Subject Description Form

Subject Code	EIE2112
Subject Title	Foundation Techniques in Artificial Intelligence
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce the latest development of Artificial Intelligence (AI) and Information Engineering (IE) and their relationship with the society development. 2. To introduce the common mathematical and programming tools used in the study of Artificial intelligence and Information Engineering.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the relationship between AI, machine learning and applications; 2. Understand the common mathematical tools used in the study of AI and IE; 3. Apply computer programming techniques to solve practical scientific problems; and Category B: Attributes for all-roundedness 4. Solve problems independently.
Subject Synopsis/ Indicative Syllabus	1. Introduction to AI and IE • Expert systems, Fuzzy logic systems, Neural networks, Natural language processing, Robotics, • Techniques and technologies in information engineering: Linear regression, Decision tree, Support vector Machine, Clustering, Dimensionality reduction, machine learning 2. Mathematical Foundations of AI and IE • Calculus: Differentiation, partial derivatives, chain rule, maxima and minima. Review of integration. Case study: Optimization using differentiation. • Signals and systems: Complex number, the Euler theorem, time and frequency, Fourier transform, sampling theorem, discrete Fourier transform. Case study: Real life application of discrete Fourier transform. • Linear algebra: Review of basic matrix operations. Determinants and systems of linear equations. Inner product and orthogonality, eigenvalues and eigenvectors. Case study: Real life application of linear algebra. 3. Scientific programming for AI • Python programming for scientific problems. • Introduction of Python specialized modules for numerical computation (e.g., Numpy, Scipy, Matplotlib, etc.) • Python framework for AI applications (e.g., Pytorch, tensorflow, etc)

Teaching/Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1,2,3	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1,2,3	Supplementary to lectures: Students will be able to clarify concepts and to have a deeper understanding of the lecture materials; Problems and applications are given and discussed.
Laboratory sessions	2,3,4	Students will experience the applications of different mathematical tools by means of some computer programming experiments in numerical computation.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Short quizzes	10%	✓	✓	✓	
2. Laboratory sessions	30%		✓	✓	✓
3. Examination	60%	✓	✓	✓	✓
Total	100%				

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

Specific Assessment Methods/Tasks	Remark
Short quizzes	They can measure the students' understanding of the theories and concepts as well as their comprehension of subject materials.
Examination	End-of-chapter-type problems are used to evaluate the students' understanding of subject materials and the ability in applying concepts and skills learned in the classroom. Students need to think critically and to learn independently in order to come up with an alternative solution to an existing problem. They need to present their solutions logically and systematically in the tests and the examination.
Laboratory sessions	Students are required to make a demonstration of their solutions on a selected open-ended question in each laboratory session for evaluating their problem solving skill. Students also need to submit lab reports for evaluating their overall performance in the laboratory sessions.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lectures	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	1. M.J. Roberts, *Fundamentals of Signals & Systems*, McGraw-Hill, 2008. 2. R. Larson, Edwards, B. *Single Variable Calculus*, Brooks/Cole 2012 3. R. Larson, *Elementary Linear Algebra*, Brooks/Cole 2013 4. S. Nagar, *Introduction to Python for Engineers and Scientists: Open Source Solutions for Numerical Computation*, Apress, 2018 5. Joshi Ameet, *"Machine learning and artificial intelligence"*, Springer 2020. 6. Ashish Ranjan Jha, Dr. Gopinath Pilai, *"Mastering PyTorch"*, Packt Publishing 2021. 7. Singh Pramod and Manure Avinash, *"Learn TensorFlow 2.0: Implement Machine Learning and Deep Learning"*, Apress, 2020.	
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