Subject Description Form

Subject Code	AAE5103
Subject Title	Artificial Intelligence in Aviation Industry
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with 1. the main concepts, ideas and techniques of advanced artificial intelligence (AI) in the aviation industry; 2. the essential principles, research methodology, data interpretation and data analysis with case examples in airline and airport operations; and 3. outlook of artificial intelligence development and its important in future air traffic and unmanned aircraft system traffic management.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. design and develop AI algorithms or adopt AI tools in solving engineering problems in airline and airport operations; b. illustrate and analysis the knowledge and data pattern generated by the AI-engine; c. master and understand the complex causal relationship and inferences of AI; and d. apply AI techniques for solving aviation engineering problems.
Subject Synopsis/ Indicative Syllabus	**Fundamental of machine learning, data mining, data analytics and artificial intelligence**: Basic soft computing methods, data mining and artificial intelligence algorithms in airline and airport applications; AI and machine learning algorithm design; Data analytics, managerial implications and actionable insights with aviation case studies analysis. **Supervised learning:** Least squares and nearest neighbours; statistical decision theory; Linear methods for regression; Linear discriminant analysis; Classifications; Logistic regression; Separating hyperplanes; Support-vector machine. **Unsupervised learning:** Clustering; Association dimensionality reduction; K-means clustering; KNN; Neural network; Principle component analysis. **Model inference and averaging:** Bootstrap and maximum likelihood methods; Bayesian method; Relationship between the bootstrap and Bayesian inference. **Advancement in artificial intelligence:** Semi-supervised learning algorithmic architecture; Generative adversarial network; Self-trained

<table>
<tr><td></td><td>Naïve Bayes classifier; Reinforcement learning; Q-learning; Model-based value estimation; Deep learning.

Data-driven optimisation and time-series modelling: Air traffic demand forecasting; Flight delay prediction; Operations management and dynamic pricing.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Teaching is conducted through lectures and case study. The basic knowledge, research methodology and theoretical models will be introduced. The understanding of how to address and formulate problems by using mathematical programming, artificial intelligence algorithms, and soft computing techniques with modern programming language is emphasised. Research methodology, data analytics skills, algorithm design skills and programme methods are taught in class as well as the related real-life scenarios using data to enhance their research abilities.

<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="4">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Case Study</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
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<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Assignment</td><td>30%</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Case study</td><td>40%</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Project report</td><td>20%</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>4. Project presentation</td><td>10%</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="4"></td></tr>
</table>

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

Overall Assessment:

1.0 × Continuous Assessment

The continuous assessment (100%) is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus via reading assignment and case study. Project report is are used to assess the students' capacities of self-study and problem-solving and effective communication skills in English so as to fulfil the requirements of working in the aviation industry.
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Student Study Effort Expected	Class contact:	
	▪ Lecture/Case Study	39 Hrs.
	Other student study effort:	
	▪ Literature review/case study/reading	36 Hrs.
	▪ Self-study/preparation	36 Hrs.
	Total student study effort	111 Hrs.
Reading List and References	1. Barber, D. (2012). Bayesian reasoning and machine learning. Cambridge University Press. 2. Boyd, S., Boyd, S. P., & Vandenberghe, L. (2004). Convex optimization. Cambridge university press. 3. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). Introduction to algorithms. MIT press. 4. De Neufville, R., & Odoni, A. (2003). Airport systems. planning, design and management. New York: McGraw-Hill. 5. EASA (2020). EASA Artificial Intelligence Roadmap 1.0 published: A human-centric approach to AI in aviation. EASA. 6. Eurocontrol. (2020). FLY AI report – demystifying and accelerating AI in aviation/ATM. Eurocontrol. 7. Guido, S., & Müller, A. (2016). Introduction to machine learning with python (Vol. 282). O'Reilly Media. 8. Marsland, S. (2015*).* Machine learning: an algorithmic perspective. CRC press. 9. Richert, W. (2013). Building machine learning systems with Python. Packt Publishing Ltd.	

July 2023