

## Subject Description Form

<b>Subject Code</b>	ME42001
<b>Subject Title</b>	Artificial Intelligence in Products
<b>Credit Value</b>	3
<b>Level</b>	4
<b>Pre-requisite/ Co-requisite/ Exclusion</b>	Pre-requisite: ME31002 Linear Systems and Control ; or ME41004 Mechatronics and Control
<b>Objectives</b>	To provide students with basic knowledge on Artificial Intelligence (AI) for product design and development.
<b>Intended Learning Outcomes</b>	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Apply knowledge of mathematics, expert systems, fuzzy systems and learning models to aid the design and development of intelligent products and systems.</li> <li>b. Understand applications of AI in different fields.</li> <li>c. Work effectively as a member to tackle a multi-disciplinary design project involving the application of AI.</li> <li>d. Appreciate the state-of-the-art applications of AI in products and present a design project via computer programming and written report.</li> </ol>
<b>Subject Synopsis/ Indicative Syllabus</b>	<p><b>Expert Systems</b> - Principles of expert systems; Knowledge representations; Inference mechanisms; Graph search algorithms; Rule-based expert systems; Application of expert systems to product design and product data management using Prolog or available software packages. (Delete some topics)</p> <p><b>Fuzzy Inference Systems</b> - Fuzzy sets and crisp sets; Membership functions; Properties of fuzzy sets; Operations on fuzzy sets; Operations on fuzzy relations; Fuzzy if-then statements; Inference rules; Developing fuzzy inference systems using Matlab or available software packages.</p> <p><b>Learning Models</b> – Introduction to different learning algorithms and models; Regression; Classification; Supervised learning; Unsupervised learning; Reinforcement learning; Neural Network; Deep learning; Developing learning models using Python or available software packages</p>

**Teaching/Learning Methodology**

1. The lectures are aimed at providing fundamental knowledge on artificial intelligence for product design and development. (Outcomes a and b)
2. The tutorials/computer labs are aimed at enhancing applicable skills of the students. Examples of machine intelligence and other forms of AI in commercial products will be involved. (Outcomes a and b)
3. The project is aimed at integrating the knowledge that will be applied through a team project on product design and development with intelligence systems. (Outcomes a - d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		
Tutorial	√	√		
Project	√	√	√	√

**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
1. Class Test	10%	√	√		
2. Homework	10%	√	√		
3. Group Project	30%	√	√	√	√
4. Examination	50%	√	√		
Total	100%				

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

Overall Assessment:  
 0.50 x End of Subject Examination + 0.50 x Continuous Assessment.

The weighting of 50% on continuous assessment is meant to allow students to consolidate their learning through continuous effort such as assignments and project work. The group project will be assigned to students at early stage of the subject study which enables students to link the knowledge they learnt with the project step by step. Report and the presentation will be major outcomes of the project work that will show how the students are able to design intelligent systems for products. The examination is used to assess the knowledge acquired by the students for understanding artificial intelligence of the products.

<b>Student Study Effort Expected</b>	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Tutorial / Computer Labs	9 Hrs.
	Other student study effort:	
	▪ Reading and review	20 Hrs.
	▪ Homework assignment	10 Hrs.
	▪ Project Report	36 Hrs.
	Total student study effort	105 Hrs.
<b>Reading List and References</b>	<ol style="list-style-type: none"> <li>1. Luger, G.F., and Stubblefield, W.A., Artificial Intelligence and the Design of Expert Systems, The Benjamin/Cummings Publishing Co., latest edition.</li> <li>2. Clocksin, W. F., Programming in Prolog, Berlin; New York: Springer-Verlag, latest edition.</li> <li>3. Ross, Timothy J., Fuzzy logic with engineering applications, Chichester; Hoboken, NJ: Wiley, latest edition.</li> <li>4. Campesato, O., Artificial Intelligence, Machine Learning, and Deep Learning, Mercury Learning &amp; Information, latest edition.</li> </ol>	

*Revised Jun 2020*