THE HONG KONG POLYTECHNIC UNIVERSITY

DEPARTMENT OF APPLIED MATHEMATICS

PROGRAMME DOCUMENT FOR RESEARCH DEGREES

Master of Philosophy

Doctor of Philosophy

2023

General Information

Institution	:	The Hong Kong Polytechnic University
Faculty	:	Faculty of Science
Department	:	Department of Applied Mathematics
Head	:	Professor Defeng SUN
Programme	:	Research Postgraduate Programme in Applied Mathematics
Mode of Attendance	:	Full time and Part time
Duration (Normal study period)	:	M.Phil 24 months for full-time, 48 months for part-time. 3- year PhD 36 months for full-time, 72 months for part-time. 4- year PhD 48 months for full-time, 96 months for part-time. (for admission with Bachelor Degree or Master Degree without any research components)
Implementation Date	:	September 2014
Programme Leader	:	Prof. Zhian WANG

The document is applicable to students admitted to the Research postgraduate programme in Applied Mathematics from academic year 2023/2024 onwards.

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 read together with the "Regulations and Administrative Procedures for the Degrees of MPhil and PhD" and the "Research Student Handbook".

1 Full ProgrammeTitles

Mater of Philosophy (MPhil)
Doctor of Philosophy (PhD)

2 Host Department(s)

Department of Applied Mathematics
應用數學系

3 Awards

1. M.Phil.

2. PhD

4 Medium of Instruction

All subjects are taught in English, unless otherwise specified.

5 Normal Duration and Mode of Attendance

M.Phil
24 months for full-time, 48 months for part-time.

3- year PhD
36 months for full-time, 72 months for part-time.

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

6 Mode of Attendance

- Full-time
- Part-time

7 Programme Management

Programme Leader
The Programme Leader will provide the academic and organizational leadership for the programme. The Programme Leader should expect the full support and cooperation of the Head of Department and Heads of other contributing Departments but should recognise that a Head will have to balance a range of departmental demands and priorities in allocating

staff and resources to the programme. In particular, a Programme Leader's responsibilities are:

(i) to ensure the effective conduct and organization of the programme within agreed policies and regulations;
(ii) to negotiate with the Head(s) of Department(s) about the allocation of appropriate staff for supervision and other duties required by the programme;
(iii) to develop good working relationships with the Heads and relevant senior staff of Departments involved in the programme and with staff for supervision on the programme;
(iv) to keep in close touch with the academic welfare and progress of students on the programme, and to be closely aware of students' views about the programme;
(v) to report to the Heads of Departments concerned on the on-going requirements of staff and resources for the programme, as part of the preparation of departmental estimates;
(vi) to lead the development of the programme and the implementation of the Programme Learning Outcomes Assessment Plan;
(vii) to coordinate the inputs to and the debate of the Departmental Programme Committee leading to the annual programme review reports (including the programme learning outcomes assessment results) which form part of the Annual QA Report and Business Plan, and other periodic programme reviews; and
(viii) to take executive action as agreed by the Departmental Programme Committee.

8 Entrance Requirements

Applicants seeking admission to a research postgraduate programme should satisfy the following minimum entrance requirements:

MPhil: a Bachelor's degree in a relevant area with Second Class Honours or above (or equivalent qualification) conferred by a recognised university.

3-year full-time / 6-year part-time PhD: an MPhil or equivalent (a research postgraduate degree with a dissertation as an award requirement) conferred by a recognised university.

4-year full-time / 8-year part-time PhD: a Master's degree; or a Bachelor's degree with First Class Honours (or equivalent qualification), conferred by a recognised university.

Applicants from a university where the language of teaching /instruction /examination is NOT entirely in English should satisfy the minimum English proficiency requirements specified by both the University and individual Faculties.

Applicants who have not obtained a degree from a recognised university in which the language of instruction is English are normally required to obtain:

1. an overall score of at least 6.5 in the International English Language Testing System (IELTS); or
2. a Test of English as a Foreign Language (TOEFL) score of 80 or above for the Internet-based test or 550.

All English language test scores are considered valid for two years after the date of the test.

9 Programme Learning Outcomes

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

The research degree programmes are designed in such a way to enable the student to:

- develop and demonstrate research skills and knowledge in applied mathematics; critically analyze new and complex information from real problems, and effectively utilize research methodologies in applied mathematics; and
- recognize the importance of research ethics; and
- provide novel solutions to research problems and effectively interpret new research results; and
- learn up-to-date research advances and developments in applied mathematics; and
- present results with good scientific writing and presentation skills (for PhD programme)

10 The Curriculum

Course/ Credit Requirement

Students are mainly conducting research study under the supervision of their main supervisor's guidance. Different categories of students need to attain different credit requirements. The credit requirements should cover attending seminars and Practicum as follows:

2-year MPhil: 9 credits
(1 credit from HTI6081 + 2 credits from attending seminars (AMA67711 +AMA67712) + 3 credits from 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) + 3 credits from 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) + 3 credits from 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.

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 thesis submission. To earn one credit, students will be required to engage in teaching activities/professional service 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 thesis submission. 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 not 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

All research students are required to take the Research Language Skills Assessment (RLSA) in their first semester of study at PolyU to be arranged by English Language Centre (ELC). Based on their performance of the RLSA, students will need to take relevant subjects according to the following arrangement:

RLSA Performance[1]	*English enhancement subjects*
Band 1 in both Writing, and Speaking tasks	exempted
Band 2 or above in both Writing, and Speaking tasks	ENGL6016: *Advanced Academic English for Research Students: Publishing and Presenting*
Band 3 or below in either Writing, or Speaking tasks	ELC6011 **and** ELC6012 ELC6011: *Presentation Skills for Research Students* ELC6012: *Thesis Writing for Research Students*

Note 1: Band 1 is the highest grade and Band 5 the lowest.

Before thesis submission, students are required to take and pass the English enhancement subjects.

National Education Requirement

All research students admitted from the 2022/23 cohort onwards are required to complete the National Education requirement before thesis submission as a graduation requirement. Student are required to take a 3-hour e-learning module on "Understanding China and the Hong Kong Special Administrative Region, P.R.C." in English. Details on the requirement are specified at: https://www.polyu.edu.hk/ous/nationaleducation/understanding-china-and-hongkong/.

Thesis requirements

For students admitted in or before the 2020/21 cohort

Option 1: 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.

Option 2: A PhD thesis must be submitted to the satisfaction of the supervisor(s) for reviews by external examiners. Prior to submission for reviews by external examiners, a PhD thesis which does not contain any accepted/published paper in a good journal must pass a review conducted by AMA PhD Thesis Assessment Committee. The AMA PhD Thesis Assessment Committee should consist of the Programme Leader (Panel Chair) and three independent members from different research groups.

For students admitted from the 2021/22 cohort onwards

A PhD thesis must be submitted to the satisfaction of the supervisor(s) for reviews by external examiners. Prior to submission for reviews by external examiners, a PhD thesis which does not contain any accepted/published paper in a good journal must pass a review conducted by AMA PhD Thesis Assessment Committee. The AMA PhD Thesis Assessment Committee should consist of the Programme Leader (Panel Chair) and three independent members from different research groups.

Graduation Requirements

A student would be eligible for award if he/she satisfies all the conditions listed below:

(i) Accumulation of the requisite number of credits for the particular award, as defined in the definitive programme document; and

(ii) Satisfying all other requirements as defined in the definitive programme document and as specified by the University; and

(iii) All MPhil and PhD students need to complete their coursework with a qualifying GPA of 2.7 or above before submission of their thesis for examination.

(iv) Take and pass an oral defense of his/her thesis

(v) All other general University requirements relating to Graduation Requirements.

11 Subjects Support to Programme Outcomes

Grading

Assessment grades shall be awarded on a criterion-referenced basis. A student's overall performance in a subject shall be graded as follows with effect from the 2020/21 academic year for all students,:

Subject grade	***Short description***
A+	Excellent
A	
A-	
B+	Good
B	
B-	
C+	Satisfactory
C	
C-	
D+	Pass
D	
F	Failure

'F' is a subject failure grade, whilst all others ('D' to 'A+') are subject passing grades. No credit will be earned if a subject is failed.

A numeral grade point is assigned to each subject grade, as follows:

Grade	New Grade Point
A+	4.3
A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D+	1.3
D	1.0
F	0.0

The qualifying Grade Point Average (GPA) will be computed as follows, and based on the grade point of all the subjects:

$$\text{GPA} = \frac{\sum_{n} \text{Subject Grade Point} \times \text{Subject Credit Value}}{\sum_{n} \text{Subject Credit Value}}$$

where n = number of all subjects (inclusive of failed subjects) taken by the student up to and including the latest semester/term, but for subjects which have been retaken, only the grade obtained in the final attempt will be included in the GPA calculation

12 The Curriculum Map

Programme Outcomes	AMA610	AMA611	AMA612	AMA613	AMA614	AMA615	AMA616	AMA617	AMA618	AMA619	AMA620	AMA6887	HTI 6081	ELC6011	ELC6012	ENGL6016	Attend seminars	Dept. training	Thesis
a. To develop and demonstrate research skills and knowledge in applied mathematics; critically analyze new and complex information from real problems, and effectively utilize research methodologies in applied mathematics	√	√	√	√	√	√	√	√	√	√	√	√							√
b. To present results with good scientific writing and presentation skills				√					√	√	√	√		√	√	√			√
c. To recognize the importance of research ethics													√						√
d. To provide novel solutions to research problems and effectively interpret new research results								√	√	√	√								√
e. To learn up-to-date research advances and developments in applied mathematics								√	√	√	√	√					√	√	√

SUBJECT DESCRIPTIONS

(AMA SUBJECTS)

arranged in alphabetical order

Master of Philosophy
Doctor of Philosophy

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	50 : 50	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
AMA617*	Optimal Stopping and Stochastic Control in Mathematical Finance*	E	3	50:50	A course in stochastic calculus and a course in partial differential equations
AMA618	Advanced Topics in Applied Mathematics	E	3	50:50	A course in calculus, linear algebra, and basic functional analysis
AMA619	Advanced Mathematical Statistics	E	3	100 : 0	A course in college calculus, college linear algebra, and basic mathematical statistics
AMA620	Advanced Statistical Learning	E	3	100 : 0	A course in college calculus, college linear algebra, and basic

					mathematical statistics
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
ELC6011	Presentation Skills for Research Students	C	2	100 : 0	None
ELC6012	Thesis Writing for Research Students	C	3	100 : 0	None
ENGL6016	Advanced Academic English for Research Students: Publishing and Presenting	C	3	100 : 0	None

*The subject will be offered to PhD students only.

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 %					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

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.

Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.

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	AMA611
Subject Title	Applied Analysis
Credit Value	3
Level	6
Expected background knowledge	A course in Linear Algebra and a course in Advanced Calculus. A course in Partial Differential Equations or Analysis would be highly recommended.
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	Upon satisfactory completion of the subject, students should be able to: 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	*Basic functional analysis* Banach and Hilbert Spaces; L**p** spaces; Sobolev spaces; inequalities; linear operators and spectrum (discrete and continuous); Compactness. *Fixed point theorems and applications* The contraction mapping; local and global well-posedness;

	Gateaux and Frechet derivatives; implicit and inverse function theorems; applications to PDEs arising from Physics, Biology, Geometry and Engineering. *Variational Calculus* Functionals; constraints and Lagrange multipliers; minimization by direct methods; saddle points and the Mountain Pass Lemma; Hamiltonian equations.
Teaching/ Learning Methodology	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.

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	25%	✓	✓	✓	✓
3. Final Exam	50%	✓	✓	✓	✓
Total	100 %				

The project must be pre-approved by the instructor.

Continuous assessment comprises of assignments and project.

A written examination is held at the end of the semester.

Student Study Effort	Class contact:	

Expected	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignments ▪ Project	30 Hrs. 30 Hrs.
	▪ Self-study	31 Hrs.
	Total student study effort	130 Hrs.
Reading List and References	M. Reed and B. Simon. Methods of Modern Mathematical Physics: Vol. I: Functional Analysis. Academic Press, 1972. E. H. Lieb and M. Loss. Analysis, Graduate studies in Mathematics. American Mathematical Society, Vol. 14, 2nd ed. 2001. G. B. Folland. Real Analysis: modern techniques and their applications. Wiley, New York, 1984. R. C. McOwen. Partial Differential Equations: methods and applications. Prentice Hall, 1996. L. C. Evans. Partial Differential Equations, volume 19 of Graduate studies in mathematics. American Mathematical Society, 1998. P. D. Hislop and I. M. Sigal. Introduction to spectral theory, Vol. 133 of Applied Mathematical Sciences. Springer Verlag, 1996. S. Gustafsson and I.M. Sigal. Mathematical Concepts of Quantum Mechanics. Springer Verlag, 2003.	

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	*Finite difference methods:* Finite difference methods for model problems, Stability, Consistency, Convergence, Lax equivalent theorem, Error estimates. *Finite element methods:* Finite element methods for model problems, Interpolation theory in Sobolev Spaces, Conforming finite elements, Error estimates. *Time discretization of evolution equations:* Parabolic equations and BDF methods, Subdiffusion equations and convolution quadrature, Approximation to nonsmooth solutions.

<table>
<tr><td>Teaching/ Learning Methodology</td><td>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.</td></tr>
</table>

<table>
<tr><td rowspan="2">Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods</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. CA</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Exam</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>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The subject focuses on knowledge, skill and understanding of <u>Numerical methods for Partial Differential equations</u>, <u>thus, 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.

Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.</td></tr>
<tr><td>Student Study Effort Expected</td><td>Class contact:
▪ Lecture</td><td></td><td>26 Hrs.</td></tr>
</table>

	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignment	36 Hrs.
	▪ Self-study	27 Hrs.
	Total student study effort	102 Hrs.
Reading List and References	J.W. Thomas, Numerical partial differential equations—Finite Difference Methods, Springer, 1995. 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. Philippe G. Ciarlet, The Finite Element Method for Elliptic Problems, SIAM: Society for Industrial and Applied Mathematics; 2nd edition, 2002. O.C. Zienkiewicz and K. Morgan, Finite Element Method, John Wiley, 1983.	

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 provide education on students' oral and written presentations of research results.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Do research on an agreed topic/area/issue. (b) Gain an in-depth understanding of the literature related to topics of interest. (c) Develop written skills for presentation of research results. (d) Develop oral academic communication and presentation skills.
Subject Synopsis/ Indicative Syllabus	Topics presented to be determined by the participants, coordinated by the subject examiner (coordinator).
Teaching/Learning Methodology	Subject lecturer teaches students about both oral and written presentation skills and chairs all students' oral presentations. 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. Students' presentation materials are required to be submitted to the subject lecturer for checking before class.

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		
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:	
▪ Three lectures	6 Hrs.
▪ Presentation of supervised research topic	10 Hrs.
▪ Presentation of selected topic	10 Hrs.
Other student study effort:	112 Hrs.
▪ Self-study	Hrs.
Total student study effort	138 Hrs.

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, 3rd 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 %					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

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.

Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.

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	**I. Unconstrained Optimization** 1.1 First, second order optimality conditions Convex optimization 1.2 First order methods Steepest descent methods, Conjugate gradient methods, Trust region methods 1.3 Second order methods Newton methods, Quasi-Newton methods, Trust region Newton methods 1.4 Non-differentiable objective function First order optimality condition, Proximal point methods, Smoothing methods **II. Constrained Optimization** 2.1 First, second order optimality conditions, KKT conditions, Constraint Qualification 2.2 Penalty methods 2.3 Augmented Lagrangian methods (ALM) 2.4 Alternating direction method of multipliers (ADMM) **III. Optimization methods in Data Science** 3.1 Least absolute shrinkage and selection operator (Lasso), Semi-smooth Newton methods 3.2 Folded concave penalized estimation, Difference-convex (DC) optimization methods 3.3 Non-Lipschitz regularization, Smoothing methods 3.4 Composite nonsmooth nonconvex optimization in deep learning
Teaching/Learning	The subject will be delivered mainly through lectures and tutorials. The

<table>
<tr><td>Methodology</td><td>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.</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="3">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td></tr>
<tr><td>1. Assignments</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Mid-term test</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>3. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="3"></td></tr>
</table>

Continuous Assessment comprises of assignments and a mid-term test. A written examination is held at the end of the semester.</td></tr>
<tr><td>Student Study Effort Required</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>13 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignment</td><td>23 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>40 Hrs.</td></tr>
<tr><td>▪ Total student study effort</td><td>102 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>
<table>
<tr><td>Fletcher, R.</td><td>Practical Methods of Optimization, 2nd Edition</td><td>Wiley, 1987</td></tr>
<tr><td>Nocedal, J. and Wright, S.J.</td><td>Numerical Optimization, 2nd Edition</td><td>Springer, 2006</td></tr>
<tr><td>Dennis, J.E. and Schnabel, R.B.</td><td>Numerical Methods for Unconstrained Optimization and Nonlinear Equations</td><td>SIAM, 1996</td></tr>
<tr><td>Mangasarian, O.L.</td><td>Nonlinear Programming</td><td>SIAM, 1994</td></tr>
<tr><td>Rockafellar, R.T.</td><td>Convex Analysis</td><td>Princeton University Press, 1970</td></tr>
<tr><td>Facchinei, F. and Pang, J-S.</td><td>Finite-Dimensional Variational Inequalities and Complementarity Problems</td><td>Springer, 2003</td></tr>
</table>
</td></tr>
</table>

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	*Option pricing theory* 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

	Financial Time series analysis Econometric models, the random walk hypothesis, unit root test, ARIMA models. ARCH and GARCH models, Exponential GARCH, stochastic volatility, multivariate GARCH models, applications.
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 %				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

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.

Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.

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	J. Franke, W. Hardle and C.M. Hafner, Statistics of Financial Markets, 3rd Edition, 2012. P.J. Wilmott, Quantitiative Finance, John Wiley & Sons Ltd., 2007. J.C. Hull, Options, Futures , and Other Derivatives, 8th Edition, Prentice Hall, 2012. C. Chatfield, The Analysis of Time Series: an introduction, 6th Edition, Chapman & Hall/CRC, 2003. J.D. Cryer and K.S. Chan, Time Series Analysis with Applications in R, 2nd Edition, Springer, 2008. R.S. Tsay, Analysis of financial time series, 3rd edition, Wiley, 2010.	

Subject Description Form

Subject Code	AMA617
Subject Title	Optimal Stopping and Stochastic Control in Mathematical Finance
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	A course in stochastic calculus and a course in partial differential equations
Objectives	This subject is to introduce students to the fundamental theory of optimal stopping and stochastic control in finance.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. Gain a deep understanding of the American option pricing model, portfolio selection problems with and without market frictions, and capital structure models. b. Learn how to conduct theoretical analysis for optimal stopping time problems and singular stochastic control problems; c. Gain a basic knowledge of the finite difference method for HJB equations arising from finance.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	American option pricing, Merton's model, dynamic mean-variance analysis, Merton's model with transaction costs, and Merton's problem with capital gains taxes, capital structure, time-inconsistency, optimal stopping problems, stochastic control, singular control, impulse control, HJB equations, viscosity solutions, variational inequality equations, numerical solutions, etc.
Teaching/Learning Methodology *(Note 3)*	The subject will be delivered mainly through lectures and tutorials. Assignments and projects will be also given.

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. CA	50%	√	√	√
2. Exam	50%	√	√	√
Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The subject focuses on knowledge and understanding of optimal stopping and stochastic control problems arising from finance. A final exam (50%) is an appropriate way to examine students' learning effect. Continuous Assessment (50%) comprises of assignments and projects, which are designed to evaluate students' progress.

Student Study Effort Expected

Class contact:	
▪ Lecture	26 Hrs.
▪ Tutorial	13 Hrs.
Other student study effort:	
▪ Assignment/ mini-project	36Hrs.
▪ Self-study	36Hrs.
Total student study effort	111Hrs.

Reading List and References

1. Fleming, W. H., and Soner, H. M. (2006). Controlled Markov Processes and Viscosity Solutions. Springer Science & Business Media.
2. Huyen Pham (2010). Continuous-time Stochastic Control and Optimization with Financial Applications, Springer.
3. Steven E. Shreve (2004). Stochastic Calculus for Finance, Volume II: Continuous-Time Models. Springer-Verlag, New York.
4. Jiongmin Yong and Xun Yu Zhou (1999). Stochastic Controls: Hamiltonian Systems and HJB Equations. Springer-Verlag, New York.

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon subject completion. 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, overcrowding 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 is intended 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	AMA618
Subject Title	Advanced Topics in Applied Mathematics
Credit Value	3
Level	6
Expected background knowledge	A course in calculus, linear algebra, and basic functional analysis
Objectives	This subject is to introduce students to some advanced topics in applied mathematics.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. Learn how to use generalized functions, Fourier transform, singular integrals, Sobolev spaces, and related concepts; b. Learn how to use Laplace transform and semigroup theory to study time-dependent partial differential equations; c. Learn how to construct numerical approximations by using Laplace transform and semigroup techniques.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	Banach spaces, generalized functions, Fourier transform, Fourier multipliers, singular integrals, Sobolev spaces, Laplace transform, second-order elliptic equations, heat equation, subdiffusion equation
Teaching/Learning Methodology *(Note 3)*	The subject will be delivered mainly through lectures and tutorials. Assignments and projects will be also given.

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. CA	50%	√	√	√
2. Exam	50%	√	√	√
Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The subject focuses on knowledge, skill and understanding of advanced topics in applied mathematics. Thus exam-based assessment is the most appropriate assessment method, including 30% mid-term test and 50% examination. Moreover, 20% worth of assignments are included as a component of continuous assessment so as to keep the students in progress. Continuous Assessment comprises of assignments and tests. A written examination is held at the end of the semester.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Assignment/ mini-project	36Hrs.
	▪ Self-study	27Hrs.
	Total student study effort	102Hrs.

Reading List and References

1. Todd Arbogast and Jerry L. Bona: Methods of Applied Mathematics. Lecture notes, Department of Mathematics, The University of Texas at Austin.

2. L. C. Evans: Partial Differential Equations. American Mathematical Society, second edition, 2010.

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon subject completion. 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, overcrowding 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 is intended 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	AMA619
Subject Title	Advanced Mathematical Statistics
Credit Value	3
Level	6
Pre-requisite	A course in college calculus, college linear algebra, and basic mathematical statistics
Objectives	The objectives of this course are to introduce the most important and modern methods and theory in mathematical statistics and provide systematic theoretical training to graduate students who are interested in pursuing a PhD degree in statistics and related fields.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. Have a systematic understanding of the basic theory and methods of modern mathematical statistics. b. Acquire the ability and skill to critically read the theoretical statistics literature. c. Develop skills to develop formal arguments for providing theoretical justifications to a statistical method. d. Be well prepared for conducting methodological and applied research in statistics and the related fields.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	1. Convergence of random vectors: basic convergence concepts, laws of large numbers and central limit theorems, delta-method. 2. Estimation Methods: moment estimators, maximum likelihood estimators, M- and Z-estimators. 3. Some basic results from empirical process theory: stochastic convergence in metric spaces, Glivenko-Cantelli and Donsker classes, applications to M- and Z-estimators. 4. Comparisons of estimators, contiguity, local asymptotic normality, relative efficiency of estimators. 5. Selected topics in high-dimensional statistics: Lasso and related methods, non-asymptotic error bounds, debiased Lasso, hypothesis testing in high-dimensional models.

<table>
<tr><td>Teaching/Learning Methodology
(Note 3)</td><td>The subject will be delivered mainly through lectures and tutorials, and class discussions, questions, and answers. Additional reading of relevant books and research papers will be encouraged. The teaching and learning approach are mainly problem-solving oriented. The approach aims at the development of statistical learning methods, theories, and algorithms and how they 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.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes
(Note 4)</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="5">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><td></td></tr>
<tr><td>Assignment</td><td>20%</td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Quiz</td><td>20%</td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Projects</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="5"></td></tr>
</table>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignment: assessment of the understanding the basic concepts and the ability for self-learning by acquiring knowledge from published works and online information.
Quiz: assessment of the ability for comprehension of fundamental concepts, principles, algorithms, and theories by providing answers to given questions.
Project: assessment of the ability for developing methods and algorithms for solving practical problems. The results will be presented in written reports and oral presentations.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorials</td><td>13 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignment</td><td>30 Hrs.</td></tr>
</table>
</td></tr>
</table>

	▪ Self-study	61 Hrs.
	Total student study effort	130 Hrs.
Reading List and References	• Lehmann, E. and Casella, G. (1998). Theory of Point Estimation. Springer, New York. • Van der Vaart, A. W. (2007). Asymptotic Statistics. Cambridge University Press. • Van der Vaart A. W. and Wellner, J. A. (1996). Weak Convergence and Empirical Processes. Springer, New York. • Wainright, M. (2019). High-Dimensional Statistics: A Non-Asymptotic Viewpoint. Cambridge University Press. • Vershynin, V. (2018). High-Dimensional Probability: An Introduction with Applications in Data Science. Cambridge University Press.	

Subject Description Form

Subject Code	AMA620
Subject Title	Advanced Statistical Learning
Credit Value	3
Level	6
Pre-requisite	A course in college calculus, college linear algebra, and basic mathematical statistics
Objectives	The objectives of this course are to introduce the most important and modern methods, theory and algorithms in statistical learning and provide a solid foundation for graduate students who are interested in working in data science and related fields.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. Have a good understanding of the basic theory and methods of modern statistical learning. b. Know how to assess statistical uncertainties for conclusions based on data and statistical analysis. c. Develop and implement new methods that are appropriate for specific data problems in applications. d. Be well prepared for conducting methodological and applied research in statistical learning and the related fields.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	**Introduction** Overview of statistical learning Review of nonparametric statistics Review of high-dimensional statistics **Deep Neural Networks** Deep neural network functions Nonparametric regression using deep neural networks Approximation properties of deep neural networks Empirical process theory for stochastic error analysis Error analysis for deep nonparametric regression **Distribution Learning** Nonparametric density estimation Generative learning: GANs, VAE

	Diffusion models Error analysis for distribution learning Applications **Conditional Distribution Learning** Nonparametric conditional density estimation Conditional generative learning Supervised learning Semi-supervised learning Prediction: conformal prediction Error analysis for conditional distribution learning Applications **Learning and Optimization** Difference between learning and optimization Challenges in neural network optimization Stochastic gradient descent **Representation learning (time permitting)** Supervised representation learning Self-supervised learning Applications: Transfer learning and domain adaptation
Teaching/Learning Methodology *(Note 3)*	The subject will be delivered mainly through lectures and tutorials, and class discussions, questions, and answers. Additional reading of relevant books and research papers will be encouraged. The teaching and learning approach are mainly problem-solving oriented. The approach aims at the development of statistical learning methods, theories, and algorithms and how they 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

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	
Assignment	20%	✓			✓	
Quiz	20%	✓	✓			
Projects	60%	✓	✓	✓	✓	
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignment: assessment of the understanding the basic concepts and the ability for self-learning by acquiring knowledge from published works and online information.
Quiz: assessment of the ability for comprehension of fundamental concepts, principles, algorithms, and theories by providing answers to given questions.
Project: assessment of the ability for developing methods and algorithms for solving practical problems. The results will be presented in written reports and oral presentations.

Student Study Effort Expected

Class contact:	
▪ Lectures	26 Hrs.
▪ Tutorials	13 Hrs.
Other student study effort:	
▪ Assignment	30 Hrs.
▪ Self-study	61 Hrs.
Total student study effort	130 Hrs.

Reading List and References

- Anthony, M. and Barttlett, P. L. (2009). Neural Network Learning: Theoretical Foundations. Cambridge University Press, Cambridge.
- Bishop, C. (2006). Pattern Recognition and Machine Learning. Springer.
- Boucheron, S., Lugosi, G., and Massart, P. (2013). Concentration Inequalities: A Nonasymptotic Theory of Independence. Oxford University Press.
- Hastie, T., Tibshirani, R. and Friedman, J. (2009). The Elements of Statistical Learning, 2nd Ed., Springer.

	• Hastie, T., Tibshirani, R., and Wainright, M. (2015), Statistical Learning with Sparsity:The Lasso and Generalizations, Chapman and Hall. • Mohri, Mehryar; Rostamizadeh, Afshin; Talwalkar, Ameet (2012). Foundations of Machine Learning. USA, Massachusetts: MIT Press. • Ian Goodfellow, Yoshua Bengio and Aaron Courville (2017). Deep Learning. The MIT Press, Cambridge, MA. • Van der Vaart A. W. and Wellner, J. A. (1996). Weak Convergence and Empirical Processes. Springer, New York.

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	♦ 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 *(Note 1)*	Upon completion of the subject, students will be able to: (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 *(Note 2)*	♦ 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.

<table>
<tr><td>Teaching/Learning Methodology
(Note 3)</td><td>Meet assigned supervisor regularly
Hand the report with full list of references</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes
(Note 4)</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>d</td><td>e</td><td></td></tr>
<tr><td>Continuous assessment</td><td>100</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></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>
</table>
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
</td></tr>
<tr><td rowspan="8">Student Study Effort Expected</td><td>Student contact:</td><td></td></tr>
<tr><td>▪ Seminar/Tutorial</td><td>26 Hrs.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignment/mini-project</td><td>34Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>60 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>120 Hrs.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Reading List and References</td><td colspan="2"></td></tr>
</table>

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.

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA67711</td></tr>
<tr><td>Subject Title</td><td>Research Seminars</td></tr>
<tr><td>Credit Value</td><td>1</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>A compulsory subject for research students of AMA</td></tr>
<tr><td>Objectives</td><td>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.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
(a) Gain a good understanding of different advanced topics.
(b) Learn oral academic communication and presentation skills.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Seminars to be attended are determined by the students and chief supervisors.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>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.

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.

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.</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></td><td></td><td></td><td></td></tr>
<tr><td>1. Attend 10 research seminars</td><td>80%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. One report on one of the attended seminars</td><td>20%</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>
</table>
</td></tr>
</table>

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	Upon completion of the subject, students will be able to: (a) Gain a good understanding of different advanced topics. (b) Learn oral academic communication and presentation skills.
Subject Synopsis/ Indicative Syllabus	Seminars to be attended are determined by the students and chief supervisors.
Teaching/Learning Methodology	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. 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. 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.
Assessment Methods in Alignment with Intended Learning Outcomes	See table below

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	Upon completion of the subject, students will be able to: (a) Gain a good understanding of different advanced topics. (b) Learn oral academic communication and presentation skills.
Subject Synopsis/ Indicative Syllabus	Seminars to be attended are determined by the students and chief supervisors.
Teaching/Learning Methodology	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. 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. 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.
Assessment Methods in Alignment with Intended Learning Outcomes	See table below

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

<table>
<tr><td>Subject Code</td><td>AMA67714</td></tr>
<tr><td>Subject Title</td><td>Research Seminars</td></tr>
<tr><td>Credit Value</td><td>1</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>A compulsory subject for research students of AMA</td></tr>
<tr><td>Objectives</td><td>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.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
(a) Gain a good understanding of different advanced topics.
(b) Learn oral academic communication and presentation skills.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Seminars to be attended are determined by the students and chief supervisors.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>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.

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.

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.</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></td><td></td><td></td><td></td></tr>
<tr><td>1. Attend 10 research seminars</td><td>80%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. One report on one of the attended seminars</td><td>20%</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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Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA67721</td></tr>
<tr><td>Subject Title</td><td>Practicum</td></tr>
<tr><td>Credit Value</td><td>1</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>A compulsory subject for PhD students of AMA</td></tr>
<tr><td>Objectives</td><td>The aim of this subject is to provide students with the opportunity to engage in teaching activities/professional service in AMA.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
(a) Gain an understanding of teaching activities.
(b) Learn to support organized research activities.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Teaching activities/professional service are assigned by the HoD or his/ her delegate.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>To earn one credit, students will be required to engage in teaching activities/professional service assigned by the HoD or his/her delegate for 6 hours/week in any 13-week semester.

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.</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></td><td></td><td></td><td></td></tr>
<tr><td>1. Undertake teaching activities/ professional service</td><td>100%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="6"></td></tr>
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Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA67722</td></tr>
<tr><td>Subject Title</td><td>Practicum</td></tr>
<tr><td>Credit Value</td><td>1</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>A compulsory subject for PhD students of AMA</td></tr>
<tr><td>Objectives</td><td>The aim of this subject is to provide students with the opportunity to engage in teaching activities/professional service in AMA.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
(a) Gain an understanding of teaching activities.
(b) Learn to support organized research activities.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Teaching activities/professional service are assigned by the HoD or his/ her delegate.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>To earn one credit, students will be required to engage in teaching activities/professional service assigned by the HoD or his/her delegate for 6 hours/week in any 13-week semester.

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.</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></td><td></td><td></td><td></td></tr>
<tr><td>1. Undertake teaching activities/ professional service</td><td>100%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="6"></td></tr>
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Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	HTI6081
Subject Title	Ethics: Research, Professional & Personal Perspectives
Credit Value	1
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objective	• To equip students with a deep appreciation of ethical guidelines and codes of conduct that they can apply in their research studies at PolyU and in their future professional and personal lives.
Intended Learning Outcomes *(Note 1)*	On successful completion of this subject, students will be able to: 1. Demonstrate knowledge and understanding of the need for ethical behavior and guiding codes of ethics in research and the professions. 2. Understand, discuss and apply ethical principles and codes across a range of disciplines and scenarios 3. Demonstrate awareness of current ethical issues and problems in relation to their own discipline and research area 4. Critically analyze and discuss scenarios cases of possible or actual ethical misconduct 5. Discuss how the guiding principles of ethics in research extend and apply to business, professional and personal codes of conduct and why this is important to the integrity and the well-being of the business, the professions, and our community. 6. Show a fundamental understanding of the issues of copyright, plagiarism, and proper citation, and be able to apply this in their own work.

Subject Synopsis/ Indicative Syllabus *(Note 2)*	• The need for ethics training and the meaning of ethical behavior in research: case studies, disasters, and learning by the mistakes of others • Philosophy and codes of ethics and their origins • Culture, religion, and the law – how these relate to ethical codes of conduct • Obtaining ethical approval for a research project: procedures and processes • Ethics in life science, humanities, education, business, and industry: common issues, guiding principles, discipline-specific scenarios • Ethics and human behavior: individual, professional, and societal responsibilities • Recent ethical issues affecting Hong Kong and society in general • Ethical use of information in thesis writing: understanding copyright, plagiarism, and proper citation

07.2015

Teaching/Learning Methodology *(Note 3)*	Lecture/seminar/workshop

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Group assignment on discipline-specific scenario/case study analysis	60%	√		√			√
2. Oral presentation	25%					√	√
3. Attendance	15%			√			
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

1. Discipline-specific scenario/case study analysis will assess the ability to identify and analyze ethical issues in the student's own discipline and to present a coherent and detailed critique and plan on how these could be avoided or resolved (giving sources and written work accompanied by a Turn-it-in Report). The group assignment will assess the student's ability to identify, discuss and analyze ethical principles and issues from a wide perspective, and evaluate how individuals, professions, and societies benefit from following ethically acceptable behavior and practices.
2. Oral presentations will assess the students' ability to present and argue points in support of their rationale.

Student Study Effort Required	Class contact:	
	• Lecture/seminar/workshop/oral presentation	16 Hrs.
	Other student study efforts:	
	• Self-study and group work	27.5 Hrs.
	• Assignment preparation	15 Hrs.
	Total student study effort	58.5 Hrs.
Reading List and References	Materials from the Hong Kong Ethics development website (http://www.icac.org.hk/hkedc/eng/library2.asp) Materials from EthicsWeb.ca (http://www.ethicsweb.ca/resources/professional/issues.html)	

07.2015

	Selected readings and videos Declaration of Helsinki (revised 2008)

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	ELC6011
Subject Title	Presentation Skills for Research Students
Credit Value	2
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject is designed to improve research students' academic speaking proficiency, enhance their awareness of academic conventions during an academic discussion/presentation, and develop their skills in using clear, appropriate, persuasive and analytical language for their delivery of effective academic presentations.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. organise academic presentations logically by following academic conventions b. present research contribution by critically analysing previous research; c. use clear, appropriate, persuasive and analytic language for presentations at seminars, conferences and viva: and d. defend research logically, critically, and persuasively.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	1. Critical analysis of prior research Understanding academic presentation process and the structure; identifying language features appropriate for academic speaking settings. 2. Awareness of academic conventions Developing awareness of citation practices, and language use adopted in the related disciplines. 3. Inter and intra section connections Using effective signpost language to organize and connect different parts of an academic presentation. 4. Clear, appropriate, persuasive, and analytical language use Summarising, evaluating, and citing sources; describing and discussing research data; objectively evaluating research contribution.

Teaching/Learning Methodology

(Note 3)

The study method is primarily seminar-based. Following a blended delivery approach, activities include teacher input, class discussion both formally and informally, and presentations both individually and in groups. Elements of the flipped classroom are integrated in the subject delivering. Peer feedback, self-reflection and critique of student presentations are also an important part of the instructional scaffolding.

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d		
Presenting an effective introduction and literature review - video submission	40%	✓	✓	✓			
Delivering an effective research presentation – in-class individual presentation	60%	✓	✓	✓	✓		
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Presenting an effective Introduction and Literature review of a study is most challenging for research students. To help them develop related skills, the subject requires that students present the Introduction and Literature review sections only in Assessment 1. This presentation will be submitted as a short video and thus allows students multiple attempts during the delivery process. After teacher feedback, peer feedback and self-reflection on the performance of Assessment 1, students are better prepared for a full presentation of a research paper required for Assessment 2.

Student Study Effort Expected

Class contact:	
▪ Seminars	20 Hrs.
▪ Assessment	6 Hrs.
Other student study effort:	
▪ Self-study/preparation for assessments	52 Hrs.
▪ Total student study effort	78 Hrs.

Reading List and References

Course material

	Learning materials tailor-made for research students by the English Language Centre. Online Videos: BBC Learning English. (2017). *Tim's pronunciation workshop.* Retrieved from http://www.bbc.co.uk/learningenglish/english/features/pronunciation Practical Psychology (2017, Jan 16). *How to give a great presentation: 7 presentation skills and tips to leave an impression* [Video file]. Retrieved from https://www.youtube.com/watch?v=MnIPpUiTcRc University of Melbourne (2015, Mar 11). *Academic skills: Presenting effectively Part 1 – 5 things you should know about presenting and organizing your talk* [Video file]**.** Retrieved from https://www.youtube.com/watch?v=qFLL-XB56UU University of Melbourne (2015, Mar 11). *Academic skills: Presenting effectively Part 2 – Engaging the audience* [Video file]**.** Retrieved from https://www.youtube.com/watch?v=lo9xOV6WUqM University of Melbourne (2015, Mar 11). *Academic skills: Presenting effectively Part 3 – Effective visuals and PowerPoint slides* [Video file]**.** Retrieved from https://www.youtube.com/watch?v=O-D9fZN01yk **Selected Websites** Dryden, A. (2013, April 20). *What you need to know about speaking at conferences*. Retrieved from https://www.ashedryden.com/blog/what-you-need-to-know-about-speaking-at-conferences Hayward, A. (2017). *9 Tips for presenting at an academic conference*. Retrieved from https://www.editage.com/insights/9-tips-for-presenting-at-an-academic-conference Johnson, C. D. (2007). *Rules for a better PhD dissertation and oral defense*. Retrieved from http://cns-alumni.bu.edu/~djohnson/dissertation_rules.html Lakdawalla, E. (2018). *Speak your science: How to give a better conference talk.* Retrieved from http://www.planetary.org/blogs/emily-lakdawalla/2018/0206-speak-your-science.html

Note 1: Intended Learning Outcomes

Intended learning outcomes should state what students should be able to do or attain upon subject completion. 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, overcrowding 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 is intended to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

(Form AR 140) 8.2020

The Hong Kong Polytechnic University

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	ELC6012
Subject Title	Thesis Writing for Research Students
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	ELC6011
Objectives	This subject aims to improve research students' academic writing proficiency, enhance their understanding of the academic audience, develop their awareness of academic conventions, and develop their skills in using clear, appropriate, persuasive, and analytical language in thesis writing.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to present their research effectively in a thesis through: a. presenting the study clearly, appropriately and concisely in the Abstract; b. providing the Introduction analytically; c. reviewing the literature critically; d. analysing the appropriateness of the methodology used in the study, e. reporting and discussing the findings of the study; and f. discussing the significance of the study in the Conclusion. To achieve the above outcomes, students are expected to use language, text structures, and cohesive devices appropriate to the academic audience, select and present information analytically, concisely and appropriately, examine and cite sources critically, and analyse the impact and significance of the research persuasively.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	1. Critical analysis of prior research Understanding research thesis writing process and the structure of a thesis; identifying language features of thesis writing. 2. Awareness of academic conventions Developing awareness of citation practices, referencing format and language use adopted in the related disciplines. 3. Inter and intra paragraphing connections Using effective cohesive devices to plan, organize and connect different parts of a research thesis.

	4. Clear, appropriate, persuasive and analytical language use Summarising, evaluating and citing sources; describing and discussing research data; objectively evaluating research contribution; writing, revising, and proofreading written texts.
Teaching/Learning Methodology *(Note 3)*	The study method is primarily seminar-based. Activities include teacher input as well as individual and group work involving writing practice, evaluation of texts, mini-presentations and discussions. Practical work will involve analysing texts such as journal articles and research theses that are relevant to students' research areas. Students will be provided with opportunities to apply the language skills acquired to the preparation of their own thesis. Students will be referred to information on the Internet and the ELC's Centre for Independent Language Learning. Learning materials developed by the English Language Centre are used throughout this course. Additional reference materials will be recommended as required.
Assessment Methods in Alignment with Intended Learning Outcomes *(Note 4)*	See table below.

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Writing an introduction for a research study (draft)	20%		✓	✓	✓		
2. Writing an introduction for a research study (final)	30%		✓	✓	✓		
3. Developing an e-Portfolio for thesis writing	50%	✓	✓	✓	✓	✓	✓
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assessments 1 and 2 assess students' abilities to write an effective introduction for their own research study. The assessments require that students introduce the background, rationale and objectives of their research, review the literature and establish the niche in their research area, and describe the methods used in their study to occupy the niche (ref. LOs (b), (c) and (d)).

Assessment 3 requires that students collect learning materials that are conducive to their writing-up of a research thesis, and provide annotated thesis excerpts to illustrate their understanding of the structure and language use specific to each thesis chapter (ref. LOs (a) to (f)).

	In addition to the three assessments, students are required to complete further language training through out-of-class collocation practice, short in-class writing tasks and language practices in the course handouts.	
Student Study Effort Expected	Class contact:	
	▪ Seminars	39 Hrs.
	Other student study effort:	
	▪ Self-study and preparation for assessments	78 Hrs.
	Total student study effort	117 Hrs.
Reading List and References	Course material Learning materials developed by the English Language Centre Recommended references Cooley, L., & Lewkowicz, J. (2003). *Dissertation writing in practice: Turning ideas into text*. Hong Kong: Hong Kong University Press. Cooksey, R. W., & McDonald, G. (2019). *Surviving and thriving in postgraduate research* (Second edition). Singapore: Springer Singapore. Feak, C. B., & Swales, J. M. (2009). *Telling a research story: Writing a literature review*. University of Michigan Press. Felix, M. S., & Smith, I. (2019). *A practical guide to dissertation and thesis writing*. UK: Cambridge Scholars Publishing. Kornuta, H. M., & Germaine, R. W. (2019). *A concise guide to writing a thesis or dissertation: Educational research and beyond (Second edition)*. Abingdon, Oxon: Routledge. Oliver, P. (2013). *Writing your thesis (Third Edition)*. London: Sage. Paltridge, B., & Starfield, S. (2020). *Thesis and dissertation writing in a second language : a handbook for students and their supervisors (Second edition)*. Abingdon, Oxon: Routledge. Swales, J. M., & Feak, C. B. (2004). *Academic writing for graduate students: Essential tasks and skills (Second Edition).* Ann Arbor, MI: University of Michigan Press.	

Note 1: Intended Learning Outcomes
Intended learning outcomes should state what students should be able to do or attain upon subject completion. 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, overcrowding 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

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(Form AR 140) 8.2020

The Hong Kong Polytechnic University

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	ENGL6016
Subject Title	Advanced Academic English for Research Students: Publishing and Presenting
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	None
Objectives	The objective of the subject is to enable research postgraduate students to publish successfully in international journals and deliver effective conference presentations. This is achieved by equipping students with the essential English language skills and linguistic knowledge to effectively communicate the background, rationale, findings, and significance of their research. Students will be guided systematically to (1) improve their academic English; (2) acquire and apply knowledge of the generic and linguistic features of conference presentations and research articles; and (3) increase the persuasiveness of their spoken and written discourse. The primary focus will be on writing research articles.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: a. Be familiar with the differences between spoken and written academic English; b. Analyze and apply generic structures and linguistic features in research writing; c. Write research articles in clear, accurate and appropriate English; d. Prepare articles for publication in light of comments from editors and reviewers; e. Structure and deliver clear and persuasive presentations in English.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	Part 1 – Publishing in international journals: (2/3) ▪ Interacting with readers; ▪ Writing effective introductions and literature reviews; ▪ Describing research methods; ▪ Discussing the implications and significance of the findings; ▪ Drawing conclusions; ▪ Writing abstracts; and ▪ Addressing editors' and reviewers' comments. Part 2 – Delivering an effective conference presentation: (1/3) ▪ Structuring and delivering conference presentations in clear and appropriate academic English; ▪ Interacting with an audience and responding to questions.

Teaching/Learning Methodology

(Note 3)

A learner-centered and highly interactive mode of teaching will be adopted. Students will engage in activities where they can share their experience and concerns, put forth their own thinking and comment on each other's research ideas, and critique each other's academic writings. Students will be encouraged and guided to discover for themselves the various ~~language~~ linguistic and generic features of successful presentations and academic writing through intellectually challenging tasks.

Assessment Methods in Alignment with Intended Learning Outcomes

(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Individual presentation	30%	✓	✓	✓		
2. Term paper	50%			✓	✓	✓
3. Class participation	20%	✓	✓	✓	✓	✓
Total	100 %					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

<u>Individual presentation</u>

Students will prepare a 15-minute conference presentation in which they demonstrate their ability to use appropriate academic English and engage effectively with the audience.

<u>Term paper</u>

This assignment requires students to critique a research article to demonstrate their knowledge of the generic and linguistic features of research articles. Their ability to present ideas and arguments coherently and persuasively using appropriate academic English will also be assessed. The term paper could be in the form of a research article from the student's field.

<u>Class participation</u>

Students' active participation and engagement with the learning activities will be part of the assessment of the subject.

Student Study Effort Expected	Class contact:	
	▪ Interactive lectures	39 Hrs.
	▪	Hrs.
	Other student study effort:	
	▪ Reading	42 Hrs.
	▪ Preparation for assignments	30 Hrs.
	Total student study effort	111 Hrs.
Reading List and References	Hyland, K. (2006). English for Academic Purposes: An Advanced Resource Book. Oxon; New York: Routledge. Jalongo, M., and Machado, C. (2016). Making effective presentations at professional conferences: a guide for teachers, graduate students and professors. Cham: Springer. Kline, J. A. (2004). Speaking Effectively: Achieving Excellence in Presentations, Upper Saddle River, N.J.: Pearson/Prentice Hall. Reinhart, S. M. (2002). Giving Academic Presentations, Ann Arbor, Michigan: University of Michigan Press. Strunk, W. & White, E.B. (2000) The Elements of Style, New York: Pearson. Swales, J. & Christine, F. (2012). Academic writing for graduate students: Essentials tasks and skill (3rd ed.) Ann Arbor: University of Michigan. Wallace, M. & Wray, A. (2011). Critical Reading and Writing for Postgraduates. London; California; New Delhi; Singapore: SAGE.	

Note 1: Intended Learning Outcomes
Intended learning outcomes should state what students should be able to do or attain upon subject completion. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/Indicative Syllabus
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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 is intended to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

Intended Learning Outcome of Individual MPhil Programme against the University's Policy & Guidelines on Learning Outcomes for Graduates of MPhil Programmes*

Programme Title: Research Postgraduate Programme in Applied Mathematics

Hosted by: Department of Applied Mathematics

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
Research and Scholarship Excellence MPhil graduates of PolyU should demonstrate advanced competence in research methods, possess in-depth knowledge and skills in their area of study and attain the ability to apply their knowledge and act as leaders in analyzing and solving identified issues and problems in their area of study. They should also be able to disseminate/communicate effectively their research findings in publications, conferences and classrooms.	**Research and Scholarship Excellence** MPhil graduates of AMA should develop and demonstrate research skills and knowledge in applied mathematics; critically analyze new and complex information from real problems, and effectively utilize research methodologies in applied mathematics.
Originality MPhil graduates of PolyU will be versatile problem solvers with good mastery of critical and creative thinking methodologies. They can generate practical and innovative solutions to problems in their area of study.	**Originality** MPhil graduates of AMA should 1. recognize the importance of research ethics; 2. provide novel solutions to research problems and effectively interpret new research results.
Lifelong Learning Capability MPhil graduates of PolyU will have an enhanced capability for continual professional development through inquiry and reflection on knowledge in their area of study.	**Lifelong Learning Capability** MPhil graduates of AMA should learn up-to-date research advances and developments in applied mathematics.

Intended Learning Outcome of Individual PhD Programme against the University's Policy & Guidelines on Learning Outcomes for Graduates of PhD Programmes*

Programme Title: Research Postgraduate Programme in Applied Mathematics

Hosted by : Department of Applied Mathematics

Institutional Learning Outcomes	Intended Learning Outcomes of Individual Research Degree Programme
Research and Scholarship Excellence PhD graduates of PolyU should demonstrate state-of-the-art expertise and knowledge in their area of study, possessed superior competence in research methodologies and contribute as leaders in creating new knowledge through analysis, diagnosis and synthesis. They should also be able to disseminate/communicate their research ideas and findings effectively and efficiently in publications, conferences and classrooms.	**Research and Scholarship Excellence** PhD graduates of AMA should 1. develop and demonstrate research skills and knowledge in applied mathematics; critically analyze new and complex information from real problems, and effectively utilize research methodologies in applied mathematics; 2. present results with good scientific writing and presentation skills.
Originality PhD graduates of PolyU will be able to think out of the box. They will be innovative problem solvers with excellent mastery of critical and creative thinking methodologies. They will create original solutions to issues and problems pertaining to their area of expertise and the society in general.	**Originality** PhD graduates of AMA should 1. recognize the importance of research ethics; 2. provide novel solutions to research problems and effectively interpret new research results.
Lifelong Learning Capability PhD graduates of PolyU will demonstrate the ability to engage in an enduring quest for knowledge and an enhanced capability for continual academic/professional development through self-directed research in their area of study.	**Lifelong Learning Capability** PhD graduates of AMA should learn up-to-date research advances and developments in applied mathematics.