

### Subject Description Form

<b>Subject Code</b>	EIE1D03 (CAR STE Subject)
<b>Subject Title</b>	Artificial Intelligence and Science Fiction
<b>Credit Value</b>	3
<b>Level</b>	1
<b>Pre-requisite / Co-requisite/ Exclusion</b>	Nil
<b>Objectives</b>	<ol style="list-style-type: none"><li>1. To inspire student interest in artificial intelligence (AI) by exploring applications of AI and its impact to human beings' life.</li><li>2. To stimulate students' critical thinking and imagination through the study of AI.</li><li>3. To provide students the fundamental theories, models and algorithms applied in AI.</li></ol>
<b>Intended Subject Learning Outcomes</b>	<p><b>Upon completion of the subject, students will be able to:</b></p> <p><u>Category A: Professional/academic knowledge and skills</u></p> <ol style="list-style-type: none"><li>1. Understand the benefits and limitations of current AI techniques, its culture and society impacts, philosophical issues, and possible future development.</li><li>2. Appreciate basic AI problems and approaches.</li><li>3. Appreciate the basic design concepts of AI games and typical AI systems.</li><li>4. Explore the applications of AI techniques and humanoid robotics in everyday life, entertainment, industry, and business.</li></ol> <p><u>Category B: Attributes for all-roundedness</u></p> <ol style="list-style-type: none"><li>5. Think critically and creatively.</li><li>6. Recognize social responsibility and ethics.</li></ol>

**Subject Synopsis/  
Indicative Syllabus**

1. Introduction  
Definitions of AI, Brief History of AI, State of the Art
2. Philosophical Issues of AI  
The basis of philosophy, Human Intelligence and Machine Intelligence, Turing Test, The Chinese Room Argument, Weak and Strong AI, Machine Consciousness, Minds, Free Will, Machine Ethics
3. Artificial Intelligence in Science Fiction  
"I, Robot" (2004), "The Terminator" (1984, 1991, 2003, 2009), and "Robocop" (1987, 1990, 1993): Cyborg, Hybrid of Man and Machine, Morality, Free Will, Empathy, Moral and Ethical Issues  
"2001: A Space Odyssey" (1968): HAL 9000, Speech Recognition, Natural Language Processing, Facial Expression Recognition, Art Appreciation, Reasoning, Emotional Behaviors  
"A.I. Artificial Intelligence" (2001): Humanoids, Thoughts and Emotions
4. Introduction to AI Approaches  
Deductive Reasoning and Inductive Reasoning, Knowledge Representation, Semantic Net, Production Rules, Learning by recording cases, Describe and match (e.g. K-D Tree, identification tree), Generate and test, Means-ends Analysis, Problem-reduction, Artificial neural networks, Evolutionary computation, Agent methods
5. Search Method and Game Playing  
Problems and formulation, Breadth-first search, Depth-first Search, Admissible Heuristics and A\* Search, Minimax, Deep Blue (Chess Computer) and AlphaGo
6. Expert Systems and Fuzzy Systems  
Structure of a rule-based expert system, Forward chaining and backward chaining, Fuzzy sets (linguistic values), Membership functions, Fuzzy inference systems, Fuzzy logic home appliances
7. Artificial Neural Networks and Deep Learning  
Human brain and artificial brain, The artificial neuron and artificial neural networks, Tasks that neural networks can perform, Activation functions, Supervised and Unsupervised Learning, Deep learning
8. Evolutionary Computation  
Basic Concepts of Evolutionary Computation, Genetic Algorithms, Chromosome Representation, Initial Population, Selection Mechanisms, Crossover and Mutation, Stopping Criteria, Fitness Functions
9. AI Applications  
AI in Finance and Investment, AI in Medicine, AI in Games
10. Robots and Robotics  
Three Laws of Robotics, Types of Robots, Manipulator, Degrees of Freedom, Sensors, Localization and Mapping, Motion Planning, Robot Locomotion, Humanoids, Emotion Recognition, Evolutionary Robotics
11. Natural Language Processing and Machine Translation  
Machine Translation (MT), Components of Natural Language Processing (NLP), Syntactic processing, Formal grammars, Sentence parsing, Speech recognition
12. Future Challenges of AI  
Humanoid robots, Hybrid intelligence machine, Cyborg, Brain-Computer Interface (BCI), Nanotechnology and AI, Merger of man and machine, Extinction or immortality

<b>Teaching/Learning Methodology</b>	<b>Teaching and Learning Method</b>	<b>Intended Subject Learning Outcome</b>	<b>Remarks</b>
	Lecture	1, 2, 3, 4, 6	fundamental principles and key concepts of the subject are delivered to students; guidance on further readings is given.
	Tutorials/ Demos	1, 2, 3, 4, 5	supplementary to lectures; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed; Demonstrations on some AI applications will be shown
	Science Fiction Films Viewing	2, 4,6	Supplementary to lectures; students are asked to identify the AI technologies portrayed and to think critically about the important issues raised in the sci-fi movies.
	Assignment	1, 4, 5, 6	Assignment will ask each student to carefully read one or more sci-fi books, or watch one or more sci-fi movies chosen by the student and write up a book or movie report to discuss the AI techniques/applications portrayed and the important issues raised in the book(s)/movie(s).
	Presentation	1, 4, 5, 6	Students are required to search information on one particular example of AI application and give presentation to discuss the culture and society impacts of this AI application, as well as the ethics and risks of developing this AI.

<b>Assessment Methods in Alignment with Intended Subject Learning Outcomes</b>	<b>Specific Assessment Methods/Tasks</b>	<b>% Weighting</b>	<b>Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</b>					
			<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
	1. Continuous Assessment	100%						
	• Assignment	40%	✓			✓	✓	✓
	• Test / Quizzes	50%	✓	✓	✓			
	• Presentation	10%	✓			✓	✓	✓
Total	100%							
<b>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</b>								
	<b>Specific Assessment Methods/Tasks</b>	<b>Remark</b>						
	Assignment	- Students need to think critically and creatively in writing up a book or movie report. - Accuracy, organization, technical content, and the presentation of the reports will be assessed.						
	Test / Quizzes	Test/quizzes are used to assess the students' understandings on the topics covered in lectures. Basic AI concepts, techniques and engineering-type problems will be tested.						
	Presentation	Students need to think critically to discuss various aspects on one selected AI application.						
<b>Student Study Effort Expected</b>	<b>Class contact (time-tabled):</b>							
	• Lecture							26 Hours
	• Tutorials/ Demos/ Presentations							13 Hours
	<b>• Other student study effort:</b>							
	• Self-learning (review of materials, intensive reading of science fiction books, watching science fiction movies, preparation for test)							35 Hours
	• Assignment and Presentation							32 Hours
	<b>Total student study effort:</b>							<b>106 Hours</b>
<b>Reading List and References</b>	<b>References:</b>							
	<ol style="list-style-type: none"> <li>1. Stuart Russell and Peter Norvig, <i>Artificial Intelligence: A Modern Approach</i>, Global Edition, Pearson Education Limited, 2016</li> <li>2. Henry Brook, <i>Artificial Intelligence</i>, Usborne Publishing Ltd, 2016</li> <li>3. Jerry Kaplan, <i>Artificial intelligence</i>, New York, NY : Oxford University Press, 2016</li> <li>4. Kevin Warwick, <i>Artificial Intelligence: The Basics</i>, Routledge, Taylor &amp; Francis Group, 2012.</li> </ol>							

	<ol style="list-style-type: none"> <li>5. G.F. Luger, <i>Artificial Intelligence: Structures and Strategies for Complex Problem Solving</i>, 6<sup>th</sup> ed., Pearson Education, 2009.</li> <li>6. S. Lucci and D. Kopec, <i>Artificial Intelligence in the 21st Century</i>, Mercury Learning and Information, 2013.</li> <li>7. P.H. Winston, <i>Artificial Intelligence</i>, 3rd ed., Addison-Wesley, 1992.</li> <li>8. R. Pfeifer and J. Bongard, <i>How the Body Shapes the Way We Think: a New View of Intelligence</i>, The MIT Press, 2007.</li> <li>9. M. Negnevitsky, <i>Artificial Intelligence: A Guide to Intelligent Systems</i>, 3rd Edition, Addison-Wesley, 2011.</li> <li>10. T.M. Georges, <i>Digital Soul: Intelligence Machines and Human Values</i>, Westview Press, 2003.</li> <li>11. J.S. Hall, <i>Beyond AI: Creating the Conscience of the Machine</i>, Prometheus books, 2007.</li> <li>12. J.P. Hogan, <i>Mind Matters: Exploring the World of Artificial Intelligence</i>, The Ballantine Publishing Group, 1997.</li> <li>13. Selected science fiction books and movies.</li> <li>14. Selected publications from relevant journals.</li> </ol>
<b>Last Updated</b>	Nov 2021
<b>Prepared by</b>	Dr Pauli Lai, Mr Richard Pang