Program	ADP Data Science	
Course Code	CC-310L	
Course Title	Artificial Intelligence (Lab)	
Credit Hours	**Theory**	**Lab**
	3	1
Lecture Duration	90 minutes (1.5 Hours), 2 lectures per week, 3 hours lab session per week	
Semester	4	
Pre-requisites	**Courses**	**Knowledge**
	Nil	Basic knowledge of Programming and Data Structures would be helpful
Follow Up Courses	Introduction to Data Science	

Course Learning Outcomes (CLOs)

CLO No	**Course Learning Outcome**	**Bloom Taxonomy**
CLO-1	Understand the fundamental constructs of Python programming language.	C2 (Understand)
CLO-2	Understand key concepts in the field of artificial intelligence	C2 (Understand)
CLO-3	Implement artificial intelligence techniques and case studies	C3 (Apply)

Aims and Objectives	1. This course aims to introduce students to the exciting and diverse field of Artificial Intelligence (AI). 2. To provide coverage of fundamental concepts of symbolic manipulations, pattern matching, knowledge representation, and decision making.
	3. The objective of this course is to equip students with the basic problem-solving techniques used in AI so that they are able to apply that knowledge to the real-world problems.
Learning Outcomes	• Understanding key concepts in the field of AI • Understanding the fundamental constructs of AI programming languages, e.g. Prolog, LISP etc. • Implementing AI techniques to solve real-world problems

Syllabus	An Introduction to Artificial Intelligence and its applications towards Knowledge Based Systems; Introduction to Reasoning and Knowledge Representation, Problem Solving by Searching (Informed searching, Uninformed searching, Heuristics, Local searching, Min-max algorithm, Alpha beta pruning, Game-playing); Case Studies: General Problem Solver, Eliza, Student, Macsyma; Learning from examples; Natural Language Processing; Recent trends in AI and applications of AI algorithms. Lisp & Prolog programming languages will be used to explore and illustrate various issues and techniques in Artificial Intelligence.
Contents	Unit 1: Introduction 1.1 Discussion on the concepts of Intelligence and AI 1.2 History of AI 1.3 Strong Vs Weak AI, Strong Vs Weak method problems solving 1.4 Reasoning and knowledge representation 1.5 Physical Symbol System Hypothesis Unit 2: Problem Solving by Searching 2.1 Uninformed search
	2.2 Informed search 2.3 Local search heuristics 2.4 Game playing: Minimax algorithm, alpha-beta pruning Unit 3: Reasoning in AI systems 3.1 Introduction to logic and reasoning in AI 3.2 Recap of Propositional and Predicate Calculi 3.3 Representation in formal logic 3.4 Automated reasoning 3.5 Resolution theorem proving Unit 4: Knowledge Based Systems: 4.1 Various types of knowledge-based systems (KBS) 4.2 Architecture of rule based Expert Systems 4.3 Case Studies: General Problem Solver, Eliza, Student etc. Unit 5: Natural Language Processing 5.1 Introduction 5.2 Phases of linguistic analysis 5.3 NLP system Unit 6: Learning in AI systems: 6.1 Genetic Models of learning 6.2 Symbolic vs Connectionist learning in AI 6.3 Artificial Neural networks: 6.3.1 Perceptrons 6.3.2 Multilayer Perceptrons 6.3.3 Deep Neural Networks
Teaching-learning Strategies	• Multimedia presentations involving interaction from students • Hands on exercises for concept reinforcement • Coding in laboratory

Assignments	There would be 4 to 5 programming assignments (2 pre and 2-3 post midterm)
Textbooks	Luger, G. F. (2009). Artificial Intelligence- Structures & Strategies for Complex Problem Solving. (6th Edition). Pearson Education, Inc. ISBN-13: 978-0-321-54589-3
Reference Material/Suggested Readings	• Russell, S., Norvig, P. (2015). Artificial Intelligence. A Modern Approach (3rd Edition). Pearson Education, Inc. ISBN-13: 978-0136042594 • Norvig, P. (1992). Paradigms of Artificial Intelligence Programming: Case studies in Common Lisp. Morgan Kaufman Publishers, Inc. ISBN-13: 978-1558601918 • Bratko, I. (2011). Prolog: Programming for Artificial Intelligence. (4th Edition). Pearson Education, Canada. ISBN-13: 978-0321417466
Notes	• Academic integrity is expected of all students. Plagiarism or cheating in any assessment will result in at least an F grade in the course, and possibly more severe penalties • There is no makeup for a missed sessional grading instruments like quizzes, assignments, and homework • The instructor reserves the right to modify the grading scheme/marks division and course outline during the semester

Detailed Lecture wise plan

Week	Lecture	Topic	Source Book (Ch#)	Recommendation for Learning Activities
1	1	Introduction: definition, concept of intelligence; attributes of intelligence; History of AI	Ch#1	
	2	Schools of thought, methods of problem solving; reasoning and representation; physical symbol system hypothesis		Reading-1
2	3	Problem solving via search: uniformed search	Ch#3	
	4	Heuristic search techniques	Ch#4	
3	5	Properties of heuristics		Quiz-1
	6	Heuristics in game playing; minimax algorithm; alpha-beta technique		
4	7	Reasoning in AI systems: introduction to logical reasoning; recap of propositional and predicate calculus	Ch#2	Assignment-1; Reading-2
	8	Representation in formal logic; unification algorithm		
5	9	Automated reasoning; resolution theorem proving	Ch#14	
	10	Examples of resolution theorem proving		

Week	Lecture	Topic	Source Book (Ch#)	Recommendation for Learning Activities
6	11	Introduction to logic programming. Horn clauses		Quiz-2
	12	Prolog as an example logic programming system	Handouts	
7	13	Knowledge based systems: types, architecture of rule-based expert systems	Ch#8	Reading-3
	14	Expert system shells		Assignment-2
8	15	Case studies: GPS, Eliza	Handouts	
	16	Midterm review		
Midterm Exam				
9	17	Natural Language Processing: Introduction; phases of linguistic analysis	Ch#15	Reading-4
	18	NLP system overview		
10	19	Genetic Models of learning: Introduction; Genetic Algorithm (GA)	Ch#12	Reading-5
	20	Representation, fitness function, selection techniques		
11	21	Genetic operators, examples and implementation of GA		Quiz-3
	22	Symbolic VS connectionist learning;	Ch#10	Assignment-3
12	23	Naïve Bayes classification	Handouts	
	24	Decision Trees: ID3 algorithm; C 4.5 algorithm	Handouts	Reading-6
13	25	Inductive bias of decision tree learning; examples and implementation		
	26	Connectionist paradigm of learning: Neuron and Neural Networks; Artificial Neural Networks	Ch#11	
14	27	Perceptron networks; delta rule; linear separability problem		Reading-7
	28	Multilayer perceptrons; generalized delta rule		
15	29	Backpropagation algorithm		Assignment-4
	30	Issues and enhancements of backpropagation algorithm	Handouts	Quiz-4
16	31	Deep neural networks	Handouts	
	32	Final term review		
Final Exam				