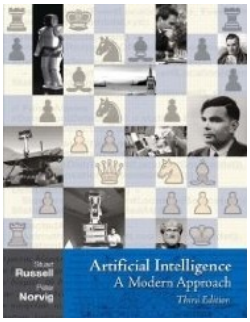
Birla Institute of Technology & Science, Pilani
Hyderabad Campus

Second Semester 2019-2020 Course Handout (Part II)

Date: 6TH Jan 2020

In addition to part-I (General handout for all courses appended to the timetable) this portion gives further specific details regarding the course:



COURSE NO.: CS F407

ARTIFICIAL INTELLIGENCE (AI)

Instructor In-Charge: Prof. Chittaranjan Hota (hota@hyderabad.bits-pilani.ac.in)

Scope and Objectives

This course introduces students to basic concepts and methods of artificial intelligence from a computer science perspective. AI concerns itself with a certain set of problems and develops a particular body of techniques for approaching these problems. The focus of the course will be on the study of methods of knowledge representation, reasoning, and algorithms required for the developing intelligent programs. AI not only strives to build intelligent entities, but also allows understanding them. This course will empower students to know how to program computers, using classical symbolic methods, to behave in ways normally attributed to "intelligence" when observed in humans. AI currently encompasses a huge variety of sub fields, like perception, logical reasoning, proving mathematical theorems, and diagnosing diseases etc. AI empowers the computer engineers to systematize and automate the intellectual tasks, with the help of a set of tools, and methodologies. The methods studied in this course can be applied in any area of human intellectual endeavor. The assignment components will emphasize the use of C/ C++, Python, R etc. The students will be asked to implement the use of Search strategies in real world problem solving, Game playing programs like chess or tic-tac-toe, Planners, Small Expert system shell with only inference engine, Programs for reasoning under uncertainties using models like TMS or Bayes' Networks, Natural Language understanding programs, and Programs in the area of Machine learning using connectionist models like neural networks etc.

TEXT BOOK

T1 Stuart Russell, and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson education, 3rd Ed, 2009.

REFERENCE BOOKS

R1 George F. Luger Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Fourth Edition, Pearson, 2002.

R2 D. W. Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI, 2002.

R3 Winston P.H., Artificial Intelligence, 3rd edition, Addison Wesley, 1995.

R4 Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 2nd Ed., 2002.

PLAN OF STUDY:

S. No.	Learning Objectives	Topics to be covered	Chapter in the Text Book	Lect.s
1.	You will learn the need of AI and what technique can be called as an AI technique.	**Fundamental Issues in Intelligent Systems:** Why study AI**?** Definitions, Attitude towards intelligence, knowledge, and human artifice, Example of an AI Technique.	T1(1), R1(1)	2
2.	This part will cover state space search for problem solving. Different approaches to search a space like heuristics, blind adversarial search etc will be covered. Planning also will be covered as a search problem. You will attempt solving real world problems using state space search in this part.	**Problem Solving using Search Strategies:** State Space search: Problem Spaces, Graph Theory, and Strategies for State Space Search. Heuristic Search: Generate & Test, Hill Climbing, Best First, Problem Reduction, Constraint Satisfaction, Properties of Heuristics like Admissibility, Monotonicity, and Informedness. Adversarial Search (Game Playing): Minimax, Alpha-Beta Cutoffs.	T1(3), R1(3) T1(4,5), R1(4) T1(6), R1(5)	2 3 2

		Planning: An Example, Goal Stack, Hierarchical Planning.	T1(11,12)	3
3.	To understand the state of art on heuristic search research.	Current Research on Search strategies from Journal of AI Research etc.	IEEE/ ACM	1
4.	You will learn in this part how to develop systems or models that can infer new information/idea/knowledge from existing ones. Also, what would be few right approaches to represent (store) the knowledge to be processed or used in the reasoning. Current day data have become vague/uncertain and you will learn techniques to handle these types.	**Knowledge Representation and Reasoning**: Issues in Knowledge representation: Approaches, and Issues, Predicate Logic: Syntax, and Semantics of Propositional and First Order Predicate Logic, Properties of wffs, Conversion to Clause Form, Deduction, Unification, Resolution based Theorem Proving. Weak & Strong Slot-and-filler Structures: Semantic Networks, Frames, Conceptual Dependency, Scripts. Reasoning under Uncertainties: Symbolic: TMS, Statistical: Bayes' Theorem, Bayesian Networks, DS-Theory.	T1(8,9), R1(2) T1(10), R1(6) T1(14,15), R1(7,8)	3 3 3
5.	To understand the state of art research in reasoning systems.	Current Research on Knowledge representation and Reasoning from International Journal of Approximate reasoning or Expert Systems with Applications etc.	IEEE/ ACM/ Elsevr.	1
6.	You will learn how to build models/ programs that can learn from the past behavior/history. Different machine learning algorithms will be covered with applications in mind. Neural networks design and working will be explained with applications using these models will also be discussed.	**Machine Learning:** Symbolic Models: General Concepts in Knowledge Acquisition, Inductive Learning: Winston's Program, Mitchell's Version Space, Decision Tree, Ensemble learning. Explanation based learning. Inductive logic programming. Connectionist Models: Introduction to Neural Networks, Hopfield Networks, Perceptron Learning, Backpropagation & Competitive Learning, Applications of Neural Net: Speech, Vision, Traveling Salesman, Handwritten digit recognition. Reinforcement Learning: Passive and Active	T1(18), R1(9) T1(19) T1(20), R1(10) T1(20) T1(21)	3 3 3 3 2
7.	To learn how to write programs that can make a computer understand natural languages.	**Understanding Natural Languages**: Introduction, Syntactic Processing, Semantic Processing, Discourse & Pragmatic Processing.	T1(22)	3
8.	To learn architecture / framework for an expert system.	**Expert Systems:** Rule based Expert System Architecture.	R1(13)	2

EVALUATION SCHEME:

Sl No.	Component & Nature	Duration	Weightage	Date and Time
1.	Coding Assignments (Take Home, Three Numbers)	*	30%	---
3.	Mid semester Test (Closed Book)	1.5 hr.	30%	4/3 3.30 - 5.00 PM
4.	Comprehensive Exam (Part Open: 50% Open+50% Closed)	3 hrs	40%	08/05 AN

Note: All notices related to the course will be displayed on the **google class page** and the **CSIS Notice Board**. Make ups shall be granted to genuine cases with a request for makeup reaching I/C on or before the test.

Chamber Consultation Hour: Will be announced in the class.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.