Subject Description Form

Subject Code	CSE1002
Subject Title	Introduction to AI and Data Analytics for Civil Engineering
Credit Value	2
Level	1
Pre-requisite/ **Co-requisite/ Exclusion**	Nil
Objectives	This subject aims to help students to learn the basic concepts in artificial intelligence (AI), machine learning, and data analytics, especially their applications in the field of civil engineering (e.g., transportation, geotechnical, hydraulic, structure, and so on). The objective is to raise the interest in AI and data analytics for first-year students and prepare them with a background to design AI and data analytics methods to benefit varying applications in the field of civil engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) Demonstrate an understanding of the foundational concepts of Artificial Intelligence and Data Analytics (AIDA). b) Acquire basic skills in using AIDA technologies and applications. c) Articulate examples of how the adoption AIDA could enhance civil engineering applications and understand the existing applications of AIDA in the field of civil engineering. d) Demonstrate an awareness of global contemporary ethical issues and the impact of AIDA applications in daily life.
Subject Synopsis/ Indicative Syllabus	**Topics:** 1. Introduction to Artificial Intelligence and Data Analytics Overall introduction to the field of AI and DA, historical developments. (2 weeks) 2. The machine learning and data analytics basics, including the concept of learning (e.g., learnability, Occam's razor), basic data analytics (e.g., EDA, visualization), supervised learning (e.g., perceptron, decision tree, linear regression, logistic regression) and unsupervised learning (e.g., k-means, hierarchical clustering). (5 weeks)

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<tr><td></td><td>3. Introduction of the advanced topics in AI and data analytics, which includes reinforcement learning, deep learning, multi-source data collection, data fusion, privacy issues, and other emerging topics related to the real-world application of AIDA. (2 weeks)

4. The applications of AI and data analytics in the field of civil engineering (e.g., transportation, geotechnical, hydraulic, structure and so on). (4 weeks)</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The subject is delivered in weekly interactive lectures, and the corresponding e-Learning materials will be provided.

The lectures in Topics 1 to 3 are to cover the basic concepts and methods about AI, DA, and mainly machine learning. Students will practice these basic concepts and methods and receive timely feedback through simple assignments and in-class exercises. The accuracy of knowledge acquired in Topics 1 to 3 will be assessed by in-class exercises, assignments, and a test.

The lectures in Topic 4 aim to expose students to the wide applications of AIDA in various fields in civil engineering and to discuss the ethical issues and practical impacts of these latest developments. Students' understanding of these aspects will be assessed by in-class exercises.</td></tr>
<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. Assignments</td><td>25%</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>2. In-class exercises</td><td>25%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>3. Test</td><td>50%</td><td>✓</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</td></tr>
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<tr><td></td><td colspan="2">Students will be assessed with continuous assessment. The continuous assessment consists of a set of assignments (25%), in-class exercises (25%), and one test (50%).

Each assignment is designed to cover a particular aspect of quantitative and qualitative skills as well as machine learning methods. The forms of assignment include questions, mini-project, and labs. Assignments mainly assess students' practical skills in understanding and solving actual problems.

The test will be conducted at the end of Topic 3, and it covers all the contents in Topics 1, 2, and 3 to test the students' understanding of technical methodologies.

Students must attain at least grade D in both coursework and final examination (whenever applicable) in order to attain a passing grade in the overall result.</td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and studying, e-Learning</td><td>24 Hrs.</td></tr>
<tr><td>▪ Assignments</td><td>20 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>70 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">(1) Mitchell, T. (1997) Machine Learning. McGraw Hill.
http://www.cs.cmu.edu/~tom/mlbook.html

(2) Bishop, B. (2006). Pattern Recognition and Machine Learning. Springer.

(3) Hong Kong Smart City Blueprint: https://www.smartcity.gov.hk/

(4) Kaggle: https://www.kaggle.com/

(5) Sidewalk Labs Toronto
https://www.sidewalktoronto.ca/documents/</td></tr>
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