

Department of Applied Mathematics

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<http://www.amath.nchu.edu.tw>

OVERVIEW

The Department of Applied Mathematics at National Chung Hsing University, established in 1961, holds the distinction of being the first department of applied mathematics in Taiwan. With over 50 years of development, the Department offers rigorous mathematics courses, extensive library resources, and state-of-the-art computing software to support students' education. Graduates of the program are well-regarded for their exceptional academic preparation. In order to address the evolving needs of the technological and industrial sectors, the Department continually adapts its courses and research focus. Specifically, the Department emphasizes mathematical analysis, applied statistics, and computational sciences. Through its commitment to integrating computer technology with applied mathematics, the Department of Applied Mathematics at National Chung Hsing University is widely regarded as one of the top programs in Taiwan.

RESEARCH FOCUS

The Department has 30 distinguished faculty members, each with her/his research interests in part of the following areas.

- ◆ Mathematical Analysis, which includes algebra, differential equations, discrete mathematics, dynamical systems, functional analysis, numerical analysis, and stochastic process.
- ◆ Applied Statistics, which encompasses Bayesian theory, biostatistics, ecology, finance, multivariate analysis, reliability theory, and time-series analysis.
- ◆ Computational Science, including big data analysis, biomathematics, computational mechanics, computer vision, machine learning,

natural language processing, and parallel computation.

In addition to the above research areas, the Department is committed to fostering interdisciplinary research in fields such as cloud services platform, cloud computing risk assessment, computational biomedical engineering, computational finance, computer network, information security, parallel computing, physiological computing, and quantum computing.

EDUCATION AND DEGREE PROGRAMS

The Department has been incorporating information education into our curriculum since 1970. Our students receive solid mathematical training as well as broad training in statistics and computer technology. We emphasize the development of students' problem-solving skills and their ability to apply mathematical concepts to other fields. We offer a variety of master's degree programs, including data science, statistics, and applied mathematics, as well as a doctoral program in applied mathematics. Additionally, we have an in-service master's program.

LIBRARY AND COMPUTER FACILITIES

The library at our Department has over 16,000 volumes covering all aspects of mathematics and statistics, such as algebra, number theory, geometry, numerical analysis, mathematical statistics, probability, data science, and machine learning. Our library is the only government-sponsored institute in the central part of Taiwan, and it also provides access to over 1,000 international mathematical journals. There is a reading area available for students who wish to study independently, as well as computer labs located in Room 315, 318, 701, 702, and 723. These labs have over 150 desktop computers that are equipped with various mathematical software, including SAS, Maple, MatLab, R, Scilab, C++, Visual Studio, and Office.

SCHOLARSHIP

Our Department provides a variety of scholarships for both undergraduate and graduate students. Graduate students also have access to part-time job opportunities through the Ministry of Education, as well as the ability to apply for teaching assistantships or research assistantships.

Institute of Statistics

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<http://www.stat.nchu.edu.tw>

The institute of statistics was established in 2008 and students majoring in statistics receive a Master of Science degree. The research interests of the 8 faculty members include: nonparametric regression, semiparametric theory, multivariate analysis, Bayesian theory, change point problem, survival analysis, statistical computing, machine learning, and statistical applications such as in ecology, finance, genetics, clinical trials, infectious diseases, and microarray studies.

COURSES

Our course design emphasizes an understanding of statistical theory and many of its applications. We provide comprehensive training in theoretical and applied statistics, including biostatistics, ecological statistics, financial statistics, industrial statistics, computational statistics, machine learning, big data analysis, etc.

FACILITY

The institute currently has a rich-enough collection of books on statistics and related applications. Academic research journals and friendly online resources are also available. Personal computers for simulation studies and statistical data analysis are distributed within individual research offices and are well-equipped with popular packages such as SAS, Python, MATLAB, and R.

INSTITUTE GOALS

To enhance decision-making and analytical capabilities. Through course training, students are expected to have sufficient skills in data analysis and independent research works.

SCHOLARSHIP

Fellowships for teaching assistant and research assistant, and grants for part-time service works, are available for students.

Institute of Data Science and Information Computing

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<http://datascience.nchu.edu.tw>

The Institute of Data Science and Information Computing was established in 2021. Approximately 16 graduate students are recruited each year. The research interests of our faculty include: image processing, optimization algorithms, big data analysis, computer vision and human-computer interaction, machine learning, computer network, scientific computing, and computational physics.

COURSES

In addition to the understanding of knowledge in data science and information computing, our courses also emphasize the practical application of big data related industries. The courses cover data science methods, mathematical modeling, data mining and visualization, machine learning, numerical optimization, mathematical image processing, statistical software and computing, big data, computing platforms, visual recognition, IoT, physiological computing, quantum computing, and information security.

INSTITUTE GOALS

The main goals of our institute are to train students with comprehensive abilities in both data science and information computing. Students will participate in various research projects from the university and the enterprises, which to provide students with internship opportunities and enhance their decision-making and analysis abilities.

Doctoral Program in Data Science and Industrial Analytics

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<http://phddsia.nchu.edu.tw/en/about.php>

FEATURES

The research direction is related to the industry and interacts closely with the partner companies. If Ph.D. students can make more specific contributions to the industry-university plan, they are expected to join the cooperative company after graduation.

SCHOLARSHIPS

Each Ph.D. student enrolled in this program would have scholarship at least NT\$25,000 per month.

COURSE

Big data related courses are: Mathematical Modeling and Data Analysis, Applied Multivariate Data Analysis, Seminar, Data Science, Machine Learning, Internet of Things (IoT), Advanced Data Mining and Big Data Analysis.

PARTICIPATE IN R&D PLANNING

The Ph.D. students participating in the project need to work closely with partner companies to understand the current status of students' research, learning bottlenecks and parts that need to be strengthened through regular meetings. Cooperative companies can provide various resources to break through the bottleneck of students, especially to provide experienced R & D personnel, various research equipment, etc.

INDUSTRY-UNIVERSITY COOPERATION

Under the joint supervision, in addition to students' advisors, qualified R&D personnel can be assigned by partner companies as students' co-advisors, so as to strengthen the interaction between students and companies and to obtain practical experience, technology and concepts which are less accessible in school.

Master's Program in Artificial Intelligence and Data Science

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<http://ai-datasci.nchu.edu.tw/>

FEATURE

- ◆ Provide updated artificial intelligence courses required for industry.
- ◆ Our faculty members are from various disciplines, including Applied Mathematics, Computer Science and Engineering, Information Management, Data Science and Information Computing, Mechanical Engineering, Statistics, Genomics and Bioinformatics, and Post-Baccalaureate Medicine. Create a learning environment that emphasizes both theory and practice.
- ◆ From shallow to deep, step by step, cross-field learners can quickly master the latest big data and AI technology.

ELIGIBILITY

- ◆ The graduate admission committees will consider students who is interested in researching artificial intelligence, information security, data science, and related topics. Applicants should have at least one year work experience.

COURSES

- ◆ Basic courses: Data Science and Regression Analysis, Machine Learning, and Advanced Python Programming and Applications in Artificial Intelligence.
- ◆ Core courses: Data Analysis, Artificial Intelligence, and Information Security.
- ◆ Research development: Thesis, Research Methods, and Literature Studies.

RESEARCH

Our research focus on Artificial Intelligence, Information Security, Image Analysis, Programming, Digital Signal Processing, Big Data Analytics, Quantum Computing, and related topics.



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FEATURES

The College of Science combines the three major fundamental areas of scientific research: Chemistry, Applied Mathematics, and Physics. Over the past 50 years, our excellent faculty has contributed extensively in all of these research fields. We offer a comprehensive set of educational experiences for both graduate and undergraduate students. The goal of the College of Science is to provide fundamental and advanced education in natural science to train researchers to innovate and to become leaders in industry, academia, and government in the career of their choice.

STATUS

The Department of Chemistry provides BS, MS, and PhD programs for future leader talents in sustainable green-chemistry and life-enhancing biomaterials. It presently has 36 full time faculty members, 230 undergraduate students and 190 graduate students. It also offers basic chemistry courses to approximately 1,800 undergraduate students among five other different Colleges weekly.

The Department of Applied Mathematics provides BS, MS and PhD programs for students developing mathematical models and quantitative techniques that can be implemented for solving problems encountered in the real world.

The Department of Physics is particularly keen on developing new research fields such as quantum technology and nanoscience. The research program seeks to find a balance between theory and practice. The experienced faculty members conduct research and advice students in both experimental physics and theoretical physics.

RESEARCH

The Department of Chemistry runs research programs focused on sustainable green-chemistry and medical biochemistry. The specific objectives include: (1) functional green-materials, especially in high-efficient solar-driven organic solar cells and green hydrogen productions; (2) negative-carbon technologies, especially in 4D printing CO₂ capturing materials; (3) life-enhancing biomaterials for drug-delivery and healthcare medicals. Currently, the Department of Chemistry is ranked around 400th in QS World University Rankings for Chemistry.

The Department of Applied Mathematics specializes in Mathematical Analysis (discrete mathematics, dynamical systems, numerical analysis, etc.), Applied Statistics (biostatistics, reliability theory, time-series analysis, etc.), and Computational Science (big data analysis, computer vision, machine learning, etc.). The Department also encourages interdisciplinary research in fields such as cloud services, biomedical engineering, and quantum computing.

Research in the Department of Physics explores nearly all representative frontiers of physics, including condensed matter physics, semiconductor physics and devices, nanomaterial design and fabrication, laser physics, optoelectronics, computational physics, quantum information science, renewable energy, solar cells, biophysics, and biomedical sensors. Armed with state-of-the-art facilities, an excellent physics library, and close collaboration with outstanding faculty members in the Schools of Engineering and Life Sciences, the Department's faculty and students are making frequent exciting progress in developing highly innovative, interdisciplinary research in Physics.

VISION

Our goals are:

- ◆ To deeply cultivate sustainable, carbon-negative, green chemistry and life-enhancing biomaterial chemistry.
- ◆ To expand our focus from the traditional realm of physics to new frontiers of interdisciplinary research such as nanoscience, quantum technology, and advanced materials.
- ◆ The strengthened teaching and research in response to the paradigm shift toward cloud computing, green computing, and big data analytics.

Department of Chemistry

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<http://www.nchu.edu.tw/chem>

The Department of Chemistry was found in 1956. It launched the Master's Degree Program in 1987 and Doctor's Degree Program in 1996. Students not only can expand their knowledge by taking solid courses in organic chemistry, inorganic chemistry, analytical chemistry, physical chemistry and biochemistry, but also they can receive practical fundamental research training for synthesis, structure characterizations, instrument analysis, and advanced industrial technology. There are 36 full-time faculty members composed of a group of highly energetic and enthusiastic researchers with strong expertise in a particular field.

FACILITIES

Our department can provide comprehensive hardware and software support for teaching and research. The departmental library owns over one hundred journals and thousands of reference books providing point-of-need assistance to researchers, and importantly, it is the Central Taiwan Chemical Library Information Service Center chartered by the National Science and Technology Council (NSTC). The university library also provides online access for literature search and other research resources. The resources for searching and exploring chemical information are available in these libraries.

To establish a world-class chemistry department, we have significantly strengthened our technological infrastructure and organized major Instruments including super-conductivity FT-NMR (multiple-nuclei high field NMR), GC-MS-MS, X-ray diffractometer and

elemental analyzers. That makes our department become the best institute for chemical research in Central Taiwan.

AREA OF RESEARCH

The Department of Chemistry carried out over 40 research projects annually ranging from fundamental studies to environmental and industrial researches. Our research budget from the university-NSTC-industry cooperative projects amounts over NT\$ 43 million, making our department as a nationally acclaimed institute of teaching and research in chemistry. With a team of the youngest and most enthusiastic faculties as well as the fullest complement of equipment and library facilities, it should not be a surprise that our department has been a hotbed of evolution for research. The research has two themes: sustainable green-chemistry and medical biochemistry.

The specific objectives for sustainable green-chemistry focus on the synthesis of functional green-materials for high-efficient solar-driven organic solar cells and green hydrogen productions, as well as the development of innovative negative-carbon technologies, for example, 4D-printing carbon capturing materials.

The specific objectives for medical biochemistry is to pursue life-enhancing biomaterials for drug-delivery and healthcare medicals.

THE FUTURE

We call upon all young people who aspire to a career in Chemistry to join our effort in this science advancement. To encourage young people of excellent caliber to join the Department of Chemistry, a scholarship is set up through the generous donations of parents of our alumni. For the benefit of the next generation and the advancement of Chemical Technology in Taiwan, we urge you to support our efforts by informing your children our progress and achievements, and further guide and counsel with them to make the correct and informed choice, that is join us to start their higher-ed journey at the best university and the best department. We are confident to provide them an important foundation for success in their education and the best preparation for their future.

Department of Physics

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<http://www.phys.nchu.edu.tw>

Founded in 1987, the Physics Department has been constantly growing over the years: it launched a Master's Degree Program in 1994 and a Doctor's Degree Program in 2000.

The Department now occupies half of the ten-story Science Building. The vastly expanded space available to teaching and research allows the Department to commence ambitious projects. In recent years the Department also began to gradually reallocate the focus of its teaching and research enterprise. Adapting to the wake of applying modern technology to teaching and learning, the Department now boasts the most extensive (in Taiwan) list of online lecture notes. This effort is further facilitated by the three libraries located in the Science Building: the Physics Library, the Chemistry Library, and the Central Taiwan Book-Center for Physics.

The Department is particularly keen on developing new research field such as nano-science and technology. Our research program seeks to find a balance between theory and experiment. As a result, there are experienced faculty conducting research and advising students both in the areas of experimental physics, including, laser and liquid crystal related optics, superconductivity, low temperature physics, semiconductor physics, surface science and nano-science, and in theoretical physics, including statistical mechanics, condensed matter physics, nonlinear physics, quantum computing, and biophysics.

FACILITIES

In addition to normal classrooms, the Department owns two large auditoriums supported with full audio-visual aids. The physics demo auditorium, equipped with a rotary stage, is the first auditorium of this kind used for demonstration and teaching for general physics in Taiwan.

The Department has been putting much effort to improve and strengthen the laboratory courses in the curriculum. At present the Department is facilitated with educational labs for general physics, fundamental physics, modern physics, applied electronics, circuitry, biophysics, optics and computational physics. Moreover, the Department established an electronics shop and a machine shop accessible to students for related skill training.

In respect of research activities, the Department has founded theoretical research groups, such as the center for nonlinear physics and biophysics research group, and experimental research labs to cover the main branches of modern physics. The research labs are the infrared optics lab, the superconducting and magnetic materials laboratory, the amorphous materials laboratory, the high magnetic field and low temperature laboratory, the nano fabrication laboratory, the surface and complex systems laboratory, and the scanning probe microscopy lab.

THE FUTURE

On its research enterprise, the Department has been shifting its research focus from the traditional realm of physics such as theoretical atomic and particle physics to new frontiers of physics as well as the boundary between physics and other sciences, for example, quantum computation, nanophysics, and biophysics. In theoretical physics, the preferred directions are biological pattern generation, fractals, nano-structural computations, quantum computation, Polymer-nano particle structural calculations, DNA-protein self-assembling processes and statistical properties for DNA sequences. In experimental physics, the preferred topics are fabrications and analysis for nano materials and nano devices, studies for SPM manipulation, novel magnetic and superconducting materials and devices, next-generation semiconducting electronic and electro-optical devices, bio-thin films and amorphous materials. For more detail, visit the website: <http://www.phys.nchu.edu.tw/>

Institute of Nanoscience

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<http://www.inanos.nchu.edu.tw>

The advances of nanoscience and nanotechnology allow researchers to see molecular structures and fabricate electronic devices down to nanometer scales. Nanoscience is a multidisciplinary science covering physics, chemistry, electronic, optoelectronics, materials, biology and agriculture fields. It has huge effects in fundamental sciences and daily life. The Institute of Nanoscience founded at National Chung Hsing University in 2008 was to pursue the advancements of nanoscience. Our institute is equipped with the state-of-art nanoscience equipment, allowing the researchers to carry out experiments on the most advanced nanotechnology.

The curriculum contains the fundamentals of both theoretical and experimental nanoscience. Many experimental courses emphasizing hand-on training are offered so that the students can apply the knowledge to their work on nanotechnology right after graduation.

RESEARCH FIELDS

- ◆ Fabrication of nanomaterials.
- ◆ Characterization techniques for nanoscience.
- ◆ Design and develop novel nanoscale electronic and optoelectronic devices.
- ◆ Biomedical nanotechnology.

Our research has strong collaboration with other colleges such as Science, Engineering, Life Science and Agriculture in the university. We also have strong ties with local industries in central Taiwan. Our goals are to raise the level of our academic research to the international level, and to help the industry to develop products of nanotechnology.

Center of Science Education

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PURPOSE

Center of Science Education is a university-wide vehicle for integrating teaching and research work in the sciences, engineering, mathematics, and technology. Center of Science Education also acts as a link for information between professors of NCHU and related communities for promotion of basic science education.

ORGANIZATION TASKS

- ◆ To integrate the science education resources at NCHU, develop demonstration materials and organize various basic science curriculum improvement programs.
- ◆ To promote interdisciplinary teaching and collaboration.
- ◆ To assist the cultivation of high school teachers in advanced placement and multidisciplinary courses.
- ◆ To carry out basic science courses or competitions.
- ◆ To promote scientific new knowledge and popular science activities in related schools.

RECENT ACTIVITIES

- ◆ Nurturing science or advanced placement teachers in high school.
- ◆ Project adventure in scientific fields.
- ◆ Scientific camps and lectures.
- ◆ Industry-university cooperative research projects
- ◆ Scientific popularization activities in environmental education, food safety issues and popular science knowledge.

