

Research Postgraduate Programme Document

**Department of Applied Mathematics
The Hong Kong Polytechnic University**

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1. General Information

Programme Title: Research Postgraduate Programme in Applied Mathematics

Host: Department of Applied Mathematics (AMA)

Award: MPhil. / PhD.

Normal study period:

**24 months for full-time MPhil., 48 months for part-time MPhil.
36 months for full-time 3-year PhD., 72 months for part-time PhD.
48 months for full-time 4-year PhD., 96 months for part-time PhD. (for admission with Bachelor Degree or Master Degree without any research components)**

Note: This Programme Document is subject to review and changes which AMA can decide to make from time to time. Students will be informed of the changes as and when appropriate.

[This Document should be combined together with the “Regulations and Administrative Procedures for the Degrees of MPhil and PhD” and the “Research Student Handbook”.](#)

2. Requirements

Coursework/credit requirement

It was agreed that the credit requirements should also cover requirement on attending seminars and Practicum.

Credit requirement of different categories of students would then be:

2-year MPhil: 9 credits

(1 credit from HTI6081 + 2 credits from attending seminars (AMA67711+AMA67712) +AMA613+ 3 credits from other subjects)

3-year PhD: 15 credits

(1 credit from HTI6081 + 3 credits from attending seminars (AMA67711+AMA67712+AMA67713)+ 2 credits from Practicum (AMA67721+AMA67722) + AMA613+ 6 credits from other subjects)

4-year PhD: 22 credits

(1 credit from HTI6081 + 4 credits from attending seminars (AMA67711+AMA67712+AMA67713+AMA67714) + 2 credits from Practicum (AMA67721+AMA67722) + AMA613+12 credits from other subjects)

Other subjects can be chosen from the research postgraduate subject list offered by AMA, other PolyU departments or other local Universities with a similar level.

List of the subjects offered by the department are varied from year to year.

All MPhil students need to complete their coursework with a qualifying GPA of 2.75 or above, and all PhD students need to complete their coursework with a qualifying GPA of 3.0 or above before submission of their thesis for examination.

Attendance in research seminars/workshops/conferences

Full-time students are required to attend at least 10 research seminars per year (of which at least 8 research seminars must be within AMA), in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.

Part-time students are required to attend at least 10 research seminars per two years (of which at least 8 research seminars must be within AMA), in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.

Students are recommended to complete one credit per year (for full-time students) or per two years (for part-time students) to fulfil the above-mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students) to fulfil the research seminar credit requirement.

Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained. The Chief Supervisor has to pass the record of the seminars attended by their students and the report with a pass grade to the Research Office for custody at the end of each academic year.

Practicum

As part of the programme requirement, PhD students, irrespective of funding source and mode of study, must complete two training credits before graduation. To earn one credit, students will be required to engage in teaching/research supporting activities assigned by the HoD or his/her delegate for 6 hours/week in any 13-week semester.

Students are allowed to complete these two credits any time before they graduate. They can choose to complete these two credits in two different semesters or within the same

semester, subject to the approval of the Chief Supervisor. Stipend recipients are allowed to fulfill part of their departmental training requirement through the completion of these compulsory training credits.

The HoD or his/her delegate is required to:

- a. ensure that the activities are structured and can be assessed properly;
- b. submit, at the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall assessment grade of Pass or Fail.

In addition to the 2 credits requirement, the department would also assign students to mark assignments and invigilate mid-term tests and examinations in every semester. Students are also expected to help in conferences organized by the department.

Guided Study Subjects

The maximum number of credits to be taken is 3.

Language proficiency requirement after admission

Students should be required to take and pass the specified remedial subjects before the submission of thesis.

Thesis requirement

A thesis must be submitted to the satisfaction of the supervisor(s) for reviews by external examiners. The submitted thesis must contain at least one accepted/published paper in an SCI journal for PhD. students.

3. Curriculum

Key: C = Compulsory CA = Continuous Assessment E =Elective EXAM= Examination

Code	Subject Title	C/E	Credit	Assessment CA : EXAM (%)	Pre-requisite (P)/ Expected background knowledge
AMA610	Advanced probability theory *	E	3	40 : 60	A course in Probability Theory and a course in Advanced Calculus
AMA611	Applied Analysis *	E	3	40 : 60	A course in Linear Algebra and a course in Advanced Calculus. A course in Partial Differential Equations or Analysis would be highly recommended.
AMA612	Numerical methods for Partial Differential Equations *	E	3	40 : 60	A course in Differential Equations and a course in Advanced Calculus
AMA613	Mathematics Seminar	C	3	100 : 0	A compulsory subject for research students of AMA enrolled for at least six months.
AMA614	Mathematical Statistics *	E	3	40 : 60	A course in Probability and Statistics and a course in Advanced Calculus
AMA615	Nonlinear Optimization Methods	E	3	40 : 60	A course in Linear Algebra and a course in Advanced Calculus
AMA616	Statistics for Finance	E	3	40:60	A course in Statistical Analysis and a course in Advanced Calculus
AMA6881	Guided Study in Applied Optimization	E	3	100:0	None
AMA6882	Guided Study in Operations Research	E	3	100:0	None

AMA6883	Guided Study in Applied Statistics	E	3	100:0	None
AMA6884	Guided Study in Financial Mathematics	E	3	100:0	None
AMA6885	Guided Study in Engineering Mathematics	E	3	100:0	None
AMA6886	Guided Study in Computational Mathematics	E	3	100:0	None
AMA6887	Guided Study on Research Topics in Applied Mathematics	E	3	100:0	None
AMA67711	Research Seminars	C	1	100:0	None
AMA67712	Research Seminars	C	1	100:0	(P): AMA67711
AMA67713	Research Seminars	C	1	100:0	(P): AMA67712
AMA67714	Research Seminars	C	1	100:0	(P): AMA67713
AMA67721	Practicum	C	1	100:0	None
AMA67722	Practicum	C	1	100:0	None
HTI6081	Ethics: Research, Professional & Personal Perspectives	C	1	100:0	None

Note: * new subjects pending approval

4. Programme Learning Outcomes and Curriculum Map

Programme Aims

The aim of the programme is to enable the students to acquire competence in research methods and scholarship in Applied Mathematics, and to display sustained independent effort and independent original thought. This programme prepares students to become academics, researchers or industrial R & D professionals upon graduation.

Programme Outcomes

- a. **To enhance students' research knowledge in Applied Mathematics**
- b. **To enhance students' scientific writing and presentation skills**
- c. **To nourish students' up-to-date research development in applied mathematics**
- d. **To recognize the importance of research ethics**
- e. **To learn the skill in writing research articles (for PhD programme)**

Part I: Curriculum map in Rpg programme

Programme Outcomes	AMA610	AMA611	AMA612	AMA613	AMA614	AMA615	AMA616	AMA6881	AMA6882	AMA6883	AMA6884	AMA6885	AMA6886	AMA6887	HTI 6081	Attend seminars	Dept. training	Thesis
a. To enhance students' research knowledge in Applied Mathematics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
b. To enhance students' scientific writing and presentation skills				✓				✓	✓	✓	✓	✓	✓	✓				✓
c. To nourish students' up-to-date research development in applied mathematics								✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
d. To recognize the importance of research ethics															✓			✓
e. To learn the skill in writing research articles				✓				✓	✓	✓	✓	✓	✓	✓				✓

Part II: Programme Learning Outcomes Assessment (LOA) Methods and Procedures

Programme learning outcomes assessment methods and procedures

Programme intended learning outcomes	LOA method and measures	How the data will be collected	Criteria for Success*	How the data will be disseminated and used for improvement
a. To enhance students' research knowledge in Applied Mathematics	Written report in AMA613	Assessment to be done by the subject coordinator and supervisor	70% or more of students being rated "satisfactory" or above in mini-project	<ul style="list-style-type: none"> • Results to be summarized in the annual LOA report that will be forwarded to the HoD and programme team
b. To enhance students' scientific writing and presentation skills	Oral presentation and written report in AMA613	Assessment to be done by the subject coordinator and supervisor	70% or more of students being rated "satisfactory" or above	<ul style="list-style-type: none"> • Results to be reviewed and discussed in the programme committee meeting each year, to identify weakness and plan for improvements
c. To nourish students' up-to-date research development in applied mathematics	Written reports in attending seminars	Assessment to be done by supervisor	70% or more of students being rated "satisfactory" or above	<ul style="list-style-type: none"> • LOA results and improvement plan to be reported in the annual Departmental QA Report for Dean's and PolyU QAC(AD)'s endorsement and

				scrutiny
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Programme intended learning outcomes	LOA method and measures	How the data will be collected	Criteria for Success*	How the data will be disseminated and used for improvement
d. To recognize the importance of research ethics	Written report in HTI 6081	Assessment to be done by HTI 6081 subject lecturer	70% or more of students being rated "satisfactory" or above	Same as above
e. To learn the skill in writing research articles (for PhD programme)	Research paper accepted or published in a journal	Assessment to be done by supervisor	70% or more of students being rated "satisfactory" or above	

Part III: Implementation Schedule and Responsibility

Programme Intended Learning Outcomes	Implementation schedule			Person(s) responsible
	2015-16	2016-17	2018-19	
a. To enhance students' research knowledge in Applied Mathematics	√			AMA613 subject coordinator & individual supervisor
b. To enhance students' scientific writing and presentation skills	√			AMA613 subject coordinator & individual supervisor
c. To nourish students' up-to-date research development in applied mathematics		√		Individual supervisor
d. To recognize the importance of research ethics		√		HTI6081 subject lecturer
e. To learn the skill in writing research articles (for PhD programme)			√	Individual supervisor

Subject Description Form

Subject Code	AMA610
Subject Title	Advanced Probability Theory
Credit Value	3
Level	6
Expected background knowledge	A course in Probability Theory and a course in Advanced Calculus
Objectives	To enable students to have an overview and thorough understanding of the modern probability theory.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Apply the concepts of probability, conditional probability and conditional expectations. (b) Calculate probabilities, moments and other related quantities based on given distributions. (c) Understand and apply the laws of large numbers and central limit theorems. (d) Understand and apply martingale limit theory. (e) Understand and apply Brownian motion model.
Subject Synopsis/ Indicative Syllabus	Measure theory concepts needed for probability. Expectation, distributions. Laws of large numbers and central limit theorems for independent random variables. Characteristic function methods. Conditional expectations, martingales and martingale convergence theorems. Brownian Motion.
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 solid mathematical techniques and how the techniques can be applied to solving research and real application 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	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c	d	e
	1. CA	40	✓	✓	✓	✓	✓
	2. Exam	60	✓	✓	✓	✓	✓
Total	100 %						
	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The subject focuses on knowledge and understanding of Measure Theory and Probability Theory. The Exam-based assessment is the most appropriate assessment method, including tests and examination. Moreover, assignments are included as a component of continuous assessment so as to keep the students in progress.</p> <p>Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.</p>						
Student Study Effort Expected	Class contact:						
	▪ Lecture		26Hrs.				
	▪ Tutorial		13Hrs.				
	Other student study effort:						
	▪ Assignment		30Hrs.				
	▪ Self-study		61Hrs.				
	Total student study effort		130Hrs.				
Reading List and References	R. Durrett, Probability: Theory and Examples. Cambridge University Press, 2010; available online at http://www.math.cornell.edu/~durrett/PTE/PTE4_Jan2010.pdf						
	K.L. Chung, A Course in Probability Theory. Academic Press, 2001.						
	S.C. Chow and H. Teicher, Probability Theory: Independence, Interchangeability, Martingales. Springer, 2003.						

Subject Description Form

Subject Code	AMA 611
Subject Title	Applied Analysis
Credit Value	3
Level	6
Expected background knowledge	<p>A course in Linear Algebra and a course in Advanced Calculus.</p> <p>A course in Partial Differential Equations or Analysis would be highly recommended.</p>
Objectives	To teach students how to use functional analysis to prove various existence, stability and dynamical results of solutions to partial differential equations (PDEs) arising from Physics, Biology, Geometry and Engineering.
Intended Learning Outcomes	<p>Upon satisfactory completion of the subject, students should be able to:</p> <ol style="list-style-type: none">a. Learn some basic functional analysis;b. Learn how to use inequalities to prove estimates;c. Prove existence and analyze qualitative features of solutions to PDEs;d. Analyze stability and dynamics of solutions to PDEs.
Subject Synopsis/ Indicative Syllabus	<p><i>Basic functional analysis</i></p> <p>Banach and Hilbert Spaces; L_p spaces; Sobolev spaces; inequalities; linear operators and spectrum (discrete and continuous); semigroups, unitary groups and dynamics.</p> <p><i>Fixed point theorems and applications</i></p> <p>The contraction mapping; local and global well-posedness;</p>

	<p>inequalities; Gateaux and Frechet derivatives; implicit and inverse function theorems; bifurcations; applications to PDEs arising from Physics, Biology, Geometry and Engineering.</p> <p><i>Variational Calculus</i></p> <p>Functionals; constraints and Lagrange multipliers; minimization by direct methods; saddle points and the Mountain Pass Lemma; Hamiltonian equations; control theory; applications.</p>
Teaching/Learning Methodology	<p>The subject will be delivered mainly through lectures and tutorials. Tutorials will be spent answering questions, reviewing some background material and going over tutorial questions that are related to assignments. In addition, tutorials will be spent discussing some possible topics for the mini projects.</p>

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
			a	b	c	d
	1. Assignments	25%	✓	✓	✓	✓
	2. Project and presentation	15%	✓	✓	✓	✓
	3. Final Exam	60%	✓	✓	✓	✓
Total	100 %					
	<p>The project must be pre-approved by the instructor.</p> <p>Continuous assessment comprises of assignments and project.</p> <p>A written examination is held at the end of the semester.</p>					
Student Study Effort	Class contact:					

Expected	<ul style="list-style-type: none"> ▪ Lecture 	26 Hrs.
	<ul style="list-style-type: none"> ▪ Tutorial 	13 Hrs.
	Other student study effort:	
	<ul style="list-style-type: none"> ▪ Assignments ▪ Project 	30 Hrs. 30 Hrs.
	<ul style="list-style-type: none"> ▪ Self-study 	31 Hrs.
	Total student study effort	130 Hrs.
Reading List and References	<p>M. Reed and B. Simon. Methods of Modern Mathematical Physics: Vol. I: Functional Analysis. Academic Press, 1972.</p> <p>E. H. Lieb and M. Loss. Analysis, Graduate studies in Mathematics. American Mathematical Society, Vol. 14, 2nd ed. 2001.</p> <p>G. B. Folland. Real Analysis: modern techniques and their applications. Wiley, New York, 1984.</p> <p>R. C. McOwen. Partial Differential Equations: methods and applications. Prentice Hall, 1996.</p> <p>L. C. Evans. Partial Differential Equations, volume 19 of Graduate studies in mathematics. American Mathematical Society, 1998.</p> <p>P. D. Hislop and I. M. Sigal. Introduction to spectral theory, Vol. 133 of Applied Mathematical Sciences. Springer Verlag, 1996.</p> <p>S. Gustafsson and I.M. Sigal. Mathematical Concepts of Quantum Mechanics. Springer Verlag, 2003.</p>	

Subject Description Form

Subject Code	AMA 612
Subject Title	Numerical methods for Partial Differential Equations
Credit Value	3
Level	6
Expected background knowledge	A course in Differential Equations and a course in Advanced Calculus
Objectives	This subject is to introduce students to numerical techniques for solving partial differential equations, with applications in physics, engineering, finance and economics.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students should be able to: a. Gain a deep understanding of algorithms of finite difference and finite element methods for solving partial differential equations; b. Solve simple partial differential equations numerically; c. Gain a basic knowledge of theories of finite difference and finite element methods; d. Apply finite difference or finite element methods to solve problems arising in physics, engineering, finance and economics numerically.
Subject Synopsis/ Indicative Syllabus	<i>Finite difference methods</i> Introduction to finite difference methods, Stability, Consistency, Convergence, Lax Equivalent Theorem, Fourier stability analysis, Finite difference methods for model problems. <i>Finite element methods</i> Ritz and Galerkin methods, Introduction to finite element methods, Interpolation Theory in Sobolev Spaces, Conforming finite elements

Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce numerical methods for partial differential equations in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments.
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Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1"> <thead> <tr> <th data-bbox="521 585 781 766" rowspan="2">Specific assessment methods</th> <th data-bbox="781 585 951 766" rowspan="2">% weighting</th> <th colspan="4" data-bbox="951 585 1380 766">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th data-bbox="951 766 1024 835">a</th> <th data-bbox="1024 766 1118 835">b</th> <th data-bbox="1118 766 1240 835">c</th> <th data-bbox="1240 766 1380 835">d</th> </tr> </thead> <tbody> <tr> <td data-bbox="521 835 781 911">1. CA</td> <td data-bbox="781 835 951 911">40%</td> <td data-bbox="951 835 1024 911">✓</td> <td data-bbox="1024 835 1118 911">✓</td> <td data-bbox="1118 835 1240 911">✓</td> <td data-bbox="1240 835 1380 911">✓</td> </tr> <tr> <td data-bbox="521 911 781 987">2. Exam</td> <td data-bbox="781 911 951 987">60%</td> <td data-bbox="951 911 1024 987">✓</td> <td data-bbox="1024 911 1118 987">✓</td> <td data-bbox="1118 911 1240 987">✓</td> <td data-bbox="1240 911 1380 987">✓</td> </tr> <tr> <td data-bbox="521 987 781 1062">Total</td> <td data-bbox="781 987 951 1062">100 %</td> <td colspan="4" data-bbox="951 987 1380 1062"></td> </tr> </tbody> </table>					Specific assessment methods	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				a	b	c	d	1. CA	40%	✓	✓	✓	✓	2. Exam	60%	✓	✓	✓	✓	Total	100 %				
	Specific assessment methods	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)																														
a			b	c	d																												
1. CA	40%	✓	✓	✓	✓																												
2. Exam	60%	✓	✓	✓	✓																												
Total	100 %																																
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The subject focuses on knowledge, skill and understanding of <u>Numerical methods for Partial Differential equations</u>, thus, <u>Exam-based assessment</u> is the most appropriate assessment method, including 25% test and 60% examination. Moreover, 15% worth of assignments are included as a component of continuous assessment so as to keep the students in progress.</p> <p>Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.</p>																																	
Student Study Effort Expected	Class contact:																																
	<ul style="list-style-type: none"> ▪ Lecture 				26 Hrs.																												

	<ul style="list-style-type: none"> ▪ Tutorial 	13 Hrs.
	Other student study effort:	
	<ul style="list-style-type: none"> ▪ Assignment 	36 Hrs.
	<ul style="list-style-type: none"> ▪ Self-study 	27 Hrs.
	Total student study effort	102 Hrs.
Reading List and References	<p>J.W. Thomas, Numerical partial differential equations—Finite Difference Methods, Springer, 1995.</p> <p>Randall J. LeVeque, Finite Difference Methods for Ordinary and Partial Differential Equations--Steady State and Time Dependent Problems, SIAM: Society for Industrial and Applied Mathematics, 2007.</p> <p>Philippe G. Ciarlet, The Finite Element Method for Elliptic Problems, SIAM: Society for Industrial and Applied Mathematics; 2nd edition, 2002.</p> <p>O.C. Zienkiewicz and K. Morgan, Finite Element Method, John Wiley, 1983.</p>	

Subject Description Form

Subject Code	AMA613																																												
Subject Title	Mathematics Seminar																																												
Credit Value	3																																												
Level	6																																												
Pre-requisite / Co-requisite/ Exclusion	A compulsory subject for research students of AMA enrolled for at least six months.																																												
Objectives	The aim of this subject is to evaluate and provide feedback on students' oral and written presentations of research results.																																												
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(a) Do research on an agreed topic/area/issue.</p> <p>(b) Gain an in-depth understanding of the literature related to topics of interest.</p> <p>(c) Develop written skills for presentation of research results.</p> <p>(d) Develop oral academic communication and presentation skills.</p>																																												
Subject Synopsis/ Indicative Syllabus	Topics presented to be determined by the participants, coordinated by the subject examiner (coordinator).																																												
Teaching/Learning Methodology	Students are required to research, develop and deliver a formal presentation using appropriate audiovisual media support and handouts. The presentation assessment tool includes three graded components: content, communication, and organization. The report is expected to include but not limited to problem identification, methodology, solutions, implementation, interpretations, conclusions, and discussions.																																												
Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 30%;">Specific assessment methods/tasks</th> <th rowspan="2" style="width: 10%;">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th style="width: 5%;">a</th> <th style="width: 5%;">b</th> <th style="width: 5%;">c</th> <th style="width: 5%;">d</th> <th style="width: 5%;"></th> <th style="width: 5%;"></th> </tr> </thead> <tbody> <tr> <td>1. Two oral presentations</td> <td style="text-align: center;">50%</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> <tr> <td>2. One research report</td> <td style="text-align: center;">50%</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td style="text-align: center;">100 %</td> <td colspan="6"></td> </tr> </tbody> </table>							Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						a	b	c	d			1. Two oral presentations	50%	✓	✓		✓			2. One research report	50%	✓	✓	✓				Total	100 %						
Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)																																											
		a	b	c	d																																								
1. Two oral presentations	50%	✓	✓		✓																																								
2. One research report	50%	✓	✓	✓																																									
Total	100 %																																												

	Selected topics will be presented by the students. Content, communication and organization will be included in assessing the oral presentation of the student; and content and organization will be included in assessing the research report.		
Student Study Effort Required	Class contact:		
	▪ Presentation of supervised research topic		6 Hrs.
	▪ Presentation of selected topic		6 Hrs.
	Other student study effort:		
	▪ Self-study		118 Hrs.
	▪		Hrs.
	Total student study effort		
Reading List and References	Bowden, John	Writing a Report: How to Prepare, Write and Present Powerful Reports, 6th ed.	Oxford, 2002
	Moore, Nick	How to Do Research: a Practical Guide to Designing and Managing Research Projects, 3 rd ed.	London: Facet Pub., 2006
	Van Emden, Joan	Presentation Skills for Students	Basingstoke: Palgrave Macmillan, 2004

Subject Description Form

Subject Code	AMA614
Subject Title	Mathematical Statistics
Credit Value	3
Level	6
Expected background knowledge	A course in Probability and Statistics and a course in Advanced Calculus
Objectives	To enable students to have an overview and thorough understanding of the modern mathematical statistics theory.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Use the approach of maximum likelihood to obtain the estimator of parameters of distributions and derive the asymptotic properties of estimators (b) Find the UMVU estimators. (c) Apply the method of pivotal quantity to obtain interval estimates. (d) Use the likelihood ratio principle to construct statistical tests. (e) Find uniformly most powerful tests based on the Neyman-Pearson Lemma.
Subject Synopsis/ Indicative Syllabus	This course is concerned with the fundamental theory of statistical inference. Topics include exponential families of distributions, sufficient statistics, complete statistics, convex loss functions, UMVU estimators, performance of the estimators, maximum likelihood estimation, the information inequality, large-sample comparisons of estimators and asymptotic efficiency.
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 solid mathematical techniques and how the techniques can be applied to solving research and real application 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	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c	d	e
	1. CA	40	✓	✓	✓	✓	✓
	2. Exam	60	✓	✓	✓	✓	✓
Total	100 %						
	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The subject focuses on knowledge and understanding of Statistical Theory. The Exam-based assessment is the most appropriate assessment method, including tests and examination. Moreover, assignments are included as a component of continuous assessment so as to keep the students in progress.</p> <p>Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.</p>						
Student Study Effort Expected	Class contact:						
	▪ Lecture		26Hrs.				
	▪ Tutorial		13Hrs.				
	Other student study effort:						
	▪ Assignment		30Hrs.				
	▪ Self-study		61Hrs.				
Total student study effort		130Hrs.					
Reading List and References	J. Shao, Mathematical Statistics. Springer. 2003.						
	G. Casella and R. L. Berger, Statistical Inference. Second edition, Thomson, 2002.						
	E. Lehmann and G. Casella, Theory of Point Estimation. Second Edition, 1998						
	Ferguson, T. S. A Course in Large Sample Theory. 1996						

Subject Description Form

Subject Code	AMA615
Subject Title	Nonlinear Optimization Methods
Credit Value	3
Level	6
Expected background knowledge	A course in Linear Algebra and a course in Advanced Calculus
Objectives	To enable students to learn to use more advanced mathematical and computational techniques applicable in solving real engineering and management problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Understand basic theory of nonlinear optimization. (b) Solve unconstrained optimization problems. (c) Solve constrained optimization problems.
Subject Synopsis/ Indicative Syllabus	<p>Convex optimization: Convex set, convex function, conjugate function, directional derivative, subgradient, duality theorem.</p> <p>Unconstrained optimization: One dimensional search algorithms: Fibonacci and golden section search. Multidimensional search method: Steepest descent method; Newton's method; conjugate gradient method, quasi-Newton methods, and trust region method.</p> <p>Constrained optimization: Kuhn-Tucker condition for optimality, application to solution of simple nonlinear problems; quadratic programming and convex programming problems. Penalty and barrier functions. Sequential unconstrained minimization technique, multipliers method.</p> <p>Nonlinear complementarity problems and variational inequalities: Nonsmooth equation reformulation, generalized Jacobians, semismooth Newton methods, smoothing Newton methods, global convergence.</p>
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	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
			a	b	c
	1. Assignments	20%	✓	✓	✓
	2. Mid-term test	20%	✓	✓	✓
	3. Examination	60%	✓	✓	✓
Total	100 %				
Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.					
Student Study Effort Required	Class contact:				
	▪ Lecture		26 Hrs.		
	▪ Tutorial		13 Hrs.		
	Other student study effort:				
	▪ Assignment		23 Hrs.		
	▪ Self-study		40 Hrs.		
	▪ Total student study effort		102 Hrs.		
Reading List and References	Fletcher, R.	Practical Methods of Optimization, 2nd Edition	Wiley, 1987		
	Nocedal, J. and Wright, S.J.	Numerical Optimization, 2nd Edition	Springer, 2006		
	Dennis, J.E. and Schnabel, R.B.	Numerical Methods for Unconstrained Optimization and Nonlinear Equations	SIAM, 1996		
	Mangasarian, O.L.	Nonlinear Programming	SIAM, 1994		
	Rockafellar, R.T.	Convex Analysis	Princeton University Press, 1970		
	Facchinei, F. and Pang, J-S.	Finite-Dimensional Variational Inequalities and Complementarity Problems	Springer, 2003		

Subject Description Form

Subject Code	AMA 616
Subject Title	Statistics for Finance
Credit Value	3
Level	6
Expected background knowledge	A course in Statistical Analysis and a course in Advanced Calculus
Objectives	To give a comprehensive introduction into important ideas of financial mathematics and statistics for the modelling and statistical analysis of financial data.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students should be able to: a. Gain a deep understanding of option pricing model and financial time series; b. Solve simple option pricing problems numerically; c. Carry out basic statistical analysis on financial data; d. Apply option pricing theory to model new financial products and various statistical models to model the financial time series.
Subject Synopsis/ Indicative Syllabus	<i>Option pricing theory</i> Derivatives, Arbitrage, Wiener process, binomial processes, geometric random walks, stochastic integrals, Ito's Lemma, Black-Scholes model, hedging. European options, Binomial model, Cox-Ross-Rubinstein approach. American options, arbitrage relationship, trinomial model, numerical techniques, applications

	<p><i>Financial Time series analysis</i></p> <p>Econometric models, the random walk hypothesis, unit root test, ARIMA models.</p> <p>ARCH and GARCH models, Exponential GARCH, stochastic volatility, multivariate GARCH models, applications.</p>
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials, which are then reinforced by learning activities involving demonstration, tutorial exercises and assignments.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
			a	b	c	d
	1. CA	40%	✓	✓	✓	✓
	2. Exam	60%	✓	✓	✓	✓
	Total	100 %				
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The subject focuses on knowledge, skill and understanding of Statistics of Finance, Exam-based assessment is the most appropriate assessment method, including tests and examination. Moreover, assignments are included as a component of continuous assessment so as to keep the students in progress.</p> <p>Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.</p>						

Student Study Effort Expected	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignment	36 Hrs.
	▪ Self-study	27 Hrs.
	Total student study effort	102 Hrs.
Reading List and References	<p>J. Franke, W. Hardle and C.M. Hafner, Statistics of Financial Markets, 3rd Edition, 2012.</p> <p>P.J. Wilmott, Quantitative Finance, John Wiley & Sons Ltd., 2007.</p> <p>J.C. Hull, Options, Futures , and Other Derivatives, 8th Edition, Prentice Hall, 2012.</p> <p>C. Chatfield, The Analysis of Time Series: an introduction, 6th Edition, Chapman & Hall/CRC, 2003.</p> <p>J.D. Cryer and K.S. Chan, Time Series Analysis with Applications in R, 2nd Edition, Springer, 2008.</p> <p>R.S. Tsay, Analysis of financial time series, 3rd edition, Wiley, 2010.</p>	

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA6881
Subject Title	Guided Study in Applied Optimization
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Postgraduate course
Objectives	<ul style="list-style-type: none"> ◆ To broaden students' knowledge in applied optimization through literature searching in various fields. ◆ To enhance student's written and oral presentation skills through their own research work or topics of their interests.
Intended Learning Outcomes <i>(Note 1)</i>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Acquire knowledge and awareness of the latest advances in research development in applied optimization from literature related to topics of interest. (b) Carry out research on an agreed topic (c) Improve written and oral presentation skills of research results on current topics of interest.
Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i>	<ul style="list-style-type: none"> ◆ The topic is determined by the Supervisor of the M. Phil/Ph. D student. ◆ Students must hand the completed guided study report to supervisor with adequate of related literature references. ◆ Student should consult supervisor regularly about the progress of the literature reviewing progress.
Teaching/Learning Methodology <i>(Note 3)</i>	<p>Meet assigned supervisor regularly Hand the report with full list of references</p>

Assessment Methods in Alignment with Intended Learning Outcomes <i>(Note 4)</i>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c		
	Continuous assessment	100	√	√	√		
	Total	100 %					
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Supervisor will go through the literature report and project report, and check the references and give a final grade to the final report</p>							
Student Study Effort Expected	Student contact:						
	▪ Seminar/Tutorial		26 Hrs.				
	Other student study effort:						
	▪ Assignment/mini-project		34Hrs.				
	▪ Self-study		60 Hrs.				
	Total student study effort		120 Hrs.				
	Reading List and References						

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA6882
Subject Title	Guided Study in Operations Research
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Postgraduate course
Objectives	<ul style="list-style-type: none"> ◆ To broaden students' knowledge in operations research through literature searching in various fields. ◆ To enhance student's written and oral presentation skills through their own research work or topics of their interests.
Intended Learning Outcomes <i>(Note 1)</i>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Acquire knowledge and awareness of the latest advances in research development in operations research from literature related to topics of interest. (b) Carry out research on an agreed topic (c) Improve written and oral presentation skills of research results on current topics of interest.
Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i>	<ul style="list-style-type: none"> ◆ The topic is determined by the Supervisor of the M. Phil/Ph. D student. ◆ Students must hand the completed guided study report to supervisor with adequate of related literature references. ◆ Student should consult supervisor regularly about the progress of the literature reviewing progress.
Teaching/Learning Methodology <i>(Note 3)</i>	<p>Meet assigned supervisor regularly Hand the report with full list of references</p>

Assessment Methods in Alignment with Intended Learning Outcomes <i>(Note 4)</i>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c		
	Continuous assessment	100	√	√	√		
	Total	100 %					
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Supervisor will go through the literature report and project report, and check the references and give a final grade to the final report</p>							
Student Study Effort Expected	Student contact:						
	▪ Seminar/Tutorial		26 Hrs.				
	Other student study effort:						
	▪ Assignment/mini-project		34Hrs.				
	▪ Self-study		60 Hrs.				
	Total student study effort		120 Hrs.				
	Reading List and References						

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

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Note 4: Assessment Method

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The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA6883
Subject Title	Guided Study in Applied Statistics
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Postgraduate course
Objectives	<ul style="list-style-type: none"> ◆ To broaden students' knowledge in applied statistics through literature searching in various fields. ◆ To enhance student's written and oral presentation skills through their own research work or topics of their interests.
Intended Learning Outcomes <i>(Note 1)</i>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Acquire knowledge and awareness of the latest advances in research development in applied statistics from literature related to topics of interest. (b) Carry out research on an agreed topic (c) Improve written and oral presentation skills of research results on current topics of interest.
Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i>	<ul style="list-style-type: none"> ◆ The topic is determined by the Supervisor of the M. Phil/Ph. D student. ◆ Students must hand the completed guided study report to supervisor with adequate of related literature references. ◆ Student should consult supervisor regularly about the progress of the literature reviewing progress.
Teaching/Learning Methodology <i>(Note 3)</i>	<p>Meet assigned supervisor regularly Hand the report with full list of references</p>

Assessment Methods in Alignment with Intended Learning Outcomes <i>(Note 4)</i>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c		
	Continuous assessment	100	√	√	√		
	Total	100 %					
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Supervisor will go through the literature report and project report, and check the references and give a final grade to the final report</p>							
Student Study Effort Expected	Student contact:						
	▪ Seminar/Tutorial		26 Hrs.				
	Other student study effort:						
	▪ Assignment/mini-project		34Hrs.				
	▪ Self-study		60 Hrs.				
	Total student study effort		120 Hrs.				
	Reading List and References						

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus

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This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA6884
Subject Title	Guided Study in Financial Mathematics
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Postgraduate course
Objectives	<ul style="list-style-type: none"> ◆ To broaden students' knowledge in financial mathematics through literature searching in various fields. ◆ To enhance student's written and oral presentation skills through their own research work or topics of their interests.
Intended Learning Outcomes <i>(Note 1)</i>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Acquire knowledge and awareness of the latest advances in research development in financial mathematics from literature related to topics of interest. (b) Carry out research on an agreed topic (c) Improve written and oral presentation skills of research results on current topics of interest.
Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i>	<ul style="list-style-type: none"> ◆ The topic is determined by the Supervisor of the M. Phil/Ph. D student. ◆ Students must hand the completed guided study report to supervisor with adequate of related literature references. ◆ Student should consult supervisor regularly about the progress of the literature reviewing progress.
Teaching/Learning Methodology <i>(Note 3)</i>	<p>Meet assigned supervisor regularly Hand the report with full list of references</p>

Assessment Methods in Alignment with Intended Learning Outcomes <i>(Note 4)</i>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c		
	Continuous assessment	100	√	√	√		
	Total	100 %					
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Supervisor will go through the literature report and project report, and check the references and give a final grade to the final report</p>							
Student Study Effort Expected	Student contact:						
	▪ Seminar/Tutorial		26 Hrs.				
	Other student study effort:						
	▪ Assignment/mini-project		34Hrs.				
	▪ Self-study		60 Hrs.				
	Total student study effort		120 Hrs.				
	Reading List and References						

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA6885
Subject Title	Guided Study in Engineering Mathematics
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Postgraduate course
Objectives	<ul style="list-style-type: none"> ◆ To broaden students' knowledge in engineering mathematics through literature searching in various fields. ◆ To enhance student's written and oral presentation skills through their own research work or topics of their interests.
Intended Learning Outcomes <i>(Note 1)</i>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Acquire knowledge and awareness of the latest advances in research development in engineering mathematics from literature related to topics of interest. (b) Carry out research on an agreed topic (c) Improve written and oral presentation skills of research results on current topics of interest.
Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i>	<ul style="list-style-type: none"> ◆ The topic is determined by the Supervisor of the M. Phil/Ph. D student. ◆ Students must hand the completed guided study report to supervisor with adequate of related literature references. ◆ Student should consult supervisor regularly about the progress of the literature reviewing progress.
Teaching/Learning Methodology <i>(Note 3)</i>	<p>Meet assigned supervisor regularly Hand the report with full list of references</p>

Assessment Methods in Alignment with Intended Learning Outcomes <i>(Note 4)</i>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c		
	Continuous assessment	100	√	√	√		
	Total	100 %					
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Supervisor will go through the literature report and project report, and check the references and give a final grade to the final report</p>							
Student Study Effort Expected	Student contact:						
	▪ Seminar/Tutorial		26 Hrs.				
	Other student study effort:						
	▪ Assignment/mini-project		34Hrs.				
	▪ Self-study		60 Hrs.				
	Total student study effort		120 Hrs.				
	Reading List and References						

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA6886
Subject Title	Guided Study in Computational Mathematics
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Postgraduate course
Objectives	<ul style="list-style-type: none"> ◆ To broaden students' knowledge in computational mathematics through literature searching in various fields. ◆ To enhance student's written and oral presentation skills through their own research work or topics of their interests.
Intended Learning Outcomes <i>(Note 1)</i>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Acquire knowledge and awareness of the latest advances in research development in computational mathematics from literature related to topics of interest. (b) Carry out research on an agreed topic (c) Improve written and oral presentation skills of research results on current topics of interest.
Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i>	<ul style="list-style-type: none"> ◆ The topic is determined by the Supervisor of the M. Phil/Ph. D student. ◆ Students must hand the completed guided study report to supervisor with adequate of related literature references. ◆ Student should consult supervisor regularly about the progress of the literature reviewing progress.
Teaching/Learning Methodology <i>(Note 3)</i>	<p>Meet assigned supervisor regularly Hand the report with full list of references</p>

Assessment Methods in Alignment with Intended Learning Outcomes <i>(Note 4)</i>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b	c		
	Continuous assessment	100	√	√	√		
	Total	100 %					
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Supervisor will go through the literature report and project report, and check the references and give a final grade to the final report</p>							
Student Study Effort Expected	Student contact:						
	▪ Seminar/Tutorial		26 Hrs.				
	Other student study effort:						
	▪ Assignment/mini-project		34Hrs.				
	▪ Self-study		60 Hrs.				
	Total student study effort		120 Hrs.				
	Reading List and References						

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AMA6887
Subject Title	Guided Study on Research Topics in Applied Mathematics
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Postgraduate course
Objectives	<ul style="list-style-type: none"> ◆ To broaden students' knowledge in applied mathematics through literature searching in various fields including applied optimization, operations research, applied statistics, financial mathematics, engineering mathematics, and computational mathematics. ◆ To enhance student's written and oral presentation skills through their own research work or topics of their interests.
Intended Learning Outcomes <i>(Note 1)</i>	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> (a) Acquire knowledge and awareness of the latest advances in research development in applied mathematics from literature related to topics of interest. (b) Do research on an agreed topic (c) Improve written and oral presentation skills of research results on current topics of interest.
Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i>	<ul style="list-style-type: none"> ◆ The topic is determined by the Supervisor of the M. Phil/Ph. D student. ◆ Students must hand the completed guided study report to supervisor with adequate of related literature references. ◆ Student should consult supervisor regularly about the progress of the literature reviewing progress.

Teaching/Learning Methodology <i>(Note 3)</i>	Meet assigned supervisor regularly Hand the report with full list of references																																																													
Assessment Methods in Alignment with Intended Learning Outcomes <i>(Note 4)</i>	<table border="1" data-bbox="523 376 1471 757"> <thead> <tr> <th data-bbox="523 376 858 479" rowspan="2">Specific assessment methods/tasks</th> <th data-bbox="868 376 1002 479" rowspan="2">% weighting</th> <th colspan="6" data-bbox="1011 376 1471 479">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th data-bbox="1011 479 1082 510">a</th> <th data-bbox="1091 479 1161 510">b</th> <th data-bbox="1171 479 1241 510">c</th> <th data-bbox="1251 479 1321 510">d</th> <th data-bbox="1331 479 1401 510">e</th> <th data-bbox="1410 479 1471 510"></th> </tr> </thead> <tbody> <tr> <td data-bbox="523 510 858 582">Continuous assessment</td> <td data-bbox="868 510 1002 582">100</td> <td data-bbox="1011 510 1082 582">√</td> <td data-bbox="1091 510 1161 582">√</td> <td data-bbox="1171 510 1241 582">√</td> <td data-bbox="1251 510 1321 582"></td> <td data-bbox="1331 510 1401 582"></td> <td data-bbox="1410 510 1471 582"></td> </tr> <tr> <td data-bbox="523 582 858 654"></td> <td data-bbox="868 582 1002 654"></td> <td data-bbox="1011 582 1082 654"></td> <td data-bbox="1091 582 1161 654"></td> <td data-bbox="1171 582 1241 654"></td> <td data-bbox="1251 582 1321 654"></td> <td data-bbox="1331 582 1401 654"></td> <td data-bbox="1410 582 1471 654"></td> </tr> <tr> <td data-bbox="523 654 858 757">Total</td> <td data-bbox="868 654 1002 757">100 %</td> <td colspan="6" data-bbox="1011 654 1471 757"></td> </tr> </tbody> </table> <p data-bbox="523 792 1471 981"> Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Supervisor will go through the literature report and project report, and check the references and give a final grade to the final report </p>								Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						a	b	c	d	e		Continuous assessment	100	√	√	√												Total	100 %																						
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Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

Subject Description Form

Subject Code	AMA67711						
Subject Title	Research Seminars						
Credit Value	1						
Level	6						
Pre-requisite / Co-requisite/ Exclusion	A compulsory subject for research students of AMA						
Objectives	The aim of this subject is to provide students with the opportunity to learn the latest advances in Applied Mathematics and facilitate communications with experts in the field.						
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(a) Gain a good understanding of different advanced topics.</p> <p>(b) Learn oral academic communication and presentation skills.</p>						
Subject Synopsis/ Indicative Syllabus	Seminars to be attended are determined by the students and chief supervisors.						
Teaching/Learning Methodology	<p>Students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p>						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b			
	1. Attend 10 research seminars	80%	✓	✓			
	2. One report on one of the attended seminars	20%	✓	✓			
	Total	100 %					

Subject Description Form

Subject Code	AMA67712						
Subject Title	Research Seminars						
Credit Value	1						
Level	6						
Pre-requisite / Co-requisite/ Exclusion	A compulsory subject for research students of AMA						
Objectives	The aim of this subject is to provide students with the opportunity to learn the latest advances in Applied Mathematics and facilitate communications with experts in the field.						
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(a) Gain a good understanding of different advanced topics.</p> <p>(b) Learn oral academic communication and presentation skills.</p>						
Subject Synopsis/ Indicative Syllabus	Seminars to be attended are determined by the students and chief supervisors.						
Teaching/Learning Methodology	<p>Students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p>						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b			
	1. Attend 10 research seminars	80%	✓	✓			
	2. One report on one of the attended seminars	20%	✓	✓			
Total	100 %						

Subject Description Form

Subject Code	AMA67713						
Subject Title	Research Seminars						
Credit Value	1						
Level	6						
Pre-requisite / Co-requisite/ Exclusion	A compulsory subject for research students of AMA						
Objectives	The aim of this subject is to provide students with the opportunity to learn the latest advances in Applied Mathematics and facilitate communications with experts in the field.						
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(a) Gain a good understanding of different advanced topics.</p> <p>(b) Learn oral academic communication and presentation skills.</p>						
Subject Synopsis/ Indicative Syllabus	Seminars to be attended are determined by the students and chief supervisors.						
Teaching/Learning Methodology	<p>Students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p>						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b			
	1. Attend 10 research seminars	80%	✓	✓			
	2. One report on one of the attended seminars	20%	✓	✓			
Total	100 %						

Subject Description Form

Subject Code	AMA67714						
Subject Title	Research Seminars						
Credit Value	1						
Level	6						
Pre-requisite / Co-requisite/ Exclusion	A compulsory subject for research students of AMA						
Objectives	The aim of this subject is to provide students with the opportunity to learn the latest advances in Applied Mathematics and facilitate communications with experts in the field.						
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(a) Gain a good understanding of different advanced topics.</p> <p>(b) Learn oral academic communication and presentation skills.</p>						
Subject Synopsis/ Indicative Syllabus	Seminars to be attended are determined by the students and chief supervisors.						
Teaching/Learning Methodology	<p>Students are required to attend at least 10 research seminars per year, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars every year.</p> <p>Part-time students are required to attend at least 10 research seminars per two years, in addition to workshops/conferences, and to submit a report, to the Chief Supervisor, of no less than 1,500 words (excluding references) on one of the attended seminars once every two years.</p> <p>Chief Supervisors are required to assess the report (with a pass or failure grade). Students who failed to submit a report to the satisfaction of their Chief Supervisor are required to make a re-submission until a pass grade is obtained.</p>						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			a	b			
	1. Attend 10 research seminars	80%	✓	✓			
	2. One report on one of the attended seminars	20%	✓	✓			
Total	100 %						

Subject Description Form

Subject Code	AMA67721					
Subject Title	Departmental training					
Credit Value	1					
Level	6					
Pre-requisite / Co-requisite/ Exclusion	A compulsory subject for PhD students of AMA					
Objectives	The aim of this subject is to provide students with the opportunity to engage in teaching / research supporting activities in AMA.					
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(a) Gain an understanding of teaching activities.</p> <p>(b) Learn to support organized research activities.</p>					
Subject Synopsis/ Indicative Syllabus	Teaching/research supporting activities are assigned by the HoD or his/her delegate.					
Teaching/Learning Methodology	<p>To earn one credit, students will be required to engage in teaching/research supporting activities assigned by the HoD or his/her delegate for 6 hours/week in any 13-week semester.</p> <p>The HoD or his/her delegate is required to:</p> <p>a. ensure that the activities are structured and can be assessed properly;</p> <p>b. submit, at the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall assessment grade of Pass or Fail.</p>					
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
			a	b		
	1. Undertake teaching/research supporting activities	100%	✓	✓		

Subject Description Form

Subject Code	AMA67722					
Subject Title	Departmental training					
Credit Value	1					
Level	6					
Pre-requisite / Co-requisite/ Exclusion	A compulsory subject for PhD students of AMA					
Objectives	The aim of this subject is to provide students with the opportunity to engage in teaching / research supporting activities in AMA.					
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <p>(a) Gain an understanding of teaching activities.</p> <p>(b) Learn to support organized research activities.</p>					
Subject Synopsis/ Indicative Syllabus	Teaching/research supporting activities are assigned by the HoD or his/her delegate.					
Teaching/Learning Methodology	<p>To earn one credit, students will be required to engage in teaching/research supporting activities assigned by the HoD or his/her delegate for 6 hours/week in any 13-week semester.</p> <p>The HoD or his/her delegate is required to:</p> <p>a. ensure that the activities are structured and can be assessed properly;</p> <p>b. submit, at the end of the training session, an assessment report on the performance of the relevant student(s), with details of activities undertaken and an overall assessment grade of Pass or Fail.</p>					
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
			a	b		
	1. Undertake teaching/research supporting activities	100%	✓	✓		