The Division of Chemistry and Biological Chemistry is one of the most rapidly growing chemistry departments in the region. Over the past decade, we have grown from zero to a department with 41 faculty members, 24 support staff, about 300 PhD students and research staff, and over 1000 undergraduates.

In our direct BSc Honours programme, students receive rigorous training that qualifies them to be educators, professional chemists in the industry, or to enter graduate school in the chemical sciences. Our curriculum places special emphasis on problem-solving, laboratory training, and project work – allowing our graduates to build teamwork and communication skills that are valued throughout the job market. Undergraduates have the chance to participate in research projects, under one-to-one supervision by our professors, from year one of their studies through to the final year research project and also have the option to experience a semester-long stint of industrial internship with leading local and international companies and research institutes. Students can also spend a semester or two studying abroad at various top institutions as part of our international exchange programme.

I hope that you find subsequent pages of this brochure informative and interesting. Come and enrol with us for your undergraduate studies to start a fascinating journey into the molecular world!

ASSOCIATE PROFESSOR
LING XING YI
Head, Division of Chemistry and Biological Chemistry
FIVE-YEAR DEGREE PROGRAMMES

BACHELOR OF SCIENCE (HONOURS) IN CHEMISTRY AND BIOLOGICAL CHEMISTRY

• World-class curriculum, based on guidelines from the American Chemical Society, emphasising broad exposure to multiple chemistry disciplines.
• Top-notch undergraduate laboratory training, equipping students with knowledge of modern laboratory practices and providing access to state-of-the-art equipment.
• Final-year students can choose between doing a Final-Year Project or a Professional Internship. This gives students the flexibility to pursue an in-depth research experience or challenge themselves in a real-world working environment.
• Opportunities for international exchange with partner universities all over the world.
• Optional concentrations in Medicinal Chemistry and Food Chemistry.

BACHELOR OF SCIENCE (HONOURS) IN CHEMISTRY AND BIOLOGICAL CHEMISTRY WITH SECOND MAJOR IN FOOD SCIENCE AND TECHNOLOGY

• Highly selective interdisciplinary programme offered in partnership with Wageningen University (The Netherlands) and two other schools from NTU: the School of Biological Sciences (SBS) and the School of Chemical and Biomedical Engineering (SCBE).
• Students gain an understanding of food processes from the multiple perspectives of chemistry, physics, biology, engineering, and industry.
• Five core modules taught by professors from Wageningen University, one of the world’s top centres of expertise in Food Science. The modules cover Food Chemistry, Food Microbiology, Food Physics, Food Process Engineering, and Quality Systems Operations.
• Electives offered by SPMS, SBS and SCBE allow students to tailor their studies in Food Science and Technology according to personal interests.
CURRICULUM OVERVIEW
BSC (HONS) IN CHEMISTRY AND BIOLOGICAL CHEMISTRY

YEAR 1
➡️ Inorganic Chemistry with Laboratory
➡️ Organic Chemistry with Laboratory
➡️ Physical Chemistry with Laboratory
➡️ Biochemistry
➡️ Research Project and/or Elective Courses

YEAR 2
➡️ Analytical Chemistry
➡️ Inorganic Chemistry
➡️ Organic Chemistry
➡️ Physical Chemistry
➡️ Chemistry and Biological Chemistry Laboratory
➡️ Research Project and/or Elective Courses

YEAR 3
➡️ Chemical Spectroscopy
➡️ Organometallic Chemistry
➡️ Physical Chemistry
➡️ Organic Chemistry
➡️ Chemistry and Biological Chemistry Laboratory
➡️ Research Project and/or Elective Courses

YEAR 4
➡️ Choice of Honours Project or Professional Internship
➡️ Advanced Elective Courses
ELECTIVES

Electives for Concentration in Medicinal Chemistry
- Medicinal Chemistry
- Drug Design and Discovery
- Molecular Modelling: Principles and Applications
- Heterocyclic Chemistry

Electives for Concentration in Food Science and Technology
- Food Chemistry and Nutrition
- Food Analysis and Safety
- Food Processing and Preservation

Additional Courses for Second Major in Food Science and Technology
- Food Microbiology
- Food Chemistry
- Food Physics
- Food Process Engineering
- Quality Systems Operations

Choice of Elective Courses, including:
- Biomedical Nanotechnology
- Pharmacokinetics and Biopharmaceutics
- Food Analysis and Safety

Other Chemistry Electives
- Advanced Analytical Chemistry
- Nanoscience and Nanotechnology
- Pharmaceutical Chemistry
- Biomedical Imaging and Sensing
- Quantum Chemistry and Statistical Thermodynamics
- Molecular Modelling: Principles and Applications
CAREER PROSPECTS

Chemistry graduates find ready employment in a wide range of chemical-related industries, both in Singapore and overseas.

INDUSTRY

1. Pharmaceutical & Biological Product Manufacturing
2. Public Administration and Defence
3. Education & Research
4. Finance and Insurance
5. Healthcare
6. Other Sectors

Pharmaceutical Companies
GlaxoSmithKline, Schering-Plough, Pfizer, Merck Sharpe & Dome, Kaneka, S'Bio, Merlion Pharmaceuticals, Novartis, Albany Molecular Research, Galileo Pharmaceuticals, Roche, Eli Lilly, and Aventis

Education
Educational Institutions and National Institute of Education (NIE). Many of our graduates also pursue further studies with us or at overseas institutions and are employed as faculty in tertiary education institutions

Food and Beverage Industry
Asia Pacific Breweries, Fraser & Neave

Petrochemical Companies
Shell, ExxonMobil, Sumitomo Chemicals, and Mitsui Chemicals

Polymer/Paint/Semiconductor/Materials Companies
TECH Semiconductor, Chartered Semiconductor Manufacturing, HP Inc, 3M Singapore, DuPont, Honeywell, Micron

Research Institutes
Institute of Chemical Engineering and Sciences (ICES), Institute of Bioengineering and Nanotechnology (IBN), Institute of Materials Research and Engineering (IMRE), and Institute of Microelectronics (IME)

Government Agencies
Health Sciences Authority (HSA), DSO National Laboratories, Defence Science and Technology Agency (DSTA), National Environment Agency (NEA), and Intellectual Property Office of Singapore (IPOS)

Other Sectors
Our graduates have gone into patent law, bioinformatics, and other intellectual property related jobs

The following is a list of job opportunities in Singapore that Chemistry and Biological Chemistry graduates are particularly well positioned for and in which many of our graduates are currently employed:

1. Pharmaceutical & Biological Product Manufacturing
2. Public Administration and Defence
3. Education & Research
4. Finance and Insurance
5. Healthcare
6. Other Sectors

* Source: Graduate Employment Survey 2017

Scan to find out more about our career prospects!
PROFESSIONAL INTERNSHIPS
Our undergraduate programmes emphasise the importance of practical training. Students are provided with opportunities to undergo a professional internship, varying from 10 to 22 weeks, during their course of study. This internship can be conducted at a private or public organisation, either locally or overseas.

Our students have interned at numerous companies, institutes and R&D centers such as:

- Abbott Nutrition Research and Development
- Akzo Nobel Paints (Singapore)
- Asia Pacific Breweries (S)
- Genome Institute of Singapore
- Givaudan Singapore
- GlaxoSmithKline (GSK)
- Health Sciences Authority (HSA)
- Institute of Materials Research & Engineering (IMRE)
- International Flavors & Fragrances (Greater Asia)
- Nestlé
- Novartis Singapore
- Public Utilities Board (PUB)
- Robert Bosch (SEA)
- Roche Singapore
- Shimadzu (Asia Pacific)
- Symrise Asia Pacific (Flavors and Scent & Care)

My industrial attachment experience helped me immensely in seeking employment. The skills I picked up during my undergraduate research experiences, and the knowledge I acquired throughout the Chemistry and Biological Chemistry (CBC) programme played a role. While I was still interning at GlaxoSmithKline (GSK), I managed to secure employment during my final semester via GSK’s Future Leaders’ Programme.

The attachment gave me a channel to explore and apply the skills I picked up as a CBC undergraduate, in the context of the pharmaceutical industry. The experience helped me to settle into my job quickly. I recommend juniors who are considering a career in chemistry to take chemistry in NTU.

LIM JIE SHENG
Chemist Associate,
Technical Development Global Manufacturing & Supply GlaxoSmithKline (GSK)
BSc (Hons) in Chemistry & Biological Chemistry

RESEARCH OPPORTUNITIES
Research within the Division covers a wide spectrum of fields in the realm of Chemical Sciences. We are particularly strong in the following areas with many of our faculty recognised internationally as leaders in their respective areas.

- Analytical and Bioanalytical Chemistry
- Biological Chemistry and Chemical Biology
- Inorganic Chemistry and Organometallics
- Nanomaterials and Materials Chemistry
- Organic Chemistry and Synthesis
- Physical Chemistry and Chemical Physics

Undergraduate students have various opportunities to immerse themselves in research right from year-1 of their studies via the CBC summer research programme, URECA and Final-Year Projects. Students interested in research also have opportunities to pursue a PhD programme in NTU upon graduation with full scholarship support.
ALUMNI AND STUDENT TESTIMONIALS

I feel very grateful to have had an opportunity to be part of a young and energetic department like CBC and to have had wonderful supervisors and mentors during my time there. I greatly appreciate the opportunities that were given to me which allowed me to expand my knowledge and build confidence in my abilities. The valuable skills I’ve learned have given me a solid foundation upon which to build my career.

Science is more than just understanding the theoretical and technical concepts. It encompasses creative thinking, logical and analytical reasoning, and sensitivity to details. These skills have been very useful to me even when I later decided to pursue a career outside of the chemicals industry.

I strongly believe there is a direct correlation between the environment you’re in and the person you become; all of the academics in SPMS were passionate about science, which created an ideal environment for the growth of my interest and led me to pursue my postgraduate studies in SPMS.

I chose to spend more time in the research laboratories, which built a strong foundation to pursue postgraduate research with a relevant skill set. The most enjoyable part of the SPMS experience was the interspersed work-and-play attitude for both the staff and students. Classes and lectures became more personal and there was a strong social support network because of various activities held in the SPMS community.

CHERYL ONG
Governance & Strategy Manager, Business Governance Markets, Australia and New Zealand Banking Group Ltd
BSc in Chemistry & Biological Chemistry, Class of 2016

NUR FILZA BINTE MOHAMED ASLAM
Medical Science Liaison, Perspectum Diagnostics (Singapore)
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2009
PhD in Chemistry & Biological Chemistry, Class of 2017

SIVARAJAN S/O KASINATHAN
Senior Process Development Scientist, Process Development, Pfizer Asia Pacific Pte Ltd
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2013

NUR FILZA BINTE MOHAMED ASLAM
Medical Science Liaison, Perspectum Diagnostics (Singapore)
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2009
PhD in Chemistry & Biological Chemistry, Class of 2017

TAY WEE SHAN
PhD student, School of Physical and Mathematical Sciences Nanyang Technological University
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2016

I strongly believe there is a direct correlation between the environment you’re in and the person you become; all of the academics in SPMS were passionate about science, which created an ideal environment for the growth of my interest and led me to pursue my postgraduate studies in SPMS.

I chose to spend more time in the research laboratories, which built a strong foundation to pursue postgraduate research with a relevant skill set. The most enjoyable part of the SPMS experience was the interspersed work-and-play attitude for both the staff and students. Classes and lectures became more personal and there was a strong social support network because of various activities held in the SPMS community.

CHERYL ONG
Governance & Strategy Manager, Business Governance Markets, Australia and New Zealand Banking Group Ltd
BSc in Chemistry & Biological Chemistry, Class of 2016

NUR FILZA BINTE MOHAMED ASLAM
Medical Science Liaison, Perspectum Diagnostics (Singapore)
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2009
PhD in Chemistry & Biological Chemistry, Class of 2017

SIVARAJAN S/O KASINATHAN
Senior Process Development Scientist, Process Development, Pfizer Asia Pacific Pte Ltd
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2013

NUR FILZA BINTE MOHAMED ASLAM
Medical Science Liaison, Perspectum Diagnostics (Singapore)
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2009
PhD in Chemistry & Biological Chemistry, Class of 2017

TAY WEE SHAN
PhD student, School of Physical and Mathematical Sciences Nanyang Technological University
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2016

I strongly believe there is a direct correlation between the environment you’re in and the person you become; all of the academics in SPMS were passionate about science, which created an ideal environment for the growth of my interest and led me to pursue my postgraduate studies in SPMS.

I chose to spend more time in the research laboratories, which built a strong foundation to pursue postgraduate research with a relevant skill set. The most enjoyable part of the SPMS experience was the interspersed work-and-play attitude for both the staff and students. Classes and lectures became more personal and there was a strong social support network because of various activities held in the SPMS community.

CHERYL ONG
Governance & Strategy Manager, Business Governance Markets, Australia and New Zealand Banking Group Ltd
BSc in Chemistry & Biological Chemistry, Class of 2016

NUR FILZA BINTE MOHAMED ASLAM
Medical Science Liaison, Perspectum Diagnostics (Singapore)
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2009
PhD in Chemistry & Biological Chemistry, Class of 2017

SIVARAJAN S/O KASINATHAN
Senior Process Development Scientist, Process Development, Pfizer Asia Pacific Pte Ltd
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2013

NUR FILZA BINTE MOHAMED ASLAM
Medical Science Liaison, Perspectum Diagnostics (Singapore)
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2009
PhD in Chemistry & Biological Chemistry, Class of 2017

TAY WEE SHAN
PhD student, School of Physical and Mathematical Sciences Nanyang Technological University
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2016
OVERSEAS EXPERIENCE

EUROPE
- Imperial College, UK
- KTH Royal Institute of Technology, Sweden
- Norwegian University of Science & Technology, Norway
- Stockholm University, Sweden
- University College London, UK
- University of Edinburgh, UK
- University of Southern Denmark, Denmark
- University of Sussex, UK
- University of Warwick, UK
- University of York, UK

ASIA
- Hong Kong University of Science & Technology, Hong Kong
- Korea University, South Korea
- Pohang University of Science & Technology (POSTECH), South Korea
- Pusan National University, South Korea

NORTH AMERICA
- University of Waterloo
- University of Ottawa
- University of Western Ontario

One of the best decisions I have made during my undergraduate years in CBC was to do my Final-Year Project (FYP) overseas at University of Bath, UK. Not only did I forge new friendships with my overseas supervisor and lab group, I also had ample time for travel and leisure.

DERRICK TAN JING YANG
PhD student,
School of Physical and Mathematical Sciences
Nanyang Technological University
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2016

I did my Final-Year Project (FYP) at the Institute Curie in Paris, France. It was a fantastic experience! I was able to expand my knowledge on synthetic chemistry and also gain hands-on experience in various purification and analytical equipment while not forgetting to travel around and enjoy the beautiful places in France.

LEONG SHI XUAN
PhD student,
School of Physical and Mathematical Sciences
Nanyang Technological University
BSc (Hons) in Chemistry & Biological Chemistry, Class of 2018

Scan to find out more about our overseas exchange!
## SCHOLARSHIPS

### THE NANYANG SCHOLARSHIP
Awarded to students who excel academically, with strong leadership potential and outstanding CCA track records.
- Full coverage of subsidised tuition fees (after Tuition Grant).
- Living allowance of S$6,500 per academic year.
- Accommodation allowance of up to S$2,000 per academic year.
    (Applicable to scholarship holders who reside in NTU hostels only.)
- Travel grant of S$5,000 for an overseas programme (one-off).
- Computer allowance of S$1,750 (one-off).
- Priority for Overseas Programme.
- Participation in Scholars Orientation Programme, Scholars Award Ceremony, Outreach Programmes, and Eminent Speaker Series.
- No bond is attached to the Nanyang Scholarship apart from the three-year bond applicable to all Singapore PRs and international students under the MOE Tuition Grant Scheme.

### THE COLLEGE OF SCIENCE SCHOLARSHIP
Awarded to students with a record of good academic performance.
- Full coverage of subsidised tuition fees (after Tuition Grant).
- Living allowance of S$3,600 per academic year.
- No bond is attached to the College Scholarship apart from the three-year bond applicable to all Singapore PRs and international students under the MOE Tuition Grant Scheme.

For enquiries pertaining to financial assistance:
Tel: (65) 6790 4115
Email: FinAid@ntu.edu.sg

For enquiries pertaining to scholarships:
Tel: (65) 6790 6766
Email: ug_scholarships@ntu.edu.sg

Visit our Scholarships page for more details

### ADMISSION REQUIREMENTS

<table>
<thead>
<tr>
<th>Programme</th>
<th>GCE A-Level</th>
<th>Polytechnic Diploma awarded in Singapore</th>
<th>International Baccalaureate Diploma</th>
<th>NUS High School Diploma</th>
<th>International &amp; Other Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry &amp; Biological Chemistry</td>
<td>Good H2 level passes in Chemistry and Mathematics or Physics</td>
<td>Good GPA in a relevant diploma</td>
<td>Chemistry and Mathematics at Higher Level</td>
<td>Major CAP of 2.0 in Chemistry and Mathematics/Physics</td>
<td>Chemistry and Mathematics/Physics at Senior High School Level/IB Higher Level</td>
</tr>
<tr>
<td>Chemistry &amp; Biological Chemistry with 2nd major in Food Science and Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Office of Admissions
Student & Academic Services Department
Nanyang Technological University
Student Services Centre, #03-01
42 Nanyang Avenue, Singapore 639815

For local students
Tel: 6790 5055 / 6790 5972 • Email: adm_local@ntu.edu.sg

For international students
Tel: (65) 6790 5806 / (65) 6790 5807 • Email: adm_intnl@ntu.edu.sg

Visit our Admissions page for more details
MESSAGE FROM THE HEAD

Founded in 2005, the Division of Mathematical Sciences (MAS) has come a long way, starting with five faculty members and an intake of 47 undergraduate students in August 2005. The graduate programme was established in 2006. Currently, MAS has 35 faculty members, around 50 graduate students, and over 1000 undergraduate students enrolled in several degree programmes: Mathematical Sciences, Mathematical Sciences with Minor in Finance, Mathematical Sciences & Economics (Double Major), Mathematical & Computer Sciences (Double Major), and Data Science & Artificial Intelligence.

Our faculty is highly active in research, and we have established a vibrant research culture that our undergraduates participate in and benefit from. We have a constant stream of academic visitors from all over the world, hosting workshops and conferences on a regular basis.

MAS is strongly committed to high-quality undergraduate education. The curriculum of our direct honours degree programme is designed with an emphasis on solid mathematical foundations, job relevance, and flexibility of course choice. Motivated and strong students can opt to take special advanced courses, and to participate in undergraduate research projects, supervised independent study courses, and overseas exchange programmes.

Associate Professor Chan Song Heng
Head, Division of Mathematical Sciences
FOUR-YEAR DEGREE PROGRAMMES

BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL SCIENCES

- Offers a good mix of fundamental, as well as applied, computational, and industrial aspects of Mathematics and Statistics.
- 18 months of foundational courses, followed by specialisation in one of four tracks: Pure Mathematics, Applied Mathematics, Statistics, or Business Analytics.

In partnership with Nanyang Business School (NBS)

BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL SCIENCES WITH MINOR IN FINANCE

- Emphasises the use of mathematical methods in finance and economics. Building on the Mathematical Sciences curriculum, students take additional NBS courses in Banking and Finance.

In partnership with the School of Social Science (SSS)

BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL SCIENCES AND ECONOMICS (DOUBLE MAJOR)

- Intended for students interested in quantitative jobs in the financial services industry.
- Curriculum covers numerical, computational and statistical mathematical methods, as well as quantitative methods in economics. Graduates will have a strong interdisciplinary skillset, and a strong background in statistics and economics.

In partnership with the School of Computer Science and Engineering (SCSE)

BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL AND COMPUTER SCIENCES (DOUBLE MAJOR) [NEW]

- Intended for students seeking careers in financial technology, cybersecurity, and data analytics, or postgraduate degrees in Mathematics, Computer Science, and related disciplines.
- Curriculum provides a strong foundation in core mathematical concepts, and in-depth training in one of four areas at the interface of Mathematical Sciences and Computer Science: Theoretical Computer Science, Cryptography and Cybersecurity, Financial Modelling, and Data Science.

BACHELOR OF SCIENCE (HONOURS) IN DATA SCIENCE AND ARTIFICIAL INTELLIGENCE [NEW]

- Intended for students interested in the rapidly expanding fields of data science and artificial intelligence (AI).
- Curriculum includes courses in both Mathematical Sciences and Computer Sciences, with an emphasis on the interactions between the two disciplines. Students read specialised courses in topics such as optimisation, regression analysis, high-dimensional statistics, data mining, machine learning, and cryptography.
- Participation in internship and industry-oriented research projects.

In partnership with the Division of Physics and Applied Physics (PAP)

BACHELOR OF SCIENCE (HONOURS) IN PHYSICS AND MATHEMATICAL SCIENCES (DOUBLE MAJOR) [NEW]

- Intended for students interested in research careers requiring strong computational and problem-solving skills or students pursuing postgraduate degree in Physics and Mathematical Sciences.
- Curriculum equips students an understanding of physical world through mathematical rigour and insights. It covers courses at the interface of Physics and Mathematics such as Differential Geometry, Algebraic Topology, Quantum Mechanics, General Relativity.

Scan to find out more about our programmes!
### CURRICULUM OVERVIEW

#### BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL SCIENCES

<table>
<thead>
<tr>
<th>APPLIED MATHEMATICS / PURE MATHEMATICS / STATISTICS TRACK</th>
<th>Year 1 + 2</th>
<th>Year 2 + 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculus</td>
<td>Linear Algebra</td>
<td>Discrete Mathematics</td>
</tr>
<tr>
<td></td>
<td>Algorithms and Computing</td>
<td>Probability and Statistics</td>
</tr>
<tr>
<td>Sample Courses for Pure Mathematics Track</td>
<td>Specialisation Track and Electives</td>
<td>Final Year Project or Professional Internship</td>
</tr>
<tr>
<td></td>
<td>Real and Complex Analysis</td>
<td>Differential Geometry</td>
</tr>
<tr>
<td></td>
<td>Number Theory</td>
<td>Topology</td>
</tr>
<tr>
<td>Sample Courses for Applied Mathematics Track</td>
<td>Numerical Analysis</td>
<td>Scientific Computing</td>
</tr>
<tr>
<td></td>
<td>Optimisation</td>
<td>Cryptography</td>
</tr>
<tr>
<td>Sample Courses for Statistics Track</td>
<td>Statistics</td>
<td>Data Analysis</td>
</tr>
<tr>
<td></td>
<td>Regression Analysis</td>
<td>Time Series Analysis</td>
</tr>
</tbody>
</table>

#### BUSINESS ANALYTICS TRACK

| Year 1 + 2 | Business Operations & Processes | Fundamentals of Management |
| Year 3 + 4  | Final Year Project or Professional Internship | Courses from NBS |
|            | Data Management | Decision Tools for Managers |
|            | Financial Analytics & Reporting | Business Intelligence |
|            | Principles of Economics | Operations Research |

| BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL SCIENCES WITH MINOR IN FINANCE |

Offered in partnership with the Nanyang Business School (NBS)

In addition to the curriculum of Major in Mathematical Sciences, students read 15 Academic Units of banking and finance courses offered by NBS. The choice of courses includes:

- Business Finance
- Financial Modelling
- Derivative Securities
- Bank Risk Management

| BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL SCIENCES AND ECONOMICS (DOUBLE MAJOR) |

Offered in partnership with the School of Social Science (SSS)

| Year 1 | Microeconomics | Macroeconomics |
| Year 2 | Econometrics | Mathematical Economics |
| Year 3 | Public Finance | Industrial Organisation |
|        | International Trade | Game Theory and Applications to Social Sciences |
|        | Financial Economics | Cost/Benefit Analysis |
|        | Econometric Modeling and Forecasting | |
### BACHELOR OF SCIENCE (HONOURS) IN MATHEMATICAL AND COMPUTER SCIENCES (DOUBLE MAJOR)

Offered in partnership with the School of Computer Science and Engineering (SCSE)

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses from SCSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Data Structures</td>
</tr>
<tr>
<td></td>
<td>Algorithms</td>
</tr>
<tr>
<td>Year 2</td>
<td>Object Oriented Design &amp; Programming</td>
</tr>
<tr>
<td></td>
<td>Software Engineering</td>
</tr>
<tr>
<td>Year 3 + 4</td>
<td>Courses from Specialisation Track and Electives</td>
</tr>
<tr>
<td></td>
<td>Final Year Project or Professional Internship</td>
</tr>
<tr>
<td>Sample Courses for Theoretical Computer Science</td>
<td>Parallel Computing</td>
</tr>
<tr>
<td></td>
<td>Advanced Topics in Algorithms</td>
</tr>
<tr>
<td>Sample Courses for Cryptography and Cybersecurity</td>
<td>Cyber Physical System Security</td>
</tr>
<tr>
<td></td>
<td>Digital Forensics</td>
</tr>
<tr>
<td>Sample Courses for Data Science Track</td>
<td>Machine Learning</td>
</tr>
<tr>
<td></td>
<td>Data Analytics and Mining</td>
</tr>
<tr>
<td>Sample Courses for Financial Modelling Track</td>
<td>Advanced Data Management</td>
</tr>
<tr>
<td></td>
<td>Neural Networks</td>
</tr>
</tbody>
</table>

### BACHELOR OF SCIENCE (HONOURS) IN DATA SCIENCE AND ARTIFICIAL INTELLIGENCE

Offered in partnership with the School of Computer Science and Engineering (SCSE)

In this programme, students will explore the emerging field of data science and artificial intelligence, by mastering the synergistic disciplines of computer science and statistics.

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses from SCSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Data Structures</td>
</tr>
<tr>
<td></td>
<td>Data Science</td>
</tr>
<tr>
<td>Year 2</td>
<td>Object Oriented Design and Programming</td>
</tr>
<tr>
<td></td>
<td>Human Computer Interaction</td>
</tr>
<tr>
<td></td>
<td>Software Engineering</td>
</tr>
<tr>
<td>Year 3</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td></td>
<td>Data Analytics and Mining</td>
</tr>
<tr>
<td>Year 4</td>
<td>Cryptography and Network Security</td>
</tr>
<tr>
<td></td>
<td>Data Science for Business</td>
</tr>
</tbody>
</table>

### BACHELOR OF SCIENCE (HONOURS) IN PHYSICS AND MATHEMATICAL SCIENCES (DOUBLE MAJOR)

Offered in partnership with the Division of Physics and Applied Physics (PAP)

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses from PAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1+2</td>
<td>Optics, Vibrations and Waves</td>
</tr>
<tr>
<td></td>
<td>Relativity and Quantum Physics</td>
</tr>
<tr>
<td></td>
<td>Thermal Physics</td>
</tr>
<tr>
<td>Year 3</td>
<td>Quantum Mechanics</td>
</tr>
<tr>
<td></td>
<td>Statistical Mechanics</td>
</tr>
<tr>
<td>Year 4</td>
<td>Major Prescribed Elective courses + Final Year Project</td>
</tr>
</tbody>
</table>

Scan to find out more about all programmes!
CAREER PROSPECTS

Due to the versatility provided by mathematical training, our graduates play a leading role in fields as diverse as finance, information technology, and biotechnology. Mathematics provides a superb foundation for developing job-specific skills, and is therefore valued by numerous employers.

INDUSTRY

1. Public Administration and Defence
2. Finance and Insurance
3. Information and Communication
4. Education and Research
5. Advertising Services and Market Research
6. Other Sectors

* Source: Graduate Employment Survey 2018

COMMON JOB TITLES

Public Administration and Defence
- Economist
- Policy Analyst
- Statistician

Finance and Insurance
- Actuary
- Financial Analyst
- Market Analyst
- Quantitative Analyst
- Risk Analyst
- Statistician

Information and Communication
- Applications Programmer
- Database Administrator
- IT Security Specialist
- IT Testing
- Software Engineer
- Systems Programmer

Education and Research
- Teacher
- Education Consultant
- Research Scientist

Other Sectors
- Health Services Manager
- Logistics Specialist
- Management Consultant
- Operations Research Analyst
- Resource Manager
PROFESSIONAL INTERNSHIPS

Our undergraduate programmes emphasise the importance of practical training. Students are given the opportunity to undergo a professional internship, varying from 10 to 22 weeks, during their course of study. This internship can be conducted at a private or public organisation, either locally or overseas.

Companies our undergraduates have interned at:

- Agilent Technologies Singapore
- A*STAR
- DSO National Laboratories
- Facebook
- Go-Jek Singapore
- Grab
- GroupM Singapore
- HP Inc
- Milliman
- OCBC Bank

In my final year as an Applied Mathematics undergraduate, I did a stint at Grab with the Data Science department. The programming courses in the SPMS curriculum positioned me well for the role. My supervisors at Grab were very friendly and offered their help whenever I needed guidance, making my time there a very enriching one. My work involved web scraping and data processing, and some of the skills I gained have proven useful in my subsequent role at a proprietary trading firm.

In the vacation after my third year, I did an internship with Facebook, Singapore, doing account management and data analytics as part of the sales and marketing team. Being the only intern with science background did not demoralise me at all. I was happy that I was able to bring to the team in a unique set of skills. Studying mathematics allowed me to develop certain analytical and critical-thinking skills, and I was able to identify insights and pick out trends more quickly than my peers.

ELWIN SIM
Junior Trader at Flow Traders
BSc (Hons) in Mathematical Sciences, Class of 2018

VALERIE EVANGELIN LAURENT
Account Manager at Facebook Singapore
BSc (Hons) in Mathematical Sciences and Economics
The history of mathematical optimisation dates to ancient Greece, when mathematicians such as Euclid and Heron solved optimisation problems in geometry. Since then, it has developed into a major field of mathematics, with numerous applications such as design of complex electronic circuits, the imaging of biological samples, computer-aided selection of financial portfolios, and more. My research focuses on the design and analysis of algorithms for solving optimisation problems, and improving our theoretical understanding of optimisation problems.

ASSOCIATE PROFESSOR CHUA CHEK BENG
Research Area: Optimisation

When you connect your laptop or phone to a WiFi access point, part of the data is corrupted by the time it reaches the antennas! And when you post a picture on Facebook, it is stored on a computer that may experience disk failure, which is why Facebook used to store redundant copies on different computers. To cope with such scenarios, data must be protected by redundancy schemes, which arise from the mathematical field of coding theory. I work on devising such coding schemes, with the aim of providing reliability at low cost.

ASSOCIATE PROFESSOR FREDÉRIQUE OGGIER
Research Area: Coding Theory

Many pieces of everyday technology, from airplanes to tennis rackets, are made of composite materials, which contain many different components mixed together. Composites can be extremely durable and light, and can possess properties not found naturally. My research focuses on how the properties of a composite material are affected by its constituents, a complicated topic where advanced mathematics plays an essential role. I use my expertise to design efficient algorithms that allow computers to solve the complex equations governing the physics of composite materials.

ASSOCIATE PROFESSOR HOANG VIET HA
Research Area: Mathematical Analysis

In the era of big data, data can be produced and stored cheaply and on a massive scale. Scientific advances, as well as economic activities, are becoming more data-driven, bringing new opportunities and challenges for data analysis and statistics. My research aims to establish rigorous statistical frameworks for big data analyses, especially for economic and financial data. Mathematical analysis can provide rigorous guidance on many issues, such as the robustness of big data solutions.

ASSOCIATE PROFESSOR ASSISTANT PROFESSOR PATRICK PUN
Research Area: Statistics & Mathematical Finance

My research is related to the partition function, a function \( p(n) \) that counts how many ways an integer \( n \) can be written as a sum of positive integers where ordering does not matter. For example, the partitions of 4 are given by \( 4 = 3+1 = 2+2 = 2+1+1 = 1+1+1+1 \), so \( p(4) = 5 \). Mathematicians over the centuries have discovered surprisingly intricate features of the partition function. Ramanujan’s discovery of three congruences, \( p(5n+4) = 0 \pmod{5} \), \( p(7n+5) = 0 \pmod{7} \), and \( p(11n+6) = 0 \pmod{11} \), inspired most of the research on the partition function in the past decades. Many mysteries remain unsolved, such as showing that asymptotically \( p(n) \) is even and odd equally often.
BAI ZHONGZHENG  
Data Scientist at First Derivatives  
BSc (Hons) in Mathematical Sciences and Economics, Class of 2017

During my studies, I embarked on a research project studying a socio-economic model of how competition affects cooperation. The project was definitely challenging. Besides devouring countless research papers, I had to programme a computer experiment for participants. The skills I picked up during the project were transferable to non-academic contexts. I am now a part-time quantitative analyst at a FinTech startup, where my research and programming skills are put to good use.

LI YONGMING  
BSc (Hons) in Mathematical Sciences

The SPMS mathematics programme offers many learning opportunities outside the core curriculum. I had the opportunity to do a project involving natural language processing and text analytics. My advisor, Dr. Fedor Duzhin, guided me through the process of reading the latest research papers, and how to learn independently about cutting-edge research.

SELVARAJ BHARATHA  
BSc (Hons) in Mathematical Sciences with Minor in Finance

Studying at SPMS is wonderful. The professors find interesting ways to help me understand concepts better and are always ready to answer questions. My courses are interesting, and enable me to challenge myself. I was also given the opportunity to participate in SPMS orientation camp, as part of the SPMS outreach committee. This has enabled me to really develop myself.

SAMUEL TEO  
Centre for Strategic Infocomm Technologies (CSIT)  
BSc (Hons) in Mathematical Sciences Cryptologist, Class of 2013

Mathematics and economics are highly relevant to the world we are living in. During my time in SPMS, I "learned how to learn", and came to understand the importance of understanding and applying concepts, not just regurgitating answers. The foundational knowledge I acquired at SPMS brought me to where I am today, and will definitely be useful in ways I've yet to discover. I am and will always be proud to be an SPMS Alumna!

LI ENLIN  
Student in the Doctor of Medicine Programme at Duke-NUS Medical School  
BSc (Hons) in Mathematical Sciences, Class of 2014

The faculty members are really approachable and open to new ideas. For my final year project, I acquired data from a social sciences project and wanted to analyse it with advanced statistical methods. Even though this was my personal initiative, a professor agreed to guide and supervise me. The project allowed me to experience the end-to-end process of research, and prepared me for my current job as a policy maker at the Ministry of Education.

AARON CHIANG  
Senior Assistant Director (Placement & Scholarships Policy), Student Placement and Services Division, Ministry of Education  
BSc (Hons) in Mathematical Sciences, Class of 2011

The SPMS mathematics programme offers many learning opportunities outside the core curriculum. I had the opportunity to do a project involving natural language processing and text analytics. My advisor, Dr. Fedor Duzhin, guided me through the process of reading the latest research papers, and how to learn independently about cutting-edge research.

LUISA LEE  
Business Development, Institutional Sales, Nomura Asset Management  
BSc, (Hons) in Mathematics and Economics, Class of 2014

Studying mathematics gave me a strong foundation in critical thinking, which has served me well in understanding concepts from other disciplines. I also benefited from the freedom and opportunities in MAS and SPMS to explore beyond my comfort zone, including the accelerated curriculum programme and overseas exposure.

LI YONGMING  
BSc (Hons) in Mathematical Sciences

Mathematics and economics are highly relevant to the world we are living in. During my time in SPMS, I "learned how to learn", and came to understand the importance of understanding and applying concepts, not just regurgitating answers. The foundational knowledge I acquired at SPMS brought me to where I am today, and will definitely be useful in ways I've yet to discover. I am and will always be proud to be an SPMS Alumna!

SAMUEL TEO  
Centre for Strategic Infocomm Technologies (CSIT)  
BSc (Hons) in Mathematical Sciences Cryptologist, Class of 2013

Mathematics and economics are highly relevant to the world we are living in. During my time in SPMS, I "learned how to learn", and came to understand the importance of understanding and applying concepts, not just regurgitating answers. The foundational knowledge I acquired at SPMS brought me to where I am today, and will definitely be useful in ways I've yet to discover. I am and will always be proud to be an SPMS Alumna!

LI ENLIN  
Student in the Doctor of Medicine Programme at Duke-NUS Medical School  
BSc (Hons) in Mathematical Sciences, Class of 2014

The faculty members are really approachable and open to new ideas. For my final year project, I acquired data from a social sciences project and wanted to analyse it with advanced statistical methods. Even though this was my personal initiative, a professor agreed to guide and supervise me. The project allowed me to experience the end-to-end process of research, and prepared me for my current job as a policy maker at the Ministry of Education.

AARON CHIANG  
Senior Assistant Director (Placement & Scholarships Policy), Student Placement and Services Division, Ministry of Education  
BSc (Hons) in Mathematical Sciences, Class of 2011

The SPMS mathematics programme offers many learning opportunities outside the core curriculum. I had the opportunity to do a project involving natural language processing and text analytics. My advisor, Dr. Fedor Duzhin, guided me through the process of reading the latest research papers, and how to learn independently about cutting-edge research.
OVERSEAS EXPERIENCE

I did my final year project overseas in France at Institut National des Sciences Appliquées de Toulouse. Professor Nicolas Privault, the lecturer for the financial mathematics course in NTU, kindly agreed to supervise me and helped me to secure a project with Professor Anthony Réveillac from INSA Toulouse. My project is concerned with principal-agent problems. Simply put, I am investigating how best a boss should pay a worker. It is exciting to see how these real-world problems can be formulated mathematically and subsequently solved for specific scenarios to yield useful results. I have also had the chance to learn French and immerse myself in the culture during my stint at INSA Toulouse. Doing my FYP overseas has truly broadened my horizons not just in mathematics, but also the world in general.

My experience in MAS has been amazing and wonderful. There are many overseas events sponsored for us undergraduate students, from mathematics competitions to overseas forums. Personally, I am most grateful for the opportunity to join the Heidelberg Laureate Forum, an annual event in Germany where young researchers are given the chance to interact with pre-eminent computer scientists and mathematicians. Not only did the school fully sponsor my whole trip there, the professors wrote me an amazing recommendation letter that allowed me to be selected. Of 1500 applicants, only 200 were selected, and fewer than 10 were undergrads. The laureates we met included Andrew Wiles, who proved Fermat’s Last Theorem, Barbara Liskov, a computing pioneer who created one of the first high-level programming languages, and many others. It was really an inspiring trip.

I chose mathematics because it is a subject that interests me. Here at MAS, I have numerous opportunities, one of which was the chance to participate in the International Mathematics Competition for University Students (IMC), an annual mathematics competition held that year in Blagoevgrad, Bulgaria. It was a wonderful experience! I got to meet mathematics students from all over the world, all of whom were passionate about mathematics.

I also got to learn more about Bulgaria, its history and culture. There was an excursion to Melnik, a town in the mountains with many historical buildings. We also got to explore Blagoevgrad, and visited the local museum and farmers’ market. On top of it all, I managed to win a first prize in the competition (2016)!
SCHOLARSHIPS

THE NANYANG SCHOLARSHIP
Awarded to students who excel academically, with strong leadership potential and outstanding CCA track records.

- Full coverage of subsidised tuition fees (after Tuition Grant).
- Living allowance of S$6,500 per academic year.
- Accommodation allowance of up to S$2,000 per academic year. (Applicable to scholarship holders who reside in NTU hostels only.)
- Travel grant of S$5,000 for an overseas programme (one-off).
- Computer allowance of S$1,750 (one-off).
- Priority for Overseas Programme.
- Participation in Scholars Orientation Programme, Scholars Award Ceremony, Outreach Programmes, and Eminent Speaker Series.
- No bond is attached to the Nanyang Scholarship apart from the three-year bond applicable to all Singapore PRs and international students under the MOE Tuition Grant Scheme.

THE COLLEGE OF SCIENCE SCHOLARSHIP
Awarded to students with a record of good academic performance.

- Full coverage of subsidised tuition fees (after Tuition Grant).
- Living allowance of S$5,000 per academic year.
- No bond is attached to the College Scholarship apart from the three-year bond applicable to all Singapore PRs and international students under the MOE Tuition Grant Scheme.

ADMISSION REQUIREMENTS

<table>
<thead>
<tr>
<th>Programme</th>
<th>GCE A-Leaves</th>
<th>Polytechnic Diploma awarded in Singapore</th>
<th>International Baccalaureate Diploma</th>
<th>NUS High School Diploma</th>
<th>International &amp; Other Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical Sciences</td>
<td>Good H2 level pass in Mathematics</td>
<td>Good GPA in a relevant diploma, and good grades in at least 2 Mathematics modules</td>
<td>Mathematics at Higher Level</td>
<td>Major CAP of 2.0 in Mathematics</td>
<td>Mathematics at Senior High School Level/IB Higher Level</td>
</tr>
<tr>
<td>Mathematical Sciences with Minor in Finance</td>
<td>Good H2 level pass in Mathematics, and good pass in General Paper or Knowledge &amp; Inquiry</td>
<td>Good GPA in a relevant diploma, and good grades in at least 2 Mathematics modules</td>
<td>Mathematics at Higher Level</td>
<td>Major CAP of 2.0 in Mathematics</td>
<td>Mathematics at Senior High School Level/IB Higher Level</td>
</tr>
<tr>
<td>Mathematical Sciences &amp; Economics (Double Major)</td>
<td>Good H2 level pass in Mathematics</td>
<td>Good GPA in a relevant diploma, and good grades in at least 2 Mathematics modules</td>
<td>Mathematics at Higher Level</td>
<td>Major CAP of 2.0 in Mathematics</td>
<td>Mathematics at Senior High School Level/IB Higher Level</td>
</tr>
<tr>
<td>Data Science &amp; Artificial Intelligence</td>
<td>Good H2/HL/A Level or equivalent pass in Mathematics and either Physics, Chemistry, Biology or Computing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For enquiries pertaining to financial assistance:
Tel: (65) 6790 4115
Email: FinAid@ntu.edu.sg

For enquiries pertaining to scholarships:
Tel: (65) 6790 6766
Email: ug_scholarships@ntu.edu.sg

Office of Admissions
Student & Academic Services Department
Nanyang Technological University
Student Services Centre, #03-01
42 Nanyang Avenue, Singapore 639798

For local students
Tel: 6790 5055 / 6790 5972 • Email: adm_local@ntu.edu.sg

For international students
Tel: (65) 6790 5806 / (65) 6790 5807 • Email: adm_intnl@ntu.edu.sg
Science and technology play a critical role in the modern economy, and nowadays the most important discoveries and inventions are often not confined to narrow technical specialisations, but draw upon multiple disciplines. Physicists are well-placed to navigate this complex landscape. They are trained in building theoretical models for complex systems, rigorously testing models against real-world data, and designing devices and methods to solve problems. This skill set is increasingly important in numerous technical domains.

In the Division of Physics and Applied Physics, we provide a top-notch physics-based education that imparts useful skills for a broad range of challenging and rewarding jobs. Our graduates have proven well-equipped for finding employment in industrial R&D, data science, computer security, finance, as well as education and academic research.

Our curriculum is designed to emphasise the most relevant topics in physics and applied physics, including both theoretical and experimental aspects. We have a young and dynamic team of faculty members, dedicated to excellence in teaching and research. This includes NTU’s first and only Principal Lecturer, known for his innovations in teaching. Our professors include world-class experts in quantum technology, nanotechnology, superconductivity, photonics, and other topics, who are all eager to share their cutting-edge knowledge. Aside from traditional coursework, our students are exposed to a great deal of cooperative learning and project work.

This brochure provides information about our programmes, as well as testimonials from current students and graduates. If you need more information, please visit our website, and do not hesitate to contact me or any of our other professors. We hope you will pursue your undergraduate education with us!

CHIA EE MIN ELBERT
ASSOCIATE PROFESSOR
Head, Division of Physics and Applied Physics
# Curriculum Overview

## BSc (Hons) in Physics

<table>
<thead>
<tr>
<th>Year 1</th>
<th>BSc (Hons) in Applied Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanics</td>
<td>Mechanics</td>
</tr>
<tr>
<td>Optics, Vibrations and Waves</td>
<td>Optics, Vibrations and Waves</td>
</tr>
<tr>
<td>Electricity and Magnetism</td>
<td>Electricity and Magnetism</td>
</tr>
<tr>
<td>Relativity and Quantum Physics</td>
<td>Relativity and Quantum Physics</td>
</tr>
<tr>
<td>Physics Laboratory</td>
<td>Physics Laboratory</td>
</tr>
<tr>
<td>Calculus</td>
<td>Calculus</td>
</tr>
<tr>
<td>Linear Algebra</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>Programming in Python</td>
<td>Programming in Python</td>
</tr>
</tbody>
</table>

## Year 2

<table>
<thead>
<tr>
<th>Year 2</th>
<th>BSc (Hons) in Applied Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantum Mechanics</td>
<td>Quantum Mechanics</td>
</tr>
<tr>
<td>Electromagnetism</td>
<td>Electromagnetism</td>
</tr>
<tr>
<td>Thermal Physics</td>
<td>Thermal Physics</td>
</tr>
<tr>
<td>Analytical Mechanics</td>
<td>Analytical Mechanics</td>
</tr>
<tr>
<td>Physics Laboratory II</td>
<td>Physics Laboratory II</td>
</tr>
<tr>
<td>Complex Methods</td>
<td>Complex Methods</td>
</tr>
</tbody>
</table>

## For Second Major in Mathematics:

- Group Theory
- Probability and Introduction to Statistics
- Intermediate Mathematics Electives

## Year 3 + 4

<table>
<thead>
<tr>
<th>Year 3 + 4</th>
<th>BSc (Hons) in Applied Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical Mechanics</td>
<td>Statistical Mechanics</td>
</tr>
<tr>
<td>Physics Electives, including:</td>
<td>Physics Electives, including:</td>
</tr>
<tr>
<td>Atomic Physics</td>
<td>Acoustics</td>
</tr>
<tr>
<td>Chaotic Dynamical Systems</td>
<td>Biophysics (§)</td>
</tr>
<tr>
<td>Classical and Quantum Information</td>
<td>Biomedical Imaging and Sensing</td>
</tr>
<tr>
<td>Computational Physics</td>
<td>Classical and Quantum Information</td>
</tr>
<tr>
<td>Condensed Matter Physics (*)</td>
<td>Computational Physics</td>
</tr>
<tr>
<td>Cosmology</td>
<td>Condensed Matter Physics (*) (‡)</td>
</tr>
<tr>
<td>Econophysics</td>
<td>Fabrication of Micro- and Nano-electronics (‡)</td>
</tr>
<tr>
<td>Electrodynamics</td>
<td>Medical Physics for Radiotherapy (§)</td>
</tr>
<tr>
<td>Fluid Mechanics</td>
<td>Nanoscale Physics (‡) (‡)</td>
</tr>
<tr>
<td>Nanoscale Physics (*)</td>
<td>Nuclear Physics (‡)</td>
</tr>
<tr>
<td>Nuclear Physics</td>
<td>Photonics (†)</td>
</tr>
<tr>
<td>Quantum Electrons</td>
<td>Plasmonics and Metamaterials</td>
</tr>
<tr>
<td>Particle Physics</td>
<td>Quantum Electronics (†)</td>
</tr>
<tr>
<td>Surface and Interface Physics (*)</td>
<td>Semiconductor and Spintron Devices (‡)</td>
</tr>
<tr>
<td>*</td>
<td>Soft Condensed Matter Physics (§)</td>
</tr>
</tbody>
</table>

## For Second Major in Mathematics:

- Advanced mathematics electives in one of three tracks - Pure Mathematics, Applied Mathematics, or Statistics.
- For optional concentration in Nanotechnology
- For optional concentration in Optical Technology
- For optional concentration in Semiconductor Technology
- For optional concentration in Biophysics or Medical Physics
CAREER PROSPECTS

Physics and Applied Physics graduates are employed in a wide range of occupations, including research and development (R&D) in industry and academia, education, finance, software development, and other professional positions.

INDUSTRY

1. Education and Research
2. Electrical and Electronics Products
3. Information and Communication
4. Public Administration and Defence
5. Finance and Insurance
6. Other Sectors

COMMON JOB TITLES

Education and Research
- Physicist
- Laboratory Manager
- Research Scientist
- Teacher

Electrical and Electronics Products
- Laboratory Executive
- Operations Manager
- Process Engineer
- Product Engineer
- Technical Support Engineer

Information and Communication
- Applications Programmer
- Data Scientist
- IT Security Specialist
- Software Engineer

Public Administration and Defence
- Armed Forces Personnel
- Defence Science Engineer
- Policy Analyst

Finance and Insurance
- Financial Analyst
- Financial Consultant
- Quantitative Analyst

PROFESSIONAL INTERNSHIPS

Our undergraduate programmes emphasise the importance of practical training. Students are given the opportunity to undergo a professional internship, varying from 10 to 22 weeks, during their course of study. This internship can be conducted at a private or public organisation, either locally or overseas.

Companies our undergraduates have interned at:

- Ace Pacific
- AEM Singapore
- Century Technology
- Ecoponics
- Environmental Solutions (Asia)
- Eurofins Mechem
- Inginim
- Micron Semiconductor Asia
- Robert Bosch (SEA)
- Singapore Health Services (SingHealth)
- Singapore Institute of Manufacturing Technology
- Thermo Fisher Scientific

Courses offered by SPMS gave me a strong foundation for analytical and quantitative skills. I was able to understand the technical issues, and to derive insights from the data using Python and R, as well as specialised data analytics programmes such as RapidMiner, IBM SPSS Statistics and Tableau.

The internship built up my confidence and greatly broadened my skillset. In 2015, I attended a networking session hosted by NTU, and interacted with the hiring managers from DSTA. I secured an interview with the organisation before graduation, and am now an engineer at DSTA’s C4I Development Programme Centre, where I develop sense-making capabilities for maritime security. I feel a sense of pride and achievement, knowing my skills can contribute to the defence and national security of Singapore.

YEÜ JUN YÜ (PICTURED FAR LEFT)
Engineer
Defence Science and Technology Agency
BSc (Hons) in Applied Physics, Class of 2016

During my sophomore year, I visited the DSTA career booth at the SPMS job fair to learn more about the role that DSTA plays in harnessing technology for Singapore’s defence. I secured the opportunity to intern at DSTA’s Networked Systems Programme Centre from July to December 2015, where I took part in a project involving data and time series analysis. The rigorous theoretical physics and mathematics courses offered by SPMS gave me a strong foundation for analytical and quantitative skills. I was able to understand the technical issues, and to derive insights from the data using Python and R, as well as specialised data analytics programmes such as RapidMiner, IBM SPSS Statistics and Tableau.

The internship built up my confidence and greatly broadened my skillset. In 2015, I attended a networking session hosted by NTU, and interacted with the hiring managers from DSTA. I secured an interview with the organisation before graduation, and am now an engineer at DSTA’s C4I Development Programme Centre, where I develop sense-making capabilities for maritime security. I feel a sense of pride and achievement, knowing my skills can contribute to the defence and national security of Singapore.

YEÜ JUN YÜ (PICTURED FAR LEFT)
Engineer
Defence Science and Technology Agency
BSc (Hons) in Applied Physics, Class of 2016

During my sophomore year, I visited the DSTA career booth at the SPMS job fair to learn more about the role that DSTA plays in harnessing technology for Singapore’s defence. I secured the opportunity to intern at DSTA’s Networked Systems Programme Centre from July to December 2015, where I took part in a project involving data and time series analysis. The rigorous theoretical physics and mathematics courses offered by SPMS gave me a strong foundation for analytical and quantitative skills. I was able to understand the technical issues, and to derive insights from the data using Python and R, as well as specialised data analytics programmes such as RapidMiner, IBM SPSS Statistics and Tableau.

The internship built up my confidence and greatly broadened my skillset. In 2015, I attended a networking session hosted by NTU, and interacted with the hiring managers from DSTA. I secured an interview with the organisation before graduation, and am now an engineer at DSTA’s C4I Development Programme Centre, where I develop sense-making capabilities for maritime security. I feel a sense of pride and achievement, knowing my skills can contribute to the defence and national security of Singapore.
Photonics is the science of controlling and manipulating light. Its applications are wide-ranging, and include lighting, displays, solar panels, fibre-based internet communications, laser surgery, and even advanced manufacturing processes. My research involves devising nanometer-scale devices that alter how light interacts with matter. This line of research involves making use of cutting-edge nanofabrication technologies, newly-discovered materials that have exotic optical properties, as well as clever use of the laws of physics.

CESARE SOCI
ASSOCIATE PROFESSOR
Nanophotonics and Nanotechnology

Quantum science and complexity science seem to be worlds apart. One deals with individual photons and atoms, while the other is associated with large-scale phenomena like weather systems and traffic networks. Yet recent developments reveal that the unique properties of quantum particles can help us understand the data in the environment around us. My research deals with the remarkable features of quantum information—entanglement, non-locality, and quantum superpositions—and their implications for our basic concepts of causality, reality and complexity. I also investigate how these fundamental theories can be used to design quantum protocols to model and simulate problems in the macroscopic world.

GU MILE
ASSISTANT PROFESSOR
Quantum Information and Complexity Science

Photonics is the science of controlling and manipulating light. Its applications are wide-ranging, and include lighting, displays, solar panels, fibre-based internet communications, laser surgery, and even advanced manufacturing processes. My research involves devising nanometer-scale devices that alter how light interacts with matter. This line of research involves making use of cutting-edge nanofabrication technologies, newly-discovered materials that have exotic optical properties, as well as clever use of the laws of physics.

S. N. PIRAMANAYAGAM
ASSOCIATE PROFESSOR
Spintronic Devices

The hidden and intricate dance of electrons in materials lies at the heart of our daily interactions with the physical world. For example, electrons enable the bonding between atoms that gives solids their rigidity, and the quantum nature of electronic spin enables modern magnetic data storage technology. My research focuses on theoretically mapping out the possible paths of electrons as they traverse the complicated landscape of a material. I aim to use this fundamental understanding to design new quantum materials and quantum machines. Such “quantum engineering” involves re-imagining how electrons can move together, consistent with the laws of quantum mechanics.

JUSTIN SONG
ASSISTANT PROFESSOR
Quantum Condensed Matter Physics

Devices such as smartphones and computers, which we use everyday, can store huge amounts of information in tiny volumes, such as SD cards. My research addresses the following questions: What are the limitations to storing information at high densities? What laws of physics can be exploited to make better memory storage devices? How can materials be tailored to push memory technologies further? My laboratory fabricates materials and nanostructures, using techniques such as sputtering and lithography, to serve as prototype memory storage devices. We work closely with industry partners to ensure that the research we do is practical and useful to humankind.
ALUMNI AND STUDENT TESTIMONIALS

I work as an optics engineer in a local company that supplies custom machine vision solutions to end-customers. Most of my work involves designing optical systems for inspecting very specific products, for which there is simply no off-the-shelf solution.

During my time as a Physics and Applied Physics student, apart from learning physics theories, there were plenty of practical opportunities: lab, research, projects, and more. These helped to develop my skills in troubleshooting, data analysis, and, most important of all, critical thinking. In my opinion, this kind of learning experience is particularly valuable in the modern world of multidisciplinary engineering.

Looking back after 4 years, I benefited from a curriculum structured with great foresight. The Division of Physics and Applied Physics recognised the growing importance of computing skills, and incorporated many programming modules into the curriculum. These skills are now my rice bowl as a PhD student working on numerical simulations. Many of my friends have secured positions in the corporate world, such as data analysts. SPMS was the most nurturing of environments. Professors are willing to mentor undergraduates, and the School’s ties to external research institutes provide opportunities to experience research outside of academia. This is the best thing about SPMS - students have countless avenues to explore what interests them.

SPMS is a very friendly place. The coursework is intellectually challenging, and the common areas are cozy and conducive for spending time in. The jovial chatter during term time, anxious exchanges during exam period, the peace and quiet during evenings - all this formed an unforgettable undergraduate life! I am personally grateful for the efficiency and flexibility of the professors, teaching assistants, and staff. I had the chance to teach in classes and laboratories, and to try out Making and Tinkering. I even managed to source for my own internship, and freely explore my research interests. If given the chance, I would like to be back in SPMS.

I enjoyed the opportunity to work on projects as early as freshman year. That allowed me to practise the discipline of Physics, experience the triumphs and pitfalls inherent to research, and appreciate how knowledge evolves. I also participated in the International Physicists’ Tournament (IPT) in Switzerland, and had a wonderful time debating physics with other young scientists globally. Such opportunities for expanding your horizons were abundant, and gave me a very fruitful college experience.

My degree in physics gave me not only a strong mathematical foundation but, more crucially, taught me to think critically. These skills have proven very transferable and have been a major asset in my career as a cognitive and computational neuroscientist.

Why is hair attracted to combs? Why does metal feel colder than wood? How do pianos produce sound? These everyday phenomena have interested me since I was little, and led me to study Physics. During my undergraduate studies at NTU, these “why” questions have been replaced by “how”, but there are yet more “whys” as I go further in depth into various topics. I enjoyed the opportunities for hands-on training, including my Final Year Project where I did mechanical design, made my own induction coils, conducted experiments, etc. These experiences gave me the confidence to challenge unsolved problems, think out of the box, and be ready for the unexpected.

I was very lucky to have spent 8 years (Undergrad + PhD) in PAP. For me, an SPMS Physics education was not only about picking up technical and technological skills, but also about being curious and developing passion for one’s subject of study. I believe this shaped us to be creative, adaptive and nimble in picking up new skills and knowledge. These are lifelong lessons which impacted me positively beyond the classroom and in the workforce. I would also like to shout out to the friends and professors in SPMS, whose brilliance and determination I am thankful for and humbled by. It was my great fortune to have shared a path with them.

CHUA CHERN FEI
Optics Engineer, Emage Vision Pte Ltd
BSc (Hons) In Applied Physics, Class of 2011

ERICO TJOA
Research Engineer, A*STAR
BSc (Hons) in Physics with Second Major in Mathematical Sciences, Class of 2018

ANG YUEN SIANG
Postdoctoral Fellow, Harvard University
BSc (Hons) in Applied Physics, Class of 2013

JEREMY LIM ZHEN JIE
PhD Candidate
SUTD Mathematics and Science Cluster
BSc (Hons) in Physics, Class of 2018

TAM QIAN XIN
Teaching Assistant at NTU
BSc (Hons) in Physics, Class of 2013

DARRELL TAY
Data Scientist, Agoda
BSc (Hons) In Physics, Class of 2012

I enjoyed the opportunity to work on projects as early as freshman year. That allowed me to practise the discipline of Physics, experience the triumphs and pitfalls inherent to research, and appreciate how knowledge evolves. I also participated in the International Physicists’ Tournament (IPT) in Switzerland, and had a wonderful time debating physics with other young scientists globally. Such opportunities for expanding your horizons were abundant, and gave me a very fruitful college experience.

My degree in physics gave me not only a strong mathematical foundation but, more crucially, taught me to think critically. These skills have proven very transferable and have been a major asset in my career as a cognitive and computational neuroscientist.

Why is hair attracted to combs? Why does metal feel colder than wood? How do pianos produce sound? These everyday phenomena have interested me since I was little, and led me to study Physics. During my undergraduate studies at NTU, these “why” questions have been replaced by “how”, but there are yet more “whys” as I go further in depth into various topics. I enjoyed the opportunities for hands-on training, including my Final Year Project where I did mechanical design, made my own induction coils, conducted experiments, etc. These experiences gave me the confidence to challenge unsolved problems, think out of the box, and be ready for the unexpected.

I was very lucky to have spent 8 years (Undergrad + PhD) in PAP. For me, an SPMS Physics education was not only about picking up technical and technological skills, but also about being curious and developing passion for one’s subject of study. I believe this shaped us to be creative, adaptive and nimble in picking up new skills and knowledge. These are lifelong lessons which impacted me positively beyond the classroom and in the workforce. I would also like to shout out to the friends and professors in SPMS, whose brilliance and determination I am thankful for and humbled by. It was my great fortune to have shared a path with them.

CHUA CHERN FEI
Optics Engineer, Emage Vision Pte Ltd
BSc (Hons) In Applied Physics, Class of 2011

ERICO TJOA
Research Engineer, A*STAR
BSc (Hons) in Physics with Second Major in Mathematical Sciences, Class of 2018

ANG YUEN SIANG
Postdoctoral Fellow, Harvard University
BSc (Hons) in Applied Physics, Class of 2013

JEREMY LIM ZHEN JIE
PhD Candidate
SUTD Mathematics and Science Cluster
BSc (Hons) in Physics, Class of 2018

TAM QIAN XIN
Teaching Assistant at NTU
BSc (Hons) in Physics, Class of 2013

DARRELL TAY
Data Scientist, Agoda
BSc (Hons) In Physics, Class of 2012

I enjoyed the opportunity to work on projects as early as freshman year. That allowed me to practise the discipline of Physics, experience the triumphs and pitfalls inherent to research, and appreciate how knowledge evolves. I also participated in the International Physicists’ Tournament (IPT) in Switzerland, and had a wonderful time debating physics with other young scientists globally. Such opportunities for expanding your horizons were abundant, and gave me a very fruitful college experience.

My degree in physics gave me not only a strong mathematical foundation but, more crucially, taught me to think critically. These skills have proven very transferable and have been a major asset in my career as a cognitive and computational neuroscientist.

Why is hair attracted to combs? Why does metal feel colder than wood? How do pianos produce sound? These everyday phenomena have interested me since I was little, and led me to study Physics. During my undergraduate studies at NTU, these “why” questions have been replaced by “how”, but there are yet more “whys” as I go further in depth into various topics. I enjoyed the opportunities for hands-on training, including my Final Year Project where I did mechanical design, made my own induction coils, conducted experiments, etc. These experiences gave me the confidence to challenge unsolved problems, think out of the box, and be ready for the unexpected.

I was very lucky to have spent 8 years (Undergrad + PhD) in PAP. For me, an SPMS Physics education was not only about picking up technical and technological skills, but also about being curious and developing passion for one’s subject of study. I believe this shaped us to be creative, adaptive and nimble in picking up new skills and knowledge. These are lifelong lessons which impacted me positively beyond the classroom and in the workforce. I would also like to shout out to the friends and professors in SPMS, whose brilliance and determination I am thankful for and humbled by. It was my great fortune to have shared a path with them.

CHUA CHERN FEI
Optics Engineer, Emage Vision Pte Ltd
BSc (Hons) In Applied Physics, Class of 2011

ERICO TJOA
Research Engineer, A*STAR
BSc (Hons) in Physics with Second Major in Mathematical Sciences, Class of 2018

ANG YUEN SIANG
Postdoctoral Fellow, Harvard University
BSc (Hons) in Applied Physics, Class of 2013

JEREMY LIM ZHEN JIE
PhD Candidate
SUTD Mathematics and Science Cluster
BSc (Hons) in Physics, Class of 2018

TAM QIAN XIN
Teaching Assistant at NTU
BSc (Hons) in Physics, Class of 2013

DARRELL TAY
Data Scientist, Agoda
BSc (Hons) In Physics, Class of 2012
The most exciting experience I had at NTU was at the PLANCKS competition, which was held in Croatia. PLANCKS is a theoretical physics competition for undergraduate and master’s students, and I am incredibly grateful to be given the opportunity to represent NTU. It was an eye-opening experience to interact with physics majors from different parts of the world, as well as to deepen my understanding of the subject. I am confident that my experiences and lessons I have learnt in NTU will help me in the future.

I had the opportunity to complete a semester abroad at the University of Toronto and to do an Overseas FYP at the High Energy Physics group in University College London. I learnt many valuable skills in and outside of Physics, and the experience also gave me a leg up in transitioning into my career as a Data Scientist in London.
**SCHOLARSHIPS**

**THE NANYANG SCHOLARSHIP**

Awarded to students who excel academically, with strong leadership potential and outstanding CCA track records.

- Full coverage of subsidised tuition fees (after Tuition Grant).
- Living allowance of $5,650 per academic year.
- Accommodation allowance of up to $2,200 per academic year. (Applicable to scholarship holders who reside in NTU hostels only.)
- Travel grant of $5,000 for an overseas programme (one-off).
- Computer allowance of $1,750 (one-off).
- Priority for Overseas Programme.
- Participation in Scholars Orientation Programme, Scholars Award Ceremony, Outreach Programmes, and Eminent Speaker Series.
- No bond is attached to the Nanyang Scholarship apart from the three-year bond applicable to all Singapore PRs and international students under the MOE Tuition Grant Scheme.

**THE COLLEGE OF SCIENCE SCHOLARSHIP**

Awarded to students with a record of good academic performance.

- Full coverage of subsidised tuition fees (after Tuition Grant).
- Living allowance of $3,600 per academic year.
- No bond is attached to the College Scholarship apart from the three-year bond applicable to all Singapore PRs and international students under the MOE Tuition Grant Scheme.

For enquiries pertaining to financial assistance:
Tel: (65) 6790 4115
Email: FinAid@ntu.edu.sg

For enquiries pertaining to scholarships:
Tel: (65) 6790 6766
Email: ug_scholarships@ntu.edu.sg

Visit our Scholarships page for more details

**ADMISSION REQUIREMENTS**

<table>
<thead>
<tr>
<th>Programme</th>
<th>GCE A-Levels</th>
<th>Polytechnic Diploma awarded in Singapore</th>
<th>International Baccalaureate Diploma</th>
<th>NUS High School Diploma</th>
<th>International &amp; Other Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>Good H2/ HL/A Level or equivalent pass in Physics and Mathematics</td>
<td>Good GPA in a relevant diploma, and good grades in at least 2 Mathematics modules</td>
<td>Physics and Mathematics at Higher Level</td>
<td>Major CAP of 2.0 in Physics and Mathematics</td>
<td>Physics and Mathematics at Senior High School Level/ IB Higher Level</td>
</tr>
<tr>
<td>Applied Physics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics with Second Major in Mathematical Sciences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Office of Admissions**

Student & Academic Services Department
Nanyang Technological University
Student Services Centre, #03-01
42 Nanyang Avenue, Singapore 639815

For local students
Tel: 6790 5055 / 6790 5972 • Email: adm_local@ntu.edu.sg

For international students
Tel: (65) 6790 5806 / (65) 6790 5807 • Email: adm_intnl@ntu.edu.sg

Visit our Admissions page for more details