

Pure Mathematics

The math majors who concentrate on pure mathematics theme usually plan to be a secondary school teacher or pursue a PhD degree in mathematics or related subjects.

Major in Mathematics (4 years and at least 96 credits)

1. Introductory level courses (48 credits)

MATH1013 University Mathematics II (6)

MATH2012 Fundamental Concepts of Mathematics (6)

MATH2211 Multivariable Calculus (6)

MATH2101 Linear Algebra I (6)

MATH2102 Linear Algebra II (6)

MATH2201 Introduction to Mathematical Analysis (6)

SCNC1111 Scientific Method and Reasoning (6)

SCNC1112 Fundamentals of Modern Science (6)

2. Advanced level courses (48 credits)

MATH3301 Algebra I (6)

MATH3401 Analysis I (6)

MATH3403 Functions of a complex variable (6)

Plus at least 24 credits advanced level Mathematics courses (MATH3XXX or MATH4XXX or MATH6XXX level), at least 12 credits of which should be from MATH4XXX or MATH6XXX level.

Pure Mathematics

Recommended courses:

MATH3303 Matrix Theory and its Applications

MATH3304 Introduction to Number Theory

MATH4402 Analysis II

MATH3302 Algebra II

MATH3001 Development of Mathematical Ideas

MATH3541 Introduction to Topology

MATH4404 Functional Analysis

MATH4406 Introduction to Partial Differential Equations

MATH4501 Geometry

MATH4511 Introduction to Differentiable Manifolds

MATH7101 Intermediate Complex Analysis

MATH7505 Real Analysis

MATH4910 Senior Mathematics Seminar

(6 credits)

- This is a seminar style course intended for those **third Year BSc students** who have very strong interests and good ability in mathematics.
- Study some book chapters and elementary research articles and make presentations in front of the whole class.
- Active participation in all the discussions is expected. The aim of the course is to let students learn how to initiate self/independent study in mathematics.

MATH4910 Senior Mathematics Seminar

- Prerequisites:

Pass in at least 24 credits of advanced level disciplinary core/elective mathematics courses (MATH3XXX, MATH4XXX, or MATH7XXX) in the Mathematics, and Mathematics/Physics Majors including MATH3301 Algebra I, MATH3401 Analysis I, and MATH3403 Functions of a complex variable.

- Enrollment needs instructors' approval.
- This course is for **third year or above** BSc students only.
- This capstone course is for Mathematics, and Mathematics/Physics Majors students **ONLY**.
- Quota:12.

MATH4910 Senior Mathematics Seminar

- Teaching: Meeting of the whole class for three hours each teaching week, plus individual meetings with the instructors.
- Assessment:
 - Dissertation (20%): based on class participation and group discussions.
 - Oral Presentation (30%): seminar presentations by students.
 - Research Report (50%): Written report/research paper.

MATH4910 Senior Mathematics Seminar

Selected topics in the past years:

- Gelfond's Solution of Hilbert's Seventh Problem
- Geometry of polynomials and Sendov conjecture
- Differential forms and de Rham cohomology
- Wedge Product and Analytic Geometry
- College Admissions and the Stability of Marriage
- Mathematics in voting (Arrow' Impossibility Theorem and Gibbard-Satterthwaite Theorem)
- Pagerank algorithm
- Polynomial Equations and Circulant Matrices



MATH3999 Directed Studies in Mathematics

This course is designed for a student who would like to take an early experience on independent study. It provides the student with the opportunity to do independently a small mathematics project close to research in nature.

Selected topics in the last year:

- Commutative Algebra
- Duplicate Bridge Movements
- Geometry of discrete groups
- Generalization of the factorial function
- Mathematical and Computational Methods in Biology
- Various Traveling Salesman Problems
- The Marriage Theorem
- Mathematical Education: How Long is a Piece of String? Hidden Mathematics of everyday life
- On Entropy Power Inequality
- With or without determinants
- Stochastic Calculus

The subject matter of the project will be determined by consultation between the student and his supervisor. He/She must achieve good standing and get the approval from both the prospective supervisor and the course coordinator to take this course.

MATH3999 Directed Studies in Mathematics

- Prerequisites: pass in
 - MATH2101 (Linear algebra I),
 - MATH2102 (Linear algebra II),
 - MATH2211 (Multivariable calculus),
 - MATH2241 (Introduction to mathematical analysis), and
 - at least 24 credits of advanced level mathematics courses (MATH3xxx or higher).
- This capstone course is for Mathematics, and Mathematics/Physics Majors students **ONLY**.

MATH4999 Mathematics Projects (12 credits)

The aim of the course is to provide students with opportunity to formulate and investigate, in depth, problems of practical interest and/or have a foretaste of mathematical research.

The work, to be done on an individual basis, is considered a highly desirable part of the training of a mathematician.

Pre-requisites: MATH3301 (Algebra I) and MATH3401 (Analysis I)

MATH4999 Mathematics Projects (12 credits)

Topics:

- Arithmetical Functions and Dirichlet Series
- Calculus of Variations
- Dirichlet's Divisor Problem
- Higher Rank Numerical Ranges
- Introduction to Algebraic Geometry
- Isoclinic n – planes in Euclidean $2n$ – space
- Mathematical Problems in Network Coding
- Numerical Simulation in Fluid Dynamics
- On Construction and Control of Probabilistic Boolean Networks
- Open problems in affine algebraic geometry and commutative/noncommutative algebra
- Perron – Frobenius Theory of Nonnegative Matrices
- Project Scheduling via Network Models: independent study & computer implementation
- Solving Non-Linear Differential Equations
- Statistical Arbitrage Strategies in Equity Market
- Supersymmetric Quantum Mechanics and the Witten Index

MATH4999 Mathematics Projects(12 credits)

- Usually, we will inform our students the project topics around June/July and inform the students the results around July/August.
- This is a **12 credit** course and students must achieve good standing and get the approval from both the prospective supervisor and the course co-ordinator to take this course.
- The student is expected to do approximately 200 hours of independent work and to attend meetings and seminars.
- **Assessment Method: By dissertation (70% weighting) and continuous assessment which may include oral presentation (30% weighting)**

Better preparations for graduate studies

Students who have done well in MATH3999 Directed Studies in Mathematics, MATH4910 Senior Mathematics Seminar, MATH4999 Mathematics Projects, plus some oversea exchange and summer research experience have better chances to get into top graduate schools .



Boya Wen, Princeton (2016-)

Yongquan Zhang, Harvard (2016-)