

**Course offerings 2023-24**

Requirements:

MPhil students: 2 compulsory courses &amp; 3 elective courses; and

PhD students: 2 compulsory courses &amp; 4 elective courses

[Students should register for the course once when they start attending the course]

**Courses offered – Full Year**

Course Code	Course Title	Compulsory (C)/ Elective (E)
SSAF6001*	Basic Laboratory Safety Course for RPg Candidate in the Faculty of Science	C
MATH6001	Guided study in mathematics	C
MATH6002	Selected topics in mathematics	E
MATH6903	Independent studies	E

\*All candidates are required to take the Faculty's compulsory course.

**Courses offered – Semester 1, 2023-24**

Course Code	Course Title	Compulsory (C)/ Elective (E)	Instructor	Class Schedule	Venue
MATH6224	Topics in advanced probability theory	E	Professor Guangyue HAN	Tue 13:30 - 15:20 Fri 14:30 - 15:20	KK102, K.K. Leung Building, HKU
MATH6501	Topics in algebra	E	Dr Zheng HUA	Wed 9:30 - 12:20	JLG01, James Hsioung Lee Science Building, HKU
<b>Joint Centre for Advanced Study courses</b>					
MATH6101	Intermediate complex analysis (HKU)	E	Professor Ngaiming MOK	Wed 13:30 - 16:15	Room 210, Run Run Shaw Building, HKU
MATH6204	Topics in partial differential equations (CUHK: MATH5021 Theory of Partial Differential Equations I)	E	Professor Chenyun LUO, CUHK	Wed 14:30 - 17:15	Room 219, Lady Shaw Building, CUHK

**Courses offered – Semester 2, 2023-24**

Course Code	Course Title	Compulsory (C)/ Elective (E)	Instructor	Class Schedule	Venue
MATH6502	Topics in applied discrete mathematics	E	Professor Wenan ZANG	Tue 12:30 - 13:20 & Fri 12:30 - 14:20	KB223, Knowles Building, HKU
MATH6503	Topics in advanced optimization	E	Professor Xiaoming YUAN	Fri 17:30 - 20:20	KK202, K.K. Leung Building, HKU
MATH6505	Real analysis	E	Dr Chun Yin HUI	Mon 9:30 - 11:20 & Thu 9:30 - 10:20	KK102, K.K. Leung Building, HKU
<b>Joint Centre for Advanced Study courses</b>					
MATH6214	Topics in analysis (CUHK: MATH6082 Topics in Analysis II)	E	Professor Edouard Daviaud	Mon 9:30 – 11:00 & Thu 9:30 to 11:00	Room 219, Lady Shaw Building, CUHK
MATH6215	Applied differential equations (CUHK: MATH5022 Theory of Partial Differential Equations II)	E	Professor Yong YU	Tue 9:30 – 11:00 & Fri 9:30 to 11:00	Room 222, Lady Shaw Building, CUHK
MATH6218	Riemannian geometry I (CUHK: MATH5061 Riemannian Geometry I)	E	Professor Man Chun LI, Martin	Mon 14:30 – 17:15	Room 222, Lady Shaw Building, CUHK

Last Updated: Jan 11, 2024

**Department of Mathematics**  
**Coursework Details (2023-24)**

Requirements:

MPhil students: 2 compulsory courses & 3 elective courses; and

PhD students: 2 compulsory courses & 4 elective courses

[Students should register for the course once when they start attending the course]

**Courses offered – Full Year**

\* SSAF6001 Basic Laboratory Safety Course for RPg Candidate in the Faculty of Science

In order to enhance the safety awareness and knowledge of Science RPg students, a 3-hour safety course will be made compulsory to RPg students of the following registration dates:

- MPhil candidates registered on or after January 1, 2009
- 3-year PhD candidates registered on or after January 1, 2008
- 4-year PhD candidates registered on or after January 1, 2007

The Basic Laboratory Safety Training will be conducted by the Safety Office twice a year (i.e. normally in Sept and Jan). RPg students are required to enroll this course during the online enrolment period. Please note that students, who have successfully completed this course requirement before, need not retake this course again.

MATH6001 Guided study in mathematics (COMPULSORY)

This course introduces students to their respective proposed fields of research, enabling them to acquire the basic knowledge, learn the research techniques and study the relevant literature. Details of the course will be organized by the supervisors for their students. The course will consist of study group, advanced reading, literature study and presentations. Details of the course will be organized by the supervisor for his/her students, subject to approval by the Head of Department.

Assessment: 100% continuous assessment

Contact Person: Professor N Mok

MATH6002 Selected topics in mathematics

This course enables students to broaden their mathematical knowledge in an area they have not studied before but may not be covered in any of the other postgraduate courses being offered in that year. The selection of topic is made with advice from the supervisor(s). This course can only be taken with the approval of the supervisor(s) and the Chairperson of the Departmental Research Postgraduate Committee.

Assessment: Continuous assessment and written examinations

Contact Person: Professor N Mok

MATH6903 Independent studies

To allow the student to pursue the study of special topics not available in regular graduate courses. The special topic(s) need to be agreed upon between the student and the supervisor(s), who will make proper arrangement to allow the student to consult an expert/experts on the topic on a regular basis during the course of a semester.

Assessment: Reports made to the supervisor(s)

Contact Person: Professor N Mok

## Courses offered – Semester 1, 2023-24

### MATH6224 Topics in advanced probability theory

Course contents & topics:	Selected topics from probability theory and related fields with their applications, including, but not limited to, probability theory, statistics, stochastic calculus, stochastic optimization, stochastic approximation, statistical inference, information theory and so on.
Assessment:	Project reports and test
Contact Person:	Professor G Han
Class schedule:	Every Tuesday 1:30 p.m. – 3:20 p.m. and Every Friday 2:30 p.m. – 3:20 p.m.
Venue:	KK102, K.K. Leung Building, HKU

### MATH6501 Topics in algebra

Course information:	This is an introduction to the local and global theory of systems of meromorphic ordinary differential equations.
Pre-requisite:	Basics on ordinary differential equations and complex functions of a single variable
Textbook:	Balser's book and Deligne's book
Assessment:	Continuous assessment and written examinations
Contact Person:	Dr. Z Hua
Class schedule:	Every Wednesday 9:30 a.m. – 12:20 p.m.
Venue:	JLG01, James Hsioung Lee Science Building, Main Campus, HKU

## Graduate Courses (Updates Autumn 2023)

### **MATH6101 Intermediate Complex Analysis**

by Professor Ngaiming Mok

Meeting Date / Time: Wednesdays, September 6 - November 29, 2023, 1:30 - 4:15pm  
**No classes on September 13 & October 18, 2023**

Venue: Room 210, Run Run Shaw Bldg., HKU

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In the course we study meromorphic functions on compact Riemann surfaces and on open Riemann surfaces using analytic and algebraic techniques. Topics on meromorphic functions include the constructions of meromorphic functions on compact Riemann surfaces, elliptic functions, Poincare series, the Mittag-Leffler Problem and the Weierstrass Problem on compact Riemann surfaces and on open Riemann surfaces.

#### *References:*

1. R. Narasimhan: Complex Analysis in One Variable (Birkhauser, 2001, 2nd edition)
2. O. Forster: Lectures on Riemann Surfaces (Springer-Verlag, 1981)
3. J.B. Conway: Functions of One Complex Variable I (Springer-Verlag, 1995) (Updates Autumn 2023)
4. K. Chandrasekharan: Elliptic Functions (Springer-Verlag, 1985)
5. K.G. Krantz, Geometric Function Theory (Birkhauser, 2006)

*August 15, 2023*



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**Joint Centre for Advanced Study (JCAS)  
2023-24, Term 1**

**MATH5021**

**Theory of Partial Differential Equations I**

*by*

***Professor Chenyun LUO***

Schedule : every Wednesday, 2:30pm – 5:15pm  
(from 4 September 2023 to 2 December 2023)

Venue : Room 219, Lady Shaw Building, CUHK

**Course outline**

We will discuss the classical theory in hyperbolic PDEs. Topics include linear hyperbolic equations, Lorentzian geometry, semilinear and quasilinear wave equations, Einstein's equation for general relativity.

Prerequisites: Multivariable calculus, graduate-level real analysis (e.g., measure theory and integration), undergraduate level PDE (e.g., L.C. Evans' PDE book chapters 1-7). Exposure to differential geometry is recommended but not required.

## **Courses offered – Semester 2, 2023-24**

### MATH6502 Topics in applied discrete mathematics

This course aims to provide students with the opportunity to study some further topics in applied discrete mathematics.

A selection of topics in discrete mathematics applied in combinatorics and optimization (such as algebraic coding theory, cryptography, discrete optimization, etc.) The selected topics may vary from year to year.

Assessment: Continuous assessment and written examinations

Contact Person: Professor W Zang

### MATH6503 Topics in advanced optimization

A study in greater depth of some special topics in mathematical programming or optimization. It is mainly intended for students in Operations Research or related subject areas.

This course covers a selection of topics which may include convex, quadratic, geometric, stochastic programming, or discrete combinatorial optimization. The selected topics may vary from year to year.

Assessment: Continuous assessment and written examination

Contact Person: Professor X Yuan

### MATH6505 Real analysis

The aim of the course is to introduce the basic ideas and techniques of measure theory and the Lebesgue integral.

Assessment: Continuous assessment and written examination

Contact Person: Dr. CY Hui



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## *Joint Centre for Advanced Study (JCAS)*

### **2023-24, Term 2**

8 January, 2024 - 20 April, 2024

## **MATH6082 Topics in Analysis II**

Teacher: Dr. Edouard Daviaud  
Class Schedule: Monday, 9:30am – 11:00am &  
Thursday, 9:30am – 11:00am  
Venue: Room 219, Lady Shaw Building, CUHK

This course will consist of two parts. In the first part, I will present some basic concepts in geometric measure theory (e.g., Hausdorff measure, content, dimension of sets and measures). In the second part, I will introduce the fundamental theory of Diophantine approximation. This theory consists of defining properly a notion of speed rate of approximation by a sequence of dense points of interest (actually we will mainly deal with rational numbers in this course) and studying the Hausdorff dimension and measures of the sets of points approximable at a given speed rate. In particular, we will establish a Hausdorff measure version of the theorem of Koivusalo and Rams (the so-called Mass transference principle from ball to arbitrary shape, <https://arxiv.org/pdf/1812.08557.pdf>) and compute the Hausdorff dimension of various sets using an appropriate version of it.

Here are some references for this course:

1. H. Koivusalo and M. Rams, Mass transference principle: from balls to arbitrary shapes. *Int. Math. Res. Not. IMRN*(2021), no. 8, 6315–6330.
2. V. Beresnevich, S. Velani, A mass transference principle and the Duffin-Schaeffer conjecture for Hausdorff measures. *Ann. of Math.* 164 (2006), 971–992.
3. B.-W. Wang, J. Wu, J. Xu, Mass transference principle for limsup sets generated by rectangles. *Math. Proc. Cambridge Philos. Soc.* 158 (2015), no. 3, 419–437.





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### **2023-24, Term 2**

8 January, 2024 - 20 April, 2024

## **MATH5022 Theory of Partial Differential Equations II**

Teacher: Professor YU Yong  
Class Schedule: **Tuesday, 9:30am to 11:00am &  
Friday, 9:30am to 11:00am**  
Venue: Room 222, Lady Shaw Building, CUHK

This course introduces basic theories on elliptic partial differential equations.

The topics include:

Classic theories on harmonic functions, Maximum principles,  $W_{2,p}$  estimate (Calderon Zygmund theory), Schauder estimate, and De Giorgi-Nash-Moser estimate.

If time permits, the following special topics will also be introduced:

Regularity theories on harmonic maps, Dirichlet eigenvalue problems, Steklov eigenvalue problems, and Related topics on the nodal set of eigenfunctions.

The course will be evaluated by final exam (50%) and students' presentation on some selected topics (50%).

Reference:

- Fanghua Lin and Qing Han: Elliptic partial differential equations second editions
- Gilbarg and Trudinger: Elliptic partial differential equations of second order
- Ambrosio: lectures on elliptic partial differential equations
- Fanghua Lin and Changyou Wang: The analysis of harmonic maps and their heat flows
- Leon Simon: Regularity theory for harmonic maps



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# *Joint Centre for Advanced Study (JCAS)*

## **2023-24, Term 2**

8 January, 2024 - 20 April, 2024

## **MATH5061 Riemannian Geometry I**

Teacher: Professor LI Man Chun, Martin  
Class Schedule: Monday, 2:30pm – 5:15pm  
Venue: Room 222, Lady Shaw Building, CUHK

This course is intended to provide a solid background in Riemannian Geometry. Topics include: affine connection, tensor calculus, Riemannian metric, geodesics, curvature tensor, completeness and some global theory. Students taking this course are expected to have knowledge in differential geometry of curves and surfaces

### References:

- S.S. Chern, W.H. Chen and K.S. Lam, Lectures on Differential Geometry
- M. do Carmo, Riemannian Geometry
- S. Gallot, D. Hulin and J. Lafontaine, Riemannian Geometry
- J. Jost, Riemannian Geometry and Geometric Analysis
- J.M. Lee, Riemannian Manifolds: An Introduction to Curvature

### Assessment:

- Assignments: 50%
- Final Examination (to be confirmed): 50%