VIETNAM NATIONAL UNIVERSITY HO CHI MINH CITY
UNIVERSITY OF INFORMATION TECHNOLOGY

COURSES SYLLABUS

Course: ARTIFICIAL INTELLIGENCE
(Vietnamese: TRÍ TUỆ NHÂN TẠO)

Programs:

Bachelor of Artificial Intelligence;

Bachelor of Computer Science.

(January 2023)

Editing Lecturer: Luong Ngoc Hoang, PhD.

HO CHI MINH CITY - 2023

1. GENERAL INFORMATION

1.1 Lecturer information:

- Name: Lương Ngọc Hoàng
- Degree: PhD
- Email: hoangln@uit.edu.vn

1.2 Course information

Course title (Vietnamese):	Trí Tuệ Nhân Tạo
Course title (English):	Artificial Intelligence
Course targets	Learners who want to gain knowledge in the science of artificial intelligence (AI)
Course ID:	CS106
Knowledge blocks:	Speciality
Programs	☒ General ☒ High Quality ☒ Honors
Department in-charge:	Department of Artificial Intelligence, Faculty of Computer Science
Total of credits:	4
Theory:	3
Practice:	1
Prerequisite courses:	
Preliminary courses:	IT003 – Data structures and algorithms

2. COURSE DESCRIPTION

The course provides foundational knowledge in the science of artificial intelligence (AI). The main contents of the course is: History of the development of AI; the state-of-the-art R&D topics in AI; potential applications of AI; Problem solving with search algorithms and heuristics; Constraint satisfaction problems; Adversarial search; Reinforcement learning and essential reinforcement learning algorithms.

3. COURSE GOALS AND LEARNING OUTCOMES

3.1 Course goals:

3.1.1. General goals: Provide learners with foundational knowledge in the science of artificial intelligence (AI).

3.1.2. Specific goals:

Goal	Goal description
CG1	Understand foundational concepts, essential algorithms, and general knowledge in the science of artificial intelligence (AI).
CG2	Able to employ AI methodolgies for problem solving.
CG3	Teamwork for efficient problem solving.
CG4	Able to perform self-study and conduct research to practice lifelong learning.
CG5	Have proper attitudes about the course.

3.2 Course learning outcomes:

After completion of the course, the learners will be able to:

Course learning outcomes	**Course learning outcome description**	**Curriculum learning outcomes**	**Course learning outcome levels of Knowledge (NT), Skill (KN), Attitude (TĐ)**
CLO1	Understand foundational artificial intelligence methodologies: classic search algorithms, heuristic methods, constraint satisfaction problems, adversarial search, reinforcement learning.	LO2.2	NT3
CLO2	Implement essential artificial intelligence algorithms for problem solving.	LO3.3, LO4.2	KN3

CLO3	Practice research skills: conducting literature survey, scientific paper reading and summarization, identifying and raising research questions	LO3.1, LO3.5	KN3
CLO4	Teamwork, and use foreign languages (mainly English) for reading comprehension and presentation.	LO5.1, LO6.2	KN2
CLO5	Develop a proper attitude about the science of artificial intelligence.	LO8.2	TĐ2

3.3 Relationship between course goals and course learning outcomes:

The relationship between course goals and course learning outcomes are exhibited in the following matrix:

Components	Goal	Learning outcome
Knowledge	CG1, CG2	CLO1, CLO2
Skill	CG3, CG4	CLO3, CLO4
Attitude	CG5	CLO5

4. COURSE REGULATIONS

- Students have to properly follow all regulations and rules of the Faculty and the University.
- Misconducts such as cheating and plagiarism in assignments and exams are subjected to the University's legislation

5. COURSE TOPICS AND SCHEDULE

- Duration: Each theory lecture involves 3 teaching units.

5.1 Theory

Week	Lecture Topic	Course Learning Outcome	Activities	Grading
1	**Overview on artificial intelligence (AI)** 1. What is AI? 2. History of AI 3. Current R&D topics in AI	CLO1, CLO5	Lecturer: - Give the lecture - Co-ordinate Q&A sessions, class discussions - Introduce research project topics Students: - Attend the lecture. - Partcipate in class activities: Q&A sessions, discussions. - Work on assignments and form groups for research projects	A1, A4
2-4	**Search algorithms and heuristics** 1. Introduction to search problems and relevant concepts: state spaces, state space graphs, and search trees. 2. Uninformed search algorithms: Depth-first search, Breadth-first search, Uniform-cost search. 3. Heuristics informed search algorithms: Greedy search and A* search.	CLO1, CLO2, CLO3, CLO4	Lecturer: - Give the lecture - Co-ordinate Q&A sessions, class discussions - Introduce final project topics Students: - Attend the lecture. - Partcipate in class activities: Q&A sessions, discussions - Work on assignments and research projects	A1, A4
5-6	**Constraint satisfaction problems (CSPs)** 1. Introduction to constraint satisfaction problems 2. The backtracking algorithm 3. Efficiency enhancement heuristics for backtracking 4. Introduciton to local search algorithms	CLO1, CLO2, CLO3, CLO4	Lecturer: - Give the lecture - Co-ordinate Q&A sessions, class discussions - Introduce final project topics Students: - Attend the lecture. - Partcipate in class activities: Q&A sessions, discussions	A1, A4

			- Work on assignments and research projects	
7-8	**Adversarial Search** 1. Introduction to adversarial search problems and game trees. 2. Minimax algorithm and the α-β pruning procedure. 3. Introduction to evaluation functions. 4. Expectimax algorithm and problem solving in the presence of uncertainty.	CLO1, CLO2, CLO3, CLO4	Lecturer: - Give the lecture - Co-ordinate Q&A sessions, class discussions - Introduce final project topics Students: - Attend the lecture. - Partcipate in class activities: Q&A sessions, discussions - Work on assignments and research projects	A1, A4
9-10	**Markov decision processes (MDP)** 1. Sequential decision making problems in the presence of uncertainty. 2. Markov decision processes: definition, problem formulation, the concept of a policy. 3. Policy evaluation 4. Optimal policy search with the Value Iteration and Policy Iteration algorithms	CLO1, CLO2, CLO3, CLO4	Lecturer: - Give the lecture - Co-ordinate Q&A sessions, class discussions - Introduce final project topics Students: - Attend the lecture. - Partcipate in class activities: Q&A sessions, discussions - Work on assignments and research projects	A1, A4
11-13	**Reinforcement learning (RL)** 1. Introduction to reinforcement learning problems. 2. Monte-Carlo methods for policy evaluation. 3. Temporal difference learning. 4. Q-Learning and SARSA algorithms, ε-greedy exploration. 5. Introduction to Deep Reinforcement Learning with Deep Q-Networks (DQN).	CLO1, CLO2, CLO3, CLO4	Lecturer: - Give the lecture - Co-ordinate Q&A sessions, class discussions - Introduce final project topics Students: - Attend the lecture. - Partcipate in class activities: Q&A sessions, discussions - Work on assignments and research projects	A1, A4
14-15	**Research project presentations**	CLO2, CLO3,	Lecturer:	A4

		CLO4, CLO5	- Grade presentations and give students feedback. Students: - Present research project results - Submit research project reports and presentation materials	

5.2 Practice

Week	Topic	Course Learning Outcome	Activities	Grading
1	Search algorithms: DFS, BFS, UCS, Greedy search, and A* search.		Hands-on tutorials	A1
2	Using Google OR-Tools to solve constraint satisfaction problems.		Hands-on tutorials	A1
3	Implement Minimax and Expectimax algorithsm		Hands-on tutorials	A1
4	Implement basic reinforcement learning algorithms: Value Iteration, Q-Learning,…		Hands-on tutorials	A1
5	Guidance on research projects.		Research project guide	A4

6. TEACHING METHODS AND MATERIALS

- **Main teaching method:** Lecturer gives the lectures and co-ordinates Q&A sessions with class discussions. Students participate in discussions, propose ideas for working on assignments and research projects.

- **Materials:** slides, books, video clips, and other references.

7. EVALUATION TYPE & RATIO

7.1 Evaluation information

	Grading components	Evaluation types	Evaluation tools	Ratio	Scale
A1	Participation	Quizzes and homework	Quizzes: Socrative, Kahoot. Programming assignments	40%	10
A2	Midterm			0	
A3	Practice	Group project	Presentations and reports	30%	10
A4	Final			30%	10
	Exam	Writing exam	Essays, short answers, and multiple-choice questions	30%	10

8. REFERENCES

- Stuart J. Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, Pearson, 4rd edition: 2020.
- Wolfgang Ertel, Introduction to Artificial Intelligence, Springer (2011)

9. SOFTWARE AND TOOLS

- Python, PyCharm, Google Colab
- Pacman Projects of UC Berkeley: http://ai.berkeley.edu/project_overview.html

10. Date of approval:

11. Approval authority: Department of Artificial Intelligence, Faculty of Computer Science

Ho Chi Minh City, 13 January 2023

Head of Department **Editing Lecturer**

Lê Đình Duy Lương Ngọc Hoàng