COURSE SYLLABUS
CSC14003 – Artificial Intelligence

1. GENERAL INFORMATION

Course name:	Artificial Intelligence
Course name (in Vietnamese):	Trí tuệ nhân tạo
Course ID:	CSC14003
Knowledge block:	Required course
Number of credits:	4
Credit hours for theory:	45
Credit hours for practice:	30
Credit hours for self-study:	90
Prerequisite:	None
Prior-course:	Data Structures and Algorithms
Instructors:	Dr. Nguyễn Tiến Huy

2. COURSE DESCRIPTION

The course is designed to provide students with core knowledge of Artificial Intelligence (AI) through the unified view of a rational agent. We organize the course content into three parts, following the evolution of agents' perception. In Part I - Searching, the agent effectively completes tasks by fitting searching strategies to diverse environments, where multiple agents and complex state spaces matter. In Part II - Knowledge representation, the agent implements algorithms, including forward/backward chaining and resolution, to reason on a knowledge base written in logic; the separation of knowledge from inference helps the agent be more adaptive to changes. In Part III – Machine learning, the agent is fully automated by basic techniques such as decision trees, regressions, and neural networks. Through lectures and practical exercises aiming to develop personal aptitudes of AI, students are exposed to relevant methods, processes, and techniques to get insights into AI agents.

3. COURSE GOALS

At the end of the course, students are able to

ID	Description	Program LOs
G1	Interpret AI from different aspects	LO1
G2	Decide a search strategy that best fits the formulation of a search problem	LO1, LO2
G3	Apply an inference mechanism on the knowledge base (KB) represented in logic or probabilistic network	LO1, LO2
G4	Demonstrate a simple agent that automatically learns from observations	LO1, LO2
G5	Manipulate tools and libraries for developing AI agent programs	LO6, LO7
G6	Promote personal aptitudes of logical thinking and communication	LO9, LO10

4. COURSE OUTCOMES

CO	Description	I/T/U
G1.1	Interpret fundamental AI concepts, and apply them in the right context	T
G1.2	Identify the relationship between AI and other science research fields, especially core fields like mathematics and cognitive science	I
G2.1	Characterize the environment in which the agent is operating using PEAS description and environment dimensions	T
G2.2	Formulate a given AI search problem	T
G2.3	Appraise search strategies according to the problem formulation (i.e., the search space landscape, the number of agents, the availability of prior knowledge, etc.)	T
G3.1	Represent a complex world using logic and/or probabilistic notions	T/U
G3.2	Apply backward/forward chaining and resolution on a KB written in logic	T/U
G3.3	Develop a Bayesian network for inference when there is uncertainty	T/U
G4.1	Explain the concept of machine learning and classify types of learning	T
G4.2	Illustrate basic machine learning algorithms (e.g., ID3 decision tree, naïve Bayes, and regression algorithms) on well-prepared datasets	T
G5.1	Develop Python programming skills to set up simple AI agent programs	T/U
G5.2	Use SWI-Prolog for backward chaining inference on first-order knowledge bases	T/U
G5.3	Manipulate open-source libraries and tools available for machine learning	T/U
G6.1	Develop practical personal communication skills, both oral and writing	U
G6.2	Develop the personal aptitudes of logical thinking	U

5. TEACHING PLAN

Week	Topic	Course outcomes	Teaching/Learning Activities
1	Introduction to AI Intelligent Agents	G1.1-2 G2.1	Lecturing and Discussion
2	Solving Problem by Searching: Basic concepts and Uninformed search	G2.1-3	Lecturing and Practicing case studies
3	Solving Problem by Searching: Informed search	G2.1-3	Lecturing and Practicing case studies Q1: PEAS – Uninformed search H1: PEAS – Basic search strategies
4	Local Search Adversarial Search	G2.1-3	Lecturing and Practicing case studies
5	Constraint Satisfaction Problem	G2.2-3	Lecturing and Practicing case studies Q2: Informed search – Local search H2: Advanced search – CSP
6	Inference with Propositional Logic	G3.1-2	Lecturing
7	**Midterm Examination** Inference with First-order Logic	G3.1-2	Lecturing and Practicing case studies Q3: PL inference
8	Inference when there is uncertainty	G3.1 G3.3	Lecturing and Practicing case studies H3: PL/FOL/Uncertain inferences Q4: FOL inference
9	Machine learning: Basic concepts and ID3 Decision tree	G4.1-2	Lecturing
10	Neural networks: Perceptron and MLP	G4.1-2	Lecturing and Practicing case studies Q5: ID3 decision trees H4: Basic machine learning algorithms

6. LABORATORY WORK PLAN

The teaching assistants are responsible for

- Consolidating students' comprehension by giving tutorials in office hours (on demand),
- Organizing review sessions for midterm and/or final examinations, and
- Giving, correcting, and grading in-class quizzes, and homework.

The lab instructors are responsible for

- Consolidating students' problem-solving and programming skills on typical AI toy/practical problems, and
- Organizing one Q&A session (or more) for each project announcement, and
- Giving, correcting, and grading lab works and projects.

Students will not have weekly classes for laboratory work. Instead, they will contact TA or lab instructors when necessary.

Week	Topic	Course outcomes	Teaching/Learning Activities
1	Introduction to AI – Intelligent Agents	G1.1-2 G2.1, G5.1	Self-study activities
2	Solving Problem by Searching: Basic concepts and Uninformed search	G2.1-3, G5.1	Self-study activities
3	Solving Problem by Searching: Informed search	G2.1-3, G5.1	Self-study activities
4	Local Search – Adversarial Search	G2.1-3, G5.1, G6.1-2	L1: Search strategies P1: Solving problem by searching
5	Constraint Satisfaction Problem	G2.2-3, G5.2	Self-study activities
6	Inference with Propositional Logic	G3.1-2, G5.2	Self-study activities
7	Inference with First-order Logic	G3.1-2, G5.2	Self-study activities
8	Inference when there is uncertainty	G3.1, G3.3 G5.2, G6.1-2	P2: Knowledge representation and inference
9	Machine learning: Basic concepts and ID3 Decision tree	G4.1-2 G5.3, G6.1-2	L3: Basic machine learning algorithms
10	Neural networks: Perceptron and MLP	G4.1-2, G5.3	Self-study activities

7. ASSESSMENTS

ID	Topic	Description	Course outcomes	Ratio (%)
A1	**Personal Assignments**			**25**
A11	In-class Quizzes (Q1 → Q5)	*15-20 minutes, closed-book, in-class written assignment* They are on any topics in any lecture covered and any reading material assigned up to the time the quiz is administered.	G1.1, G2.1-3 G3.1-3, G4.1-2 G6.2	15
A12	Lab work (L1 → L2)	*2 weeks, take-home coding assignments* They are tiny programs aiming to solve AI toy problems.	G2.1-3, G4.1-2 G5.1, G5.3 G6.1-2	10
A2	**Group assignments**			**30**
A21	Projects (P1 → P2)	*3-4 weeks, take-home coding assignments, 3-4 members per group* Each project includes *a Python program* sufficient for solving practical AI problems and *a written report*.	G1.1 G2.1-3, G3.1-3 G5.1-2, G6.1-2	30
A22	Homework (H1 → H4)	*2 weeks, take-home assignments, exactly 2 members per group. OPTIONAL.* They are on any fundamental topics in any lecture covered and any advanced topics found in other reading materials.	G1.1 G2.1-3, G3.1-3 G4.1-2	**+10**
A3	**Examinations**			**45**
A31	Midterm exam	*60 minutes, closed-book, in-class written exam* They are on any topics in any lecture covered and any reading material assigned up to the time the exam is administered	G1.1 G2.1-3, G6.1-2	15
A32	Final exam	*100 minutes, closed-book, in-class written exam* They are on any topics in any lecture covered and any reading material assigned up to the time the exam is administered	G1.1 G2.1-3, G3.1-3 G4.1-2, G6.1-2	30

8. RESOURCES

Textbooks

- Stuart Russell and Peter Norvig. **Artificial Intelligence: A Modern Approach** (4th ed.). Pearson, 2020.
- Lê Hoài Bắc and Tô Hoài Việt. **Giáo trình Cơ sở Trí tuệ nhân tạo**. Khoa Công nghệ Thông tin, Nhà xuất bản Khoa học kỹ thuật, 2014.

Others

- Negnevitsky, Michael. **Artificial intelligence: A guide to intelligent systems**. Pearson, 2005.

Tools, libraries, software

- IDE for Python 3 programming
- SWI-Prolog for logic programming
- Weka software and scikit-learn library for machine learning algorithms

9. GENERAL REGULATIONS & POLICIES

- All students are responsible for reading and following strictly the regulations and policies of the school and university.
- Students who are absent for more than 3 theory sessions are not allowed to take the exams.
- For any kind of cheating and plagiarism, students will be graded 0 for the course. The incident is then submitted to the school and university for further review.
- Students are encouraged to form study groups to discuss on the topics. However, individual work must be done and submitted on your own.
- Students who are absent for mid-term exam or final exam and students who have less than 10% project scores are considered as unqualified for course completion.