ARTIFICIAL INTELLIGENCE

Programme Structure

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits
CSE2351	Basics of Artificial Intelligence	3	-	-	3
CSE2451	Artificial Neural Networks	3	-	-	3
CSE 2551	Fuzzy Logic	3	-	-	3
CSE2651	Introduction to Genetic Algorithm	3	-	-	3
CSE2751	Soft Computing	3	-	-	3
CSE2851	Project (Artificial Intelligence)	3	-	-	3
	TOTAL				**18**

ARTIFICIAL INTELLIGENCE

Syllabus

BASICS OF ARTIFICIAL INTELLIGENCE

Course Code: CSE2351 **Credit Units: 03**

Course Objective:
To develop semantic-based and context-aware systems to acquire, organize process, share and use the knowledge embedded in multimedia content. Research will aim to maximize automation of the complete knowledge lifecycle and achieve semantic interoperability between Web resources and services. The field of Robotics is a multi disciplinary as robots are amazingly complex system comprising mechanical, electrical, electronic H/W and S/W and issues germane to all these.

MODULE- I
AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

MODULE-II
Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions**.**

MODULE-III
Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Baye's probabilistic interferences and dempstershafer theory.

MODULE- IV
First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning,Decisiontrees,Explanationbasedlearning,Statistical Learning methods ,Reinforcement Learning.

MODULE- V
Expert systems:- Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Reference Books:-

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.
4. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

ARTIFICIAL NEURAL NETWORKS

Course Code: CSE2451 **Credit Units: 03**

Module-I

Artificial Neural Networks (ANN) and their biological roots and motivations. ANNs as numerical data/signal/image processing devices.a summing dendrite, synapses and their weights, pre- and post-synaptic signals, activation potential and activation function. Excitatory and inhibitory synapses. The biasing input. Types of activating functions.Encoding (training phase) and decoding (active phase). Taxonomy of neural networks:-feedforward and recurrent networks with supervised and unsupervised learning laws, static &dynamic processing systems, basic data structures: mapping of vector spaces, clusters, principal components.

Module-II

Linear Networks:-Adaline - the adaptive linear element, Linear regression. The Wiener-Hopf equation.The Least-Mean-Square (Widrow-Hoff) learning algorithm.Method of steepest descent.Adaline as a linear adaptive filter.A sequential regression algorithm.

Multi-Layer Feedforward Neural Networks:- Multi-Layer Perceptrons. Supervised Learning.Approximation and interpolation of functions.Back-Propagation Learning law. Fast training algorithms. Applications of multilayer perceptrons: Image coding, Paint-quality inspection, Nettalk.

Module-III

Self-Organising Systems:-Unsupervised Learning,Pattern clustering , Topological mapping , Kohonen's self-organizing map , Local learning laws-GeneralisedHebbian Algorithm. The Oja's and Sanger's rules. Principal component analysis - Karhunen-Loeve transform.

Module-IV

Feedback neural networks:- Pattern storage and retrieval, Hopfield model, Boltzmann machine, Recurrent neural networks.

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Module-V

Radial basis function networks:- Regularization theory, RBF networks for function approximation, RBF networks for pattern classification.

Kernel methods for pattern analysis:- Statistical learning theory, Support vector machines for pattern classification, Support vector regression for function approximation, Relevance vector machines for classification and regression.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Reference Books:-

1. B.Yegnanarayana, Artificial Neural Networks, Prentice Hall of India.
2. Satish Kumar, Neural Networks – A Classroom Approach, Tata McGraw-Hill.
3. S.Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall.

FUZZY LOGIC

Course Code: CSE2551 **Credit Units: 03**

MODULE- I

Introduction: Background, Uncertainty and imprecision, Statistics and random processes, Uncertainty in information, Fuzzy sets and membership, Chance versus ambiguity, Classical sets - operations on classical sets to functions, Fuzzy sets-fuzzy set operations, Properties of fuzzy sets, sets as points in hypercube.

MODULE-II

Classical Relations And Fuzzy Relations: Cartesian product, Crisp relations-cardinality of crisp relations, Operations on crisp relations, Properties of crisp relations, Compositions, Fuzzy relations-cardinality of fuzzy relations, Operations on fuzzy relations, Properties of fuzzy relations, Fuzzy Cartesian product and composition, Non interactive fuzzy sets, Tolerance and equivalence relations-crisp equivalence relation, Crisp tolerance relation, Fuzzy tolerance, Max-min Method, other similarity methods.

MODULE-III

Membership Functions: Features of the membership function, Standards forms and boundaries, fuzzification, Membership value assignments-intuition, Inference, Rank ordering, Angular fuzzy sets.

MODULE- IV

Fuzzy-To-Crisp Conversions And Fuzzy Arithmetic: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Extension principle-crisp functions, Mapping and relations, Functions of fuzzy sets-extension principle, Fuzzy transform (Mapping), Fuzzy numbers Interval analysis in Arithmetic.

MODULE- V

Fuzzy Logic &Fuzzy Rule-Based Systems: Fuzzy logic, approximate reasoning, Fuzzy tautologies, Contradictions, Equivalence and logical proofs. Natural language, Linguistic hedges, Rule-based system-canonical rule forms, Decomposition of compound rules, Likelihood and truth qualification, Aggregation of fuzzy rules.

MODULE- VI

Fuzzy Decision Making, Classification & Hybrid formation: Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multiobjective decision making under fuzzy states and fuzzy actions. Classification by equivalence relations-crisp relations, Fuzzy relations cluster analysis, neuro fuzzy and fuzzy genetic system, applications to engineering problems.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Reference Books:-

- Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.
- Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan andRai – PHI Publication.
- Fuzzy Sets, Fuzzy Logic, and Fuzzy Systems by Lotfi A. Zadeh
- Fuzzy logic with engineering application by Timothy J. Ross-wiley

INTRODUCTION TO GENETIC ALGORITHM

Course Code: CSE2651 **Credit Units: 03**

Module-I
Fundamentals of genetic algorithm: A brief history of evolutionary computation, biological terminology, search space encoding, reproduction elements of genetic algorithmgenetic modeling, comparison of GA and traditional search methods. The Fundamental Theorem, Schema Processing at work, Two-armed and k-armed Bandit problem, The Building block hypothesis.

Module-II
Genetic technology:- steady state algorithm, fitness scaling, inversion.Geneticprogramming:- Genetic Algorithm in problem solving, Implementing a Genetic Algorithm:- computer implementation, operator (reproduction, crossover and Mutation, Fitness Scaling, Coding, Discretization). Knowledge based techniques in Genetic Algorithm.Advanced operators and techniques in genetic search:-Dominance, Diploidy and Abeyance. Inversion and other reordering operators, Niche and speciation.

Module-III
Genetic Algorithm in engineering and optimization-natural evolution –Simulated annealing and Tabu search -Genetic Algorithm in scientific models and theoretical foundations.

Module-IV
Introduction to genetics - based machine learning: Classifier system, Rule and Message system, Apportionment of credit, Knowledge based Techniques, Genetic Algorithms and parallel. processors.

Module-V
Applications of Genetic based machine learning-Genetic Algorithm and parallel processors- composite laminates- constraint optimization- multilevel optimization- real life problem.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text Book:-
David E.Goldberg, "Genetic Algorithms in search , Optimization & Machine Learning"

Reference Books:-
1. William B. Langdon, Riccardo Poli,"Foundations of Genetic Programming"
2. P. J. Fleming, A. M. S. Zalzala "Genetic Algorithms in Engineering Systems “
3. David A. Coley, "An Introduction to Genetic Algorithms for Scientists and Engineers ".
4. Melanie Mitchell- ’An introduction to Genetic Algorithm’- Prentice-Hall of India

SOFT COMPUTING

Course Code: CSE2751 **Credit Units: 03**

Module-I

Introduction of soft computing, soft computing vs. hard computing,various types of soft computing techniques,applications of soft computing. Artificial Intelligence: Introduction,Various types of production systems, characteristics of production systems,breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning,forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

Module-II

Structure and Function of a single neuron:Biological neuron,artificial neuron, definition of ANN,Taxonomy of neural net,Difference b/w ANN and human brain,characteristic and applications of ANN, single layer network, Perceptron training algorithm,Linear separability, Delta rule.Introduction of MLP,different activation functions,Error back propagation algorithm,derivation of BBPA, momentum, limitation, characteristics and application of EBPA.

Module-III

Counter propagation network:-Architecture,functioning & characteristics of counter Propagation network,Hop field/ Recurrent network,configuration, stability constraints, associative memory, and characteristics,limitations and applications.

Module-IV

Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations,Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions,Fuzzy rule base system : fuzzy propositions, formation,decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making.

Module-V

Genetic algorithm:Fundamental,basic concepts,working, principle,encoding, fitnessfunction, reproduction,Genetic modeling:Inheritance operator,cross over,inversion & deletion,mutation operator,Bitwise operator,Generational Cycle,Convergence of GA, Applications & advances in GA,Differences & similarities between GA & other traditional methods.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Reference Books :

- S, Rajasekaran & G.A. VijayalakshmiPai, Neural Networks, Fuzzy Logic & GeneticAlgorithms, Synthesis & applications, PHI Publication.
- Rich E and Knight K, Artificial Intelligence, TMH, New Delhi.
- Bose, Neural Network fundamental with Graph , Algo.&Appl, TMH
- Kosko: Neural Network & Fuzzy System, PHI Publication

PROJECT (ARTIFICIAL INTELLIGENCE)

Course Code: CSE2851 **Credit Units: 03**

Methodology

Topics of project are to be based on the latest trends in Artificial Intelligence, verifying engineering concepts in Artificial Intelligence /principals and should involve elementary research work. The projects may involve design, fabrications, testing, computer modeling, and analysis of any engineering problem. On completion of the project, the students are to present a report covering various aspects learnt by them and give a presentation on same.

Examination Scheme:

Literature study/ Fabrication/ Experimentation	40
Written Report	20
Viva	15
Presentation	25
Total	**100**