INNOVATION & DESIGN
SECOND MAJOR
Our Distinctive Approach

Our curriculum brings students through an enriching journey in innovation. Students begin by learning what to design before moving on to learn how to design. Those who are keen on entrepreneurship are encouraged to further develop their ideas for commercialisation through a pre-accelerator track. All these happen through project-based learning within a multidisciplinary team setting.

Design Thinking

Design Thinking is a human-centred approach to innovation to arrive at solutions that meet the needs, wants, and desires of target users. Students learn how to understand users, build personas, gain insights, identify opportunities, generate ideas, and validate their ideas through prototyping.

Innovation Framework

Innovation happens when people’s needs and desires are met in a technologically feasible manner and matched with a viable business strategy. Students learn a variety of tools that help them to generate innovative solutions to a wide range of problems in a manner that creates value to end users as well as exploit market opportunity.
Design can be carried out through a systematic process that consists of distinct, coherent and well-organised steps. Using well-established design methodologies, students learn how to transform ideas into functional prototypes and thereafter viable products and services.

**Design Methodology**

Innovation needs a team-based process to succeed. From day one, our students learn to work together with teammates from different disciplines and are mentored by faculty members with diverse backgrounds. Through open-ended projects, students learn how to apply their design skills as well as their disciplinary knowledge to solve real-world problems. Such an approach helps students to develop transversal skills such as teamwork, leadership, communication, and project management. It also develops important character qualities such as resilience, persistence and self-motivation.

**Innovation and Enterprise**

Through the electives in our curriculum, students learn strategies to establish market value and create business ventures from their ideas, protect their intellectual property, and gain a deeper understanding of the economics of entrepreneurship. Students who are keen to develop their ideas for commercialisation will also be groomed in a pre-accelerator track during their final year.

**Multidisciplinary Project-based Learning**

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Our Student Projects

Innovating for Better Healthcare

Designing solutions for healthcare needs in hospitals and the community.

Neural Relinking
Stroke rehabilitation device

Data analytics with clinical wearables

LEGO-inspired human-on-chip modules for pharmaceutical applications

Low-cost motorised wheelchair for the elderly

Smart hospital bed and information system
Designing future mobility solutions and novel vehicles for people and goods.

**Formula SAE Race Car**
Ranked 7th in the world in 2015, 12th in 2016, 14th in 2017

**Car-lite transportation network for gateway zone of Jurong Innovation District**

**Delta**
World’s lightest electric paraglider trike
(Featured in National Geographic Channel’s “Machine Impossible” episode in July 2016)

**Snowstorm**
Singapore’s first personal flying experience vehicle
**Innovating for Smarter Living**

Designing smart devices and services to enhance everyday life, work, and play.

- Virtual reality-based fire safety training
- Detecting falling objects for workplace safety

**Innovations in Intelligent Systems**

Designing complex engineering systems for special missions on land, water, air and outer space.

- Galassia
  - Student-built nanosatellite
  - (Launched in December 2015)

- Bumblebee ASV
  - Student-led competition team working on autonomous surface vehicles (4th place in Maritime RobotX Challenge 2016)

- Bumblebee AUV
  - Student-led competition team working on autonomous underwater vehicles (1st runner-up (overall) in RoboSub 2015, 1st in static judging in 2016, 2nd runner-up (overall) in 2017)
Innovating for Sustainable Cities

Designing solutions to tackle challenges of urbanisation and sustainability.

1. **Solar Panel**
   - Generates energy during the day

2. **High Pressure fans**
   - Introduce fresh air into the room

3. **Peltier Unit + Heatsinks**
   - Thermoelectric cooling device with heatsinks to cool the air introduced into the room

4. **Turns on during late afternoon**

5. **High Flow fans**
   - Remove hot air from inside the room

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**Verdana**
Solar-powered cooling device for homes (1st runner-up in Energy Innovation Challenge 2017 and 1st runner-up in E²Festa 2017 Capstone Design Fair)

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**Solar Cooler**
Low-cost solution for food preservation in rural communities

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**Autonomous robot**
For plant maintenance
The Innovation & Design programme taught us how to transform thoughts and ideas from classrooms to practical and tangible real-world applications. The experience from discovery to creation is eye-opening, and is essential for anyone thinking of designing and creating for users.

**Kelvin Tan Xuan De**  
Electrical Engineering, Year 2 (Class of 2020)

The Innovation & Design programme taught me the value of exploration and willingness to learn new things. If you do what you always do, you get what you always get. Get out there and try everything!

**Udayagiri Vishnu Saran**  
Materials Science & Engineering, Year 3 (Class of 2019)

Design with the user in mind. Innovation & Design modules aim to mould future leaders in innovation and enterprise. If you are looking to enact change in the world, Innovation & Design is the programme for you.

**Zufar B Adnan**  
Electrical Engineering, Year 4 (Class of 2018)  
Chief Technology Officer, PitchSpot

The key value of Innovation & Design is the opportunity to learn from doing and to learn from each other. The feedback from professors and peers provides an unparalleled opportunity for personal and professional growth.

**Pranav Kalra**  
Engineering Science, Year 2 (Class of 2020)
Having worked with students from different programmes, I must say that Innovation & Design students have the formidable ability to take preemptive measures against possible problems. This skill arises from the intense and rigorous training that they experience in using foresight to predict possible problems that may arise, critical thinking, and high levels of innovation and initiative.

Ms Karolina Kochman
Employer of an Innovation & Design graduate

Innovation & Design graduates from NUS have an inquiring mind. They often try to understand how things work and why things are done in certain ways, as compared to other interns.

Mr Martin Pang
Employer of an Innovation & Design graduate

The Innovation & Design programme has given me the opportunity to put what I have learnt in my bioengineering course into practice. It is in this programme that I realised my passion to build devices for medical use. I highly recommend the Innovation & Design programme to those who want to turn their creative ideas into reality.

Cai Xinchen
Biomedical Engineering, Year 3 (Class of 2019)

Participating in the Innovation & Design programme was the best choice I made in university! The environment was encouraging and my supervisors were always ready to support. My team built an AI humanoid that can speak!

Valerie Foong
Mechanical Engineering (Class of 2017)
FAQs

What is the focus for this Second Major?

Students will be focusing on creating innovative designs and solutions to solve problems. You will also learn the various tools and processes for ideation and design.

Who should enroll in this Second Major?

This programme is for students who aspire to be technopreneurs, whether it involves deep technology or social enterprises. For others, it is a programme that leads you down a learning journey to enhance your discipline skills (Engineering, Social Sciences, etc) through projects which have real-world impact.

How do I learn in this Second Major?

Much of your learning will involve projects, working in groups with students from other disciplines. You will have ample opportunities to define your own design problem.

What do I learn in this Second Major?

You will start your journey with design thinking, which is a design process to systematically uncover insights, leading to new ideas for products or services. Your ideas can be prototyped and tested in design projects in your higher years of study.

What projects can I be involved in?

There are 5 project themes for you to choose from (see overleaf), or you may also define your own projects.

What are the possible career paths?

This programme trains students to think about developing new ideas and solutions to solve ill-defined problems. Such a mindset is a good starting point for any career. Coupled with some Engineering knowledge and skills, you will be well placed to pursue a wide range of careers in the industry such as technology start-ups, product design and other engineering related jobs and services. Our graduates have been able to secure their first jobs relatively easily.
Innovation & Design by Numbers

Student Enrolment

NUMBER OF STUDENTS

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
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<th>Year 4</th>
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<td>AY17/18</td>
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Time Taken to Secure First Job (from 2013 to 2016)

PERCENTAGE OF GRADUATES

- < 3 Months *: 70%
- 3 to 6 Months: 14%
- 6 to 9 Months: 11%
- N.A.: 5%

* Compared to 38% for other NUS Engineering graduates in 2016
Admission

Students who are interested to join the Innovation & Design Second Major may select this option when they apply to any Engineering programme during the admission exercise. Those who are unsure whether to take up this second major at matriculation may apply at the end of the first semester. This Second Major is also open to non-Engineering students. They may apply at the end of the first semester.

Apply to an Engineering programme of your choice

Interested in the Innovation & Design Second Major?

- **YES**
  - Select an Engineering programme + Innovation & Design Second Major during application

- **NOT SURE**
  - Apply for Innovation & Design Second Major at the end of Semester 1

**THE WORLD IS YOURS TO CONQUER!**
The Innovation & Design Second Major comprises project modules and taught courses that are spread over 8 semesters. These make up 48 modular credits (MCs) out of a total of 160 MCs required for a 4-year degree programme in NUS. Of these 48 MCs, up to 16 MCs can be double-counted towards a student’s primary major.

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<th>Semester</th>
<th>Primary Major Requirements</th>
<th>Second Major Requirements</th>
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<tr>
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<td>Year 1 Fundamentals</td>
<td>Critical Thinking &amp; Writing</td>
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<td>General Education Modules</td>
<td>Design Thinking</td>
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<td>Year 2 Core Modules</td>
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<td>General Education Modules</td>
<td>Design Project</td>
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<td>Year 3 Core &amp; Electives</td>
<td>Design Methodology</td>
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<td>Vacation Internship</td>
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PROGRAMME ENQUIRIES

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NUS.Engineers