Planning and Quality Assurance Affairs

Course Specifications

General Information

Course name	Advanced Artificial Intelligence
Course number	ITCS6301
Faculty	
Department	
Course type	Major Needs
Course level	6
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - Learn AI from the computational (how can we design effective and efficient algorithms to solve problems that typically have exponential complexity) viewpoint

2 - Learn AI from the cognitive (how do humans solve complex problems effectively and efficiently) viewpoint.

3 - Lean and apply fundamental concepts, ideas, techniques, and applications and provide practical experience by implementing intelligent reasoning techniques

Intended Learning Outcomes

Knowledge and Understanding	* a1) Define major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas
	* a2) Explain the principles and techniques of a number of application areas informed by the research directions of artificial intelligence
	* a3) Explain selected advanced topics to provide a deeper understanding of some aspects of artificial intelligence
Intellectual Skills	* b1) Generate an innovative design to solve a problem containing a range of commercial and industrial constraints
Professional Skills	* c1) Specify, design, and implement computer-based system
	* c2) Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem
General Skill	* d1) Communicate effectively by oral, written and visual means
	* d2) Work effectively as an individual and as a member of a team
	* d3) Develop Creativity and imagination skills, Self-assessment ability and Critical thinking and analytic ability

Course Contents

1 - This course will build on the basic concepts covered in AI Course , and take a more in depth look at advanced material on a set of core topics. This will involve additional reading mostly survey papers and research articles from journals and edited texts. The core advanced topics will include: • Advanced Search Algorithms: Iterative Deepening search, Advanced CSP topics. • with resource constraints. • Reasoning under Uncertainty: Dynamic Bayes Nets and Decision making under uncertainty. • Machine Knowledge Representation: Ontologies and Ontological Engineering. • Planning systems: Planning with graphs, Partial order planning, and planning and scheduling Learning: Classification and clustering methods. Advanced Topics: survey of an AI topic of current interest. Students will choose their own topics

Teaching and Learning Methods

1 - Lectures

Students Assessment

Assessment Method	TIME	MARKS
Mid -Tearm Exam	8th week	20
Research Paper	12th week	20
Home Work	During the 16 weeks	10
Final Exam	16th week	50

Books and References

Essential books   • Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Third edition, Prentice Hall, NJ, 2009.

Recommended books   • Jeff Heaton, Artificial Intelligence for Humans, Volume 1: Fundamental Algorithms, Create Space Independent Publishing Platform; 1st edition, 2013.

• G.F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Ad-dison Weseley, 2005.

• N.J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, 1998.

Knowledge and Skills Matrix

Main Course Contents	Study Week	Knowledge and Understanding	Intellectual Skills	Professional Skills	General Skill
Introduction to AI (self study & discussion) Intelligent Agents (self-study & discussion)	1-2	a1,a2	b1	c1	d1
Search and Problem Solving A*, Iterative Deepening A*, Anytime Heuristic Search Simulated Annealing, Genetic Search Algorithms	3-4	a2,a3	b1	c1	d2
Adversarial Search (Two person games) Discussion of algorithms (Alpha-Beta) + applications	5	a3	b1	c2	d3
Machine Learning Supervised Learning (Decision Trees, Linear Regression)	6	a1,a3	b1	c1	d1-d3
Constraint Satisfaction Problems (CSP)	7	a2	b1	c2	d3
Knowledge Representation and Reasoning Propositional Logic (self study) First Order Logic and Inference (self-study) Knowledge Representation & Ontologies	8-9	a1,a2	b1	c1	d2
Planning & Scheduling Planning as State Space Search (self-study) Forward Search & Backward Search (Regression) (self-study) Planning (GRAPHPLAN) & Partial Order Planning	10-11	a3	b1	c1	d2-d3
Reasoning under Uncertainty Bayes Rule and Bayes Nets Hidden Markov Models, Dynamic Bayes Nets Making Simple Decisions (Utility Theory Framework)	12-13	a1-a3	b1	c1	d1-d3
Discussion of state of the art + applications	14-15	a1-a3	b1	c1-c2	d1-d3