

Department of Mathematics

Graduate School
Sungshin Univ.



성신여자대학교 | 대학원
SUNGSHIN WOMEN'S UNIVERSITY | GRADUATE SCHOOL

In this applied mathematics major, we explore various areas of mathematics from a computational perspective with a focus on cryptography which is the foundation of security. The program delves deeply into the computational aspects of number theory and algebra. Research in this major is dedicated to the design of cryptographic algorithms and protocols as well as their implementation making it one of the key research areas in our department.

The ultimate goal of this applied mathematics major is for students to gain not only specialized knowledge in the fields of cryptography and security but also a profound understanding of mathematics from a computational perspective. The program investigates how algorithms from various mathematical domains are implemented optimized and applied in computer systems. Through this students develop the capability to propose creative and innovative solutions in the rapidly evolving technological landscape of modern society.

Department Introduction and History

Department's Educational goal and Specialization Objectives

Faculty Members

Name	Major	Research Achievements	E-mail & Extension Number
Yong-Su Shin	Algebra	- Commutative Algebra and Algebraic Geometry. Artinian algebras, Lefschetz properties, and fat points scheme. In particular, this area is related to Gorenstein algebras, Level algebras, Fat point schemes, Representation theory, Coding theory, Algebraic Complexity Theory.	ysshin@sungshin.ac.kr 02-920-7160
Ju Hong Kim	Applied Mathematics	- Financial Mathematics, Numerical Analysis, Graphical Neural Network.	jhkkim@sungshin.ac.kr 02-920-7524
Seong-A Shim	Applied Mathematics	- Parabolic types models in mathematical biology - Theoretical research on partial differential equations	shims@sungshin.ac.kr 02-920-7608
Ki-Heon Yun	Topology	- Classification of smooth 4-manifolds - Lefschetz fibrations on symplectic 4-manifolds	kyun@sungshin.ac.kr 02-920-7534
Jung Yeon Hwang	Cryptography (Authentication /Privacy)	- Research on anonymous credential protocols and post-quantum cryptography	jyhwang@sungshin.ac.kr 02-920-7579
Suhri Kim	Cryptography (Elliptic Curve Cryptography/Implementation)	- Research on post-quantum cryptography and optimizing the public-key algorithms	suhrikim@sungshin.ac.kr 02-920-7431
Beom-Seok Han	Stochastic Partial differential equation	- Regularity theory for nonlinear stochastic partial differential equations - Regularity theory for partial differential equations with nonlocal operators - Qualitative behaviors of the solution for nonlinear stochastic partial differential equations with nonlocal operators	b_han@sungshin.ac.kr 02-920-7523

Curriculum

DEGREE PROGRAM	RECOMMENDED COURSE ROADMAP BY SEMESTER			
	1ST	2ND	3RD	4TH
MASTER	<ul style="list-style-type: none"> ● Finite field theory ● Modern cryptography 1 	<ul style="list-style-type: none"> ● Modern cryptography 2 ● Cryptanalysis 	<ul style="list-style-type: none"> ● Cryptographic Primitive 1 ● Security Engineering 	<ul style="list-style-type: none"> ● Cryptographic Primitive 2 ● AI Security

Name	RESEARCH ACHIEVEMENTS	INTRODUCTION
Jung Yeon Hwang	<ul style="list-style-type: none"> •Research on anonymous credential cryptographic protocols with provable security (National Research Foundation of Korea, April 2023 - February 2025) •Analysis of standard information for blockchain interoperability models (Dream Security Inc., 2023) •Development of privacy protection technology based on blockchain data encryption (IITP, April 2021 - December 2025) •Research on the aggregation technology of multiple ZKP-based credentials (ETRI, 2021) •Research on technology for personal information protection in a blockchain-based distributed identity verification environment (Financial Security Institute, 2020) •Development of a responsibility-based zero-knowledge proof credential system (ETRI, 2020) 	<p>Research and development of various advanced cryptographic techniques applied in innovative fintech areas such as financial data protection, blockchain-based new financial services, user-friendly payment/authentication, privacy protection technologies based on zero-knowledge proof, and Distributed ID</p> <ul style="list-style-type: none"> •International standards expert •KISA evaluation committee member (Blockchain projects, etc.) •National Intelligence Service information security status evaluation committee member •Prime Minister's Commendation(2020)
Suhri Kim	<ul style="list-style-type: none"> •High-speed implementation research on public-key cryptography •Research projects at the National Institute for Mathematical Sciences, the National Security Research Institute, and the Korea Research Foundation. 	<p>Public-key cryptography is a core technology of secure communication that provides not only key exchange but also user authentication. Research on fast implementations of post-quantum algorithms has been ongoing since the development of quantum computers. In this lab, algorithmic optimization methods based on mathematics are studied.</p>
Beom-Seok Han	<ul style="list-style-type: none"> •Research Achievements: Nine articles addressing the properties of solutions to stochastic partial differential equations with nonlocal operators and nonlinear terms. •Funding: Sejong Science Fellowship (2021.03~) 	<p>We study stochastic partial differential equations that describe natural phenomena, with a special focus on the properties of their solutions. Additionally, we employ mathematical tools developed through this process for mathematical proofs in various fields, including artificial intelligence.</p>

Department's Research and Project Achievements

Students not only rely on major courses but also learn how technology is applied in real industries through projects conducted in collaboration with national research institutions and private companies. Specifically, students engage in research related to 1) computational optimization, 2) the design and implementation of post-quantum algorithms, and 3) the integration of machine learning and artificial intelligence. This approach goes beyond the theoretical learning, providing practical insights into the utilization of technology in various industrial settings.

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**Department's
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After graduation, students have the opportunity to be employed in specialized research institutions such as the National Security Research Institute, the National Institute for Mathematical Sciences, and the Electronics and Telecommunications Research Institute. Additionally, they may join the security research teams of major corporations like Samsung, LG, SK, and others.

In this department, implementing mathematical concepts plays a crucial role. Therefore, at the undergraduate level, it is recommended to acquire not only mathematical concepts such as analysis, differential equations, linear algebra, and algebra but also proficiency in programming languages such as C and Python.

**Achievable
Certifications and
Career Paths After
Graduation**

**Required
Qualifications for
Admissions**