Subject Description Form

Subject Code	COMP4431
Subject Title	Artificial Intelligence
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: COMP2011
Objectives	The objectives of this subject are to: 1. To introduce the fundamental concepts of artificial intelligence; 2. To equip students with the knowledge and skills in logic programming; 3. To explore the different paradigms in knowledge representation and reasoning; 4. To understand the contemporary techniques in machine learning; 5. To evaluate the effectiveness of hybridization of different artificial intelligence techniques.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: *Professional/academic knowledge and skills* (a) understand the history, development and various applications of artificial intelligence; (b) familiarize with propositional and predicate logic and their roles in logic programming; (c) understand logical programming and write programs in declarative programming style; (d) learn the knowledge representation and reasoning techniques in rule-based systems, case-based systems, and model-based systems; (e) appreciate how uncertainty is being tackled in the knowledge representation and reasoning process, in particular, techniques based on probability theory and possibility theory (fuzzy logic); (f) master the skills and techniques in machine learning, such as decision tree induction, artificial neural networks, and genetic algorithm; (g) apply and integrate various artificial intelligence techniques in intelligent system development as well as understand the importance of maintaining intelligent systems. *Attributes for all-roundedness* (h) explore the nature of human intelligence and its role in problem solving; (i) deepen thoughts and understanding of human abilities such as learning, reasoning and planning; (j) appreciate the rooted philosophical arguments in logic and its impact on human thoughts.

Subject Synopsis/ Indicative Syllabus

1. Artificial Intelligence (AI): its roots and scope. Early history and applications; the development of formal logic; the Turing test; overview of AI application areas: game playing, automated theorem proving, expert systems, natural language understanding and semantics, planning and robotics, and machine learning.
2. Artificial intelligence as representation and search. The Propositional Calculus and Predicate Calculus; using inference rules to produce predicate calculus expressions; strategies and structures for state space search; heuristic search; recursion-based search; admissibility, monotonicity and informed-ness of search algorithms.
3. Knowledge representation and reasoning. Rule-based production systems; case-based reasoning systems and model based reasoning systems; reasoning under uncertain situations: stochastic methods, fuzzy logic and fuzzy set theory; fuzzy expert systems.
4. Machine learning. Decision tree induction algorithms; artificial neural networks; genetic algorithms.
5. Hybrid intelligent techniques and maintenance of intelligent systems. Hybridization of neural networks, fuzzy logic, genetic algorithms and other intelligent techniques for problem solving; maintenance of the completeness, correctness and consistency of intelligent systems.

Teaching/Learning Methodology

Lectures

During the lectures, students will come across the concepts, algorithms and applications in artificial intelligence, and will be supplemented by exercises, homework and project in machine learning. During the labs / tutorials, students will have the opportunity to practice, apply, and use PROLOG, Matlab toolboxes on fuzzy logics and neural networks. Decision trees development and hybrid systems will also be introduced.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)									
		a	b	c	d	e	f	g	h	i	j
Continuous Assessment	55	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Final Examination	45	✓	✓	✓	✓	✓	✓	✓			
Total	100 %										

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Students need to complete a major machine learning project using neuro-fuzzy hybridization technique. It starts from the selection and formulation of the problem to algorithms, tools and techniques analysis. This project is used to develop students' ability in AI system's design and development.

Students also need to complete a number of programming exercises and

	a test of logic programming. This will help student to apply all these learning in analyzing real problems that call for knowledge representation and reasoning techniques.	
Student Study Effort Expected	Class contact:	
	Lecture	39 Hrs.
	Tutorial/Lab	0 Hrs.
	Other student study effort:	
	Coursework and project	80 Hrs.
	Total student study effort	119 Hrs.
Reading List and References	Textbook: 1. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 6th Edition, Addison Wesley, 2009. Reference Books: 1. Sankar K. Pal and Simon C. K. Shiu, Foundations of Soft Case-Based Reasoning, John Wiley, 2004. 2. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems. 2nd edition, Addison Wesley, 2005.	