BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
Instruction Division

FIRST SEMESTER 2016-2017
Course Handout (Part II)

Date: 06.08.2016

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No : **CS F407 /BITS F444**
Course Title : **Artificial Intelligence**
Instructor-in-charge : **Vandana Agarwal (email:** vandana@pilani.bits-pilani.ac.in**)**
Course Website : **Nalanda**

Objective

Artificial Intelligence (AI) is a field of computer science that attempts to build technology to inculcate human cognition in computer systems. A primary goal of AI is to build intelligent entities. This course is structured to give an overview of the area, as well as it provides necessary depth of the fundamental techniques. The attributes of human intelligence such as reasoning, planning, learning etc. will be attempted to be understood to be able to make computers behave intelligently in solving problems. By the end of the course, the students should have a general knowledge of the field of AI. They should be able to recognize when and how to use AI techniques to solve problems. The students should also be able to evaluate new techniques they encounter.

Scope

This course covers the issues and techniques involved in the creation of computer systems that engage in intelligent behavior. The following are among the topics that we will cover: AI search techniques, Game Playing, Planning, Knowledge Representation, Reasoning under Uncertainty and Machine Learning. Students will take up a term paper to study in detail the complex theoretical details of an intelligent system and implement that during the semester.

Text Book

T1. Stuart Russell and Peter Norvig.
Artificial Intelligence A Modern Approach
Prentice Hall, Second Edition (Indian reprint: Pearson Education).

Reference Books

R1.George F.Luger
Artificial Intelligence
Pearson Education
R2.Ben Coppin
Artificial Intelligence Illuminated
Jones and Bartlett Publishers

Course Plan:Lecture Modules

Modules	Topic	Learning Objectives
-	Introduction	Definitions of Artificial Intelligence, Different Perspectives, Historical background
1	Problem Solving by search	To understand those elements constituting problems and learn to solve it by various uninformed and informed (heuristics based)

		searching techniques
2	Knowledge Representation and Reasoning	To understand those formal methods for representing the knowledge and the process of inference to derive new representations of the knowledge to deduce what to do
3	Planning	To understand the notion of planning in AI and some techniques in the classical planning system
4	Uncertain Knowledge Representation and Reasoning	To understand the notion of uncertainty and some of probabilistic reasoning methods to deduce inferences under uncertainty
5	Machine Learning	To understand some of those mechanisms by which an AI system can improve it's behavior through its experience

Lecture Schedule

Lecture	Topics	Reading	Module No
1 – 2	Introduction to AI, background, Overview of course		
3 – 5	Problem Solving Agents, Example Problems, Uninformed Search Strategies, Avoiding Repeated States in search	T1: 3.1 – 3.5	1
6 – 7	Heuristic Search Strategies (Greedy Best First Search, A* Search, Memory Bounded Heuristic Search)	T1: 4.1	1
8	Designing Heuristic Functions	T1: 4.2	1
9-10	Local Search Algorithms (Hill-Climbing Search, Simulated Annealing Search, Local Beam Search)	T1: 4.3	1
11	Game Playing, Minimax & Alpha-Beta Pruning Algorithm, Imperfect Real-time decisions	T1: 6.1 – 6.4	1
12-13	Knowledge Based Agents, Example, Propositional Logic, Reasoning Patterns in Propositional Logic, Propositional Inference	T1: 7.1 – 7.7	2
14-15	Syntax and semantics of First Order Logic, Inference in First Order Logic Knowledge Base	T1: 8, 9	2
16	Reasoning Systems for Categories (Semantic Networks, Description Logics), Reasoning with default Information	T1: 10.6, 10.7	2
17-18	Acting under uncertainty, Basic Probability Notation, Inference Using Full Joint Distribution, Independence, Bayes's Rule and it's Use	T1: 13	2
19	The Planning Problem, Planning with State Space Search, Planning Graphs, Other approaches in planning & analysis	T1: 11.1, 11.2, 11.4	3
20-21	Bayesian Networks, Efficient Representation of Conditional Distribution, Exact Inference, Approximate Inference	T1: 14.1 – 14.5	4
22	Extending Probability to First Order Representations	T1: 14.6	4
23	Alternatives for Uncertain Reasoning (Rule Based Methods, Dempster-Shafer Theory, Fuzzy sets * Fuzzy Logic)	T1: 14.7	4

24-25	Forms of Learning, Inductive Learning, Learning Decision Trees	T1: 18.1 – 18.3	5
26	Ensemble Learning	T1: 18.4	5
27-28	Logical Formulation of Learning, Knowledge in Learning	T1: 19.1 – 19.2	5
29	Maximum Likelihood Parameter Learning (Discrete Models, Continuous Models), EM Algorithm	T1: 20.1 – 20.3	5
30-34	Neural Networks	T1: 20.5 – 20.6	5
35	Course Summary	-----	---

Evaluation Scheme

Component	**Mode**	**Duration**	Dates	**Weightage**
Mid Semester Test	Closed Book	90 minutes	**3/10 10:00 - 11:30 AM**	**25%**
Surprise Quiz/ Assignments	Closed/open book	(Details will be announced)		**15%**
Term Paper	Open Book/Take home/ Lab			**20%**
Comprehensive	Partially Closed Book	3 hours	**1/12 FN**	**40%**

Term Paper: The objective of the term paper is to give broader exposure of today's intelligent systems to the students, beyond the classroom activities.

- A team of two students will select one intelligent system and study various theoretical aspects that make the system intelligent. The students are expected to apply the knowledge gained during the class and their own intelligence in understanding the complex theoretical base for the intelligent behavior of the system chosen.
- The students working on different intelligent systems will share the understanding with the entire class by presenting the details through presentations.
- After the first set of presentations, the team will develop the system using JAVA or C programming languages.
- Plagiarism, unauthorized cooperation or any form of cheating will not be accepted. This will be brought to the attention of the Dean for disciplinary action and will attract severe penalty.
- The dates for the following stages will put up on the course website
  Stage 1: Selection of intelligent system to study and Implement
  Stage 2: Presentation –I : Intelligent system description and theoretical complexities
  Stage 3: Report development status to the instructor [Personal interaction will be scheduled]
  Stage 4: Presentation –II : Implementation Issues and status of work
  Stage 5: Presentation –III : Demonstration and complete working of the intelligent system

- A complete report on the work will be prepared and submitted by the team at the time of demonstration.

Chamber Consultation Hours: *To be announced*
Notices: All notices concerning this course will be put on the **IPC notice board** and the **Nalanda portal**

Malpractice Regulations: The following regulations are supplementary to BITS-wide policies regarding malpractices:

- Any student or team of students found involved in malpractices in working out assignments / projects/term paper will be awarded a zero for that assignment / project/term paper and will be blacklisted. Note that the entire project component will be awarded zero, irrespective of the stage at which the malpractice is found.
- Any student or team of students found repeatedly – more than once across all courses – involved in malpractices will be reported to the Disciplinary Committee for further action. This will be in addition to the sanction mentioned above.
- A malpractice - in this context - will include but not be limited to:
    - submitting some other student's / team's solution(s) as one's own;
    - copying some other student's / team's data or code or other forms of a solution;
    - seeing some other student's / team's data or code or other forms of a solution;
    - permitting some other student / team to see or to copy or to submit one's own solution;
    - OR other equivalent forms of plagiarism wherein the student or team does not work out the solution and/or uses some other solution or part thereof (such as downloading it from the web).

4. The degree of malpractice (the size of the solution involved or the number of students involved) will not be considered as mitigating evidence. Failure on the part of instructor(s) to detect malpractice at or before the time of evaluation may not prevent sanctions later on.

Makeup Policy:

- **Permission of the Instructor-in-Charge is required** to take a make-up
- **Make-up applications must be given to the Instructor-in-charge personally.**
- ***A make-up test shall be granted only in genuine cases where - in the Instructor's judgment - the student would be physically unable to appear for the test.***
- In case of an unanticipated illness preventing a student from appearing for a test, the student must present a Medical Certificate from BITS hospital.
- In case of unanticipated absence for a test due to a trip out of Pilani, the student must present a letter from his/her Warden or the Chief Warden certifying such absence and the reason(s).
- Requests for make-up for the comprehensive examination – under any circumstances – can only be made to Dean, Instruction Division.

Instructor-in-charge
CS F407/BITS F444