Subject Description Form

Subject Code	AMA569
Subject Title	Stochastic Models for Carbon Pricing and Trading
Credit Value	3
Level	5
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	This subject introduces students fundamental theories and methods of data mining and stochastic models that are useful for analyzing environmental data and carbon trading.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) understand the principle of data analytics and data mining; (b) apply various data analytics algorithms and techniques to analyze data related to carbon neutrality; (c) understand different stochastic models for carbon trading
Subject Synopsis/ Indicative Syllabus	**Overview of statistics and applied probability**: Basic concepts in statistics and probability, point estimation (MME and MLE), hypothesis testing. **Statistical data mining for environmental data**: Data analysis methods include principal component analysis, linear regression, basic time series models, fundamentals of spatial random processes, spatio-temporal models. **Stochastic models for carbon pricing and trading**: Markov chain, binomial tree model, random walk, Brownian motion, Feynman-Kac formula, return and risk, Markowitz model, Black-Scholes model, carbon asset pricing, carbon option pricing, European option, American option.
Teaching/Learning Methodology	This subject mainly deliveries through lectures and programming training. The teaching and learning approach is mainly problem-solving oriented. The approach aims at the development of data analytics techniques and how the techniques can be applied to problem solving. Students are encouraged to adopt a deep study approach by employing high level cognitive strategies, such as critical and evaluative thinking, relating, integrating and applying theories to practice.

<table>
<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="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Continuous Assignments</td><td>25%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>2. Project</td><td>30%</td><td></td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>3. Examination</td><td>45%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
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Continuous Assignment: includes participation in the computer laboratory sessions and turning on time the graded quizzes to check students' progress throughout the semester.

Project: will be assigned during the second half of the semester. Students will use their knowledge gained in the class/lab to tackle problems related to data analytics in semiconductor manufacturing.

Examination: assess the knowledge acquired by the students, as well as to determine the extent to which they have achieved the intended learning outcomes.
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Computer Laboratory and Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>Other student study efforts:</td><td></td></tr>
<tr><td>▪ Assignment/Projects</td><td>51 Hrs.</td></tr>
<tr><td>▪ Reading and self-study</td><td>30 Hrs.</td></tr>
<tr><td>The total student study effort</td><td>120 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>

R. Durrett, Essentials of Stochastic Processes. Springer 2016.

J. Hull, Options, Futures, and Other Derivatives, Prentice Hall, 2009.

R. Peck, C. Olsen and J. Devore, Introduction to Statistics and Data Analysis, 3rd Ed, Thomson Higher Education, 2008.

N. Cressie, C.K. Wikle, Statistics for Spatio-Temporal Data, John Wiley & Sons, 2015.

C.K. Wikle, A. Zammit-Mangion, C. N. Cressie, Spatio-Temporal Statistics with R, Chapman and Hall/CRC 2019.

O. Lamiguerio, Displaying Time Series, Spatial, and Space-Time Data with R, Chapman and Hall/ 2014

OECD, Effective Carbon Prices, OECD Publishing, 2013. http://dx.doi.org/10.1787/9789264196964-en

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