Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA569</td></tr>
<tr><td>Subject Title</td><td>Stochastic models for carbon pricing and trading</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>5</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>Nil</td></tr>
<tr><td>Objectives</td><td>This subject introduces students fundamental theories and methods of data mining and stochastic models that are useful for analyzing environmental data and carbon trading.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
(a) understand the principle of environmental policy and carbon market;
(b) understand the principle of data analytics and data mining, apply various data analytics algorithms and techniques to analyze data related to carbon neutrality;
(c) understand different stochastic models for carbon trading</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Introduction to the Theory of Environmental Policy: Basic concepts in environmental economics in understanding the principle of environmental policies.
Overview of statistics and applied probability: Basic concepts in statistics and probability, point estimation, 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.
Stochastic models for carbon pricing and trading: Markov chain, binomial tree model, random walk, Brownian motion, Black-Scholes model, carbon asset pricing, derivatives pricing in carbon market.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>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.</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="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. 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. Midterm Test</td><td>45%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
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	Total	100 %	
	Assignments: will be included as a component of continuous assessment 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. **Midterm Test**: assess the theoretical knowledge acquired by the students, as well as to determine the extent to which they have achieved the intended learning outcomes.		
Student Study Effort Expected	Class contact:		
	▪ Lecture		26 Hrs.
	▪ Computer Laboratory and Tutorial		13 Hrs.
	Other student study efforts:		
	▪ Assignment/Projects		51 Hrs.
	▪ Reading and self-study		30 Hrs.
	The total student study effort		120 Hrs.
Reading List and References	D. J. Phaneuf, T. Requate. A course in environmental economics: theory, policy, and practice. Cambridge University Press 2016. 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		