

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA575
Subject Title	Advanced Topics in Investment Science
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To introduce some advanced concepts and methods in financial markets and portfolio management. To equip students with different performance measures and risk analysis in static and dynamic portfolio analysis. To enable students to master some continuous-time stochastic control theories with applications in optimal portfolio decision making and optimal executions in the dynamic setting.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Master some key principles and advanced financial market models and various performance criteria. (b) Apply mathematical methods to formulate investment problems and solve the real-life portfolio management problems in both static and dynamic market models. (c) Quantify the market risk, risk measurement of portfolios, risk preference of investors in investment decision making (d) Master advanced technical tools in stochastic control to formulate and solve the continuous-time optimal portfolio management applications. Interpret the financial implications of the derived solutions.
Subject Synopsis/ Indicative Syllabus	Portfolio return and risk, mean-variance portfolio analysis, market efficiency, empirical means and covariances Capital asset pricing model (CAPM), single factor and multi-factors model, arbitrage pricing theory Empirical Bayesian estimators, Black-Litterman model, 1/N rule,

	Risk aversion and utility theory, Arrow-Pratt measures of absolute risk aversion, static one-period portfolio management under utility maximization, indifference curves Risk measures, VaR and CvaR, static portfolio management under risk measurs Dynamic money management problems, gambling’s ruin problem, Kelly’s criterion Continuous-time martingale, stochastic differential equations, introduction to dynamic programming principle, continuous-time stochastic control, HJB equation, verification theorem Merton’s optimal portfolio management problem in continuous time, optimal liquidation of market orders in continuous time, Continuous-time optimal mean-variance portfolio management																																		
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The teaching and learning approach is mainly problem-solving oriented. The approach aims at the development of mathematical techniques and how the techniques can be applied to solving problems. 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.																																		
Assessment Methods in Alignment with Intended Learning Outcomes	<table><tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th></tr><tr><th>a</th><th>b</th><th>c</th><th>d</th></tr><tr><td>1.Assignments</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr><tr><td>2.Midterm Test</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr><tr><td>3.Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr></table> Continuous Assessment comprises of assignments and a midterm test. A written examination is held at the end of the semester.	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				a	b	c	d	1.Assignments	20%	✓	✓	✓		2.Midterm Test	20%	✓	✓	✓		3.Examination	60%	✓	✓	✓	✓	Total	100 %				
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2.Midterm Test	20%	✓	✓	✓																															
3.Examination	60%	✓	✓	✓	✓																														
Total	100 %																																		

Student Study Effort Expected	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignments	36 Hrs.
	▪ Self-study	60 Hrs.
	Total student study effort	135 Hrs.
Reading List and References	Luenberger, D.G. Investment Science, 2nd Edition Oxford University Press, 2013 Bjork, T. Arbitrage Theory in Continuous Time, 3rd Edition Oxford University Press, 2009 Shreve, S. Stochastic Calculus for Finance II: Continuous-time Models Springer, 2010 Elton, E.J. Gruber, M.J., Brown, S.J., and Goetzmann, W. Modern Portfolio Theory and Investment Analysis, 9th Edition Wiley & Sons, 2014	