regression, implementation, Kernel Trick.

Use of SVM–A Process-Based Approach, Support Vector Machines versus Artificial Neural Networks, Disadvantages of Support Vector Machines, Genetic Algorithm Support to Data Mining, Demonstration of Genetic Algorithm, Application of Genetic Algorithms in Data Mining

UNIT-V

Performance Evaluation for Predictive Modeling, Performance Metrics for Predictive Modeling, Estimation Methodology for Classification Models, Simple Split, The k -Fold Cross Validation Bootstrapping and Jackknifing, Area Under the ROC Curve.

Applications: Applications of Methods Memory-Based Application, Association Rule Application Fuzzy Data Mining, Rough Set Models, Support Vector Machine Application, Genetic Algorithm Applications-Product Quality Testing Design, Customer Targeting .

Text Book:

[1] Advanced Data Mining Techniques Authors: David L. Olson (Author), Dursun Delen.

References :

[1] Advances in data mining and modeling by Wai-Ki Ching Michael Kwok-Po Ng

[2] Advanced Techniques in Knowledge Discovery and Data Mining edited by Nikhil R. Pal, Lakhmi C Jain.

[3] Dynamic and Advanced Data Mining for Progressing Technological Development: Innovations and Systemic Approaches A B M Shawkat Ali (Central Queensland University, Australia) and Yang Xiang (Central Queensland University, Australia)

M.Tech. I– IISem (AI)

T	P	C
4	0	4

**2MTAI 08: Big Data
Analytics(Elective
III)**

Course Objectives:

- To understand Big Data Analytics for different systems like Hadoop.
- To learn the design of Hadoop File System.
- To learn how to analyze Big Data using different tools.
- To understand the importance of Big Data in comparison with traditional databases.

Course Outcomes:

- To gain knowledge about working of Hadoop File System.
- Ability to analyze Big Data using different tools.

UNIT- I

Introduction to Big Data. 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.

UNIT-II

The design of HDFS. 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.

UNIT-III

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.

UNIT-IV

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.

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.

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.

References:

1. Big Data and Health Analytics Hardcover [Katherine Marconi](#) (Editor), [Harold Lehmann](#) (Editor)
2. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications by bart baesens, Wiley publications.

**2MTAI05: Computational Intelligence
(ELECTIVE-III)**

Course Objectives:

- Computational Intelligence is the successor to Artificial Intelligence
- Offering special benefits in its applications in certain areas like Classification, Regression, Pattern Matching, Control, Robotics, Data Mining etc.
- To introduce the basic tools and techniques in Computational Intelligence such as Neural Networks and Genetic Algorithms from an application perspective to the students.

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

SunRise University

**2MTAI 06: Text
Processing
(Elective IV)**

OBJECTIVES:

To understand:

- various static methods of the Character wrapper class
- additional methods of the String class
- the difference between a String object and a String Buffer object
- the use of a String Tokenizer object that extracts tokens from a string
- the processing of delimited values read in from a text file

UNIT-I

The Information Environment- Automatic information processing, Types of information. The Automated Office - The Office Environment, Analyzing Office Systems, File Management Systems, Office Display Systems, Office-Information Retrieval. Text Editing and Formatting- Introduction, Approaches to word Processing, Text Editing & Formatting, Typical processing systems, Automatic typesetting systems.

UNIT-II

Text Compression-Statistical language characteristics, rationale for text compression, Text compression methods. Text Encryption- Basic cryptographic concepts, Conventional cryptographic systems, DES. File Accessing Systems- Basic concepts, Sequential search, single key Indexed searches, Tree searching, Balanced Search Trees, Multiway Search Trees, Hash-Table Access, Indexed Searches for Multikey Access, Bitmap Encoding for Multikey Access.

UNIT-III

Conventional Text-Retrieval Systems- Database Management and Information Retrieval, Text Retrieval Using Inverted Indexing Methods, Typical File Organization, Text-scanning systems, Hardware aids to text searching. Automatic Indexing - Indexing Environment, Indexing Aims, Single – term Indexing Theories, Term Relationships in Indexing, Term-phrase Formation, Thesaurus-Group Generation, A blue print for Automatic indexing.

UNIT-IV

Advanced Information-Retrieval Models- The Vector Space Model, Automatic Document Classification, Probabilistic Retrieval Model, Extended Boolean Retrieval Model, Integrated System for Processing Text and Data, Advanced Interface Systems. Language Analysis and Understanding- The Linguistic Approach, Dictionary Operations, Syntactic Analysis, Knowledge-based Processing, Specialized Language Processing.

UNIT-V

Automatic Text Transformations- Text transformations, Automatic writing Aids, Automatic abstracting systems, Automatic Text Generation, Automatic Translation. Paperless Information Systems- Paperless Processing, Processing Complex Documents, Graphics Processing, Speech Processing, Electronic Mail and Messages, Electronic Information Services, Electronic Publications and the Electronic Library.

Text Books:

1. Gerald Salton, "Automatic Text Processing", Addison-Wesley, 1989.

References:

1. Bran Boguraev, Ted Briscoe (Eds), "Computational Lexicography for Natural Language Processing", Longman, 1989.
2. A V Aho, Ravi Sethi, J D Ullman, "Compilers: Principles, Techniques and Tools", Addison-Wesley.
3. Robert Sedgewick, "Algorithms in C", Addison Wesley, 1990.

M.Tech. I– II Sem (AI)

T	P	C
4	0	4

2MTAI07: Geographical Information Systems & Spatial Decision Support Systems

(Elective-IV)

Course Outcomes:

- Analyse the Fundamental mechanism of GIS
- Process spatial and attribute data to prepare thematic maps
- Identify decision support models, methods, and technologies
- Analyse and prepare the DSS for the remote sensing and GIS applications

UNIT 1

Map – mapping concepts, analysis with paper based maps, limitations, Computer Automated Cartography – History and Developments, GIS- Definition, advantages of digital maps.

UNIT 2

Fundamentals of GIS – Information Systems, Modeling Real World Features Data , Data Formats – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arcview, ArcGIS, Autocad Map, Map Info etc.

UNIT 3

Spatial Analysis and Modeling – Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis, Spatial Auto Correlation, Gravity Modeling, DTM/DEM, Integration with Remote Sensing data

UNIT 4

Introduction: Concepts of decision making, systems and modeling, Need for DSS, Expert Systems.

Decision Analysis and Decision Making: Decision environments, Decision making under certainty, risk and uncertainty, Concepts of multicriteria decision making, Value and utility concepts in decision making, overview of methods of multicriteria decision making.

UNIT 5

Overview of DSS: Characteristics and capabilities of DSS, Components of DSS, Data management, model management and user interface subsystems, Classification of DSS, Development of DSS, Approaches to DSS construction, DSS development tools.

Text Books:

1. Thanappan Subash., Geographical Information System, Lambert Academic Publishing, 2011.
2. Paul Longley., Geographic Information systems and Science, John Wiley & Sons, 2005
3. Efraim Turban and Jay E. Aronson, Decision Support Systems and Intelligent Systems, Prentice Hall College Div; 5 edition.,1997.

References:

1. Marble, D.F & Calkins, H.W., Basic Readings in Geographic Information System, Spad System Ltd, 1990. ArcGIS 10.1 Manuals, 2013.
2. Kang Tsung Chang., Introduction to Geographic Information Systems, Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2008.
3. Burrough, P.A., Principles of GIS for Land Resource Assessment, Oxford Publications, 2005

2MTAI 08: Logic and Engineering
(Elective IV)

OBJECTIVES:

- To understand fuzzy logic basics and operations,
- To understand fuzzy arithmetic and representations and classical logic.
- Able to understand automated methods for fuzzy systems.
- Able to apply fuzzy logic for engineering problems.

UNIT-I

Introduction: The Case for Imprecision, A Historical Perspective, The Utility of Fuzzy Systems, Limitations of Fuzzy Systems, The Illusion: Ignoring Uncertainty and Accuracy, Uncertainty and Information, The Unknown, Fuzzy Sets and Membership, Chance Versus Fuzziness, Sets as Points in Hypercubes.

Classical Sets and Fuzzy Sets: Classical Sets, Fuzzy Sets

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations, Fuzzy Relations, Tolerance and Equivalence Relations, Fuzzy Tolerance and Equivalence Relations, Value Assignments, Other Forms of the Composition Operation.

Properties of Membership Functions, Fuzzification, and Defuzzification: Features of the Membership Function, Various Forms, Fuzzification, Defuzzification to Crisp Sets, λ -Cuts for Fuzzy Relations, Defuzzification to Scalars.

UNIT-II:

Logic and Fuzzy Systems: Logic, Fuzzy Systems.

Development of Membership Functions: Membership Value Assignments.

UNIT-III:

Automated Methods for Fuzzy System: Definitions, Batch Least Squares Algorithm, Recursive Least Squares Algorithm, Gradient Method, Clustering Method, Learning From Examples, Modified Learning From Examples,

Decision Making with Fuzzy Information: Fuzzy Synthetic Evaluation, Fuzzy Ordering, Nontransitive Ranking, Preference and Consensus, Multiobjective Decision Making, Fuzzy Bayesian Decision Method, Decision Making Under Fuzzy States and Fuzzy Actions.

UNIT-IV:

Fuzzy Classification: Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, c -Means Clustering, Hard c -Means (HCM), Fuzzy c -Means (FCM), Classification Metric, Hardening the Fuzzy c -Partition, Similarity Relations from Clustering.

Fuzzy Pattern Recognition: Feature Analysis, Partitions of the Feature Space, Single-Sample Identification, Multifeature Pattern Recognition, Image Processing.

UNIT-V:

Fuzzy Arithmetic and the Extension Principle: Extension Principle, Fuzzy Arithmetic, Interval Analysis in Arithmetic, Approximate Methods of Extension

Fuzzy Control Systems: Control System Design Problem, Examples of Fuzzy Control System Design, Fuzzy Engineering Process Control, Fuzzy Statistical Process Control, Industrial Applications.

Text Book:

Timothy J. Ross, Fuzzy Logic with Engineering Applications, third edition, Willey, 2010.

Text Books:

2. Gerald Salton, "Automatic Text Processing", Addison-Wesley, 1989.

References:

4. Bran Boguraev, Ted Briscoe (Eds), "Computational Lexicography for Natural Language Processing", Longman, 1989.
5. A V Aho, Ravi Sethi, J D Ullman, "Compilers: Principles, Techniques and Tools", Addison-Wesley.
6. Robert Sedgewick, "Algorithms in C", Addison Wesley, 1990.

M.Tech. I – II Sem.(AI)

2MTAI 01: Research Methodology (Audit Course)

Audit Course For M.Tech. –II Semester

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)**

SunRise University

2MTAI09: Natural Language Processing & Genetic Algorithms Lab

Objectives:

- able to explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
- Understand language modeling.
- To implement the reproduction concepts.
- To design the techniques of dominance in genetic algorithms

Part A: Natural Language Processing

1. Write a program given a piece of text, we want to split the text at all spaces (including new line characters and carriage returns) and punctuation marks.
2. Write a program to remove the first and last characters if they are not letters or numbers from a given sentence.
3. Write a program to split a word into pair's at all possible positions. For example, carried will be split into {c, arried, ca ,rried, car, ried, carr, Ied, carri, ed, carri, d}.
4. Write a program to find out the frequencies of distinct words, given a sentence.
5. Write a program to remove digits from a given sentence using Greedy Tokenizer.

Part B: Genetic Algorithms

1. Write a program that generates a pseudorandom integer between some specified lower limit and some specified upper limit. Test the program by generating 1000 numbers between 3 and 12.
2. Create a procedure that receives two binary strings and a crossing site value, performs simple crossover, and returns two offspring strings. Test the program by crossover the following strings of length 10:1011101011, 0000110100. Try crossing site values of -3, 1, 6 and 20.

3. For the function $f(x)=x^2$ on the interval $[0,31]$ coded as a five-bit, unsigned binary integer. Calculate the average fitness values for all 3^5 schemata.
4. Improve the efficiency of the selection procedure by implementing a binary search using cumulative selection probability distribution values.
5. Implement a coding routine to implement a floating-point code with specified mantissa and exponent.
6. Develop a ranking procedure that gives one copy to the population mean, MAX copies to the population best, with linear variation of copies assumed everywhere else (use stochastic remainder selection after ranking and assignment).
7. Develop a multiple-point crossover procedure similar to De Jong's with parameter CP (no. of crossover points).
8. Write a program and test the cycle crossover operator for a permutation string representation
9. Write a program to test the order crossover operator for permutation coding.
 - a) Write a program to demonstrate the genetic operator mutation.
 - b) Write a program to demonstrate the crossover genetic operator.
10.
 11. Write a program to evolve a word with non-repetitive character (eg 'computer') by taking a population size of say 5 and performing mutation and crossover.