# Kick-off webinar: Nordic Five Tech (N5T) Extended Campus Programme in Batteries

31 Oct 2023

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CHALMERS DTU NTNU

# Agenda

1. Welcome to N5T kick-off webinar and introduction to Batteries
2. N5T Extended Campus Programme – Batteries and how it works for a student?

3. University presentations:

   - Aalto, Finland
   - Chalmers, Sweden
   - NTNU, Norway
   - DTU, Denmark
   - KTH, Sweden

4. Student Experiences
5. Questions and answers

**Questions/comments can be added in Presemo: https://presemo.aalto.fi/nordicfivetechwebinar**

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# Welcome words by Prof. Mikael Enelund, Chalmers

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# Welcome to Nordic Five Tech Extended Campus Programmes in Batteries

Nordic Five Tech (N5T) is an alliance of five linked leading technical universities in the Nordic region:

- Aalto University, Finland,
- Chalmers University of Technology, Sweden,
- Technical University of Denmark (DTU),
- Royal Institute of Technology, Sweden (KTH), and
- Norwegian University of Science and Technology (NTNU).

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# Why studying at a N5T university

- **Academic Excellence**: Top-quality educations that are highly respected globally.
- **Strong Engineering Programmes:** Progressive and responsive educations taught in English. Close connections to world-leading industries, research and society.
- **Innovation and Entrepreneurship:** Inherent innovation and startup culture with ties to the local business and tech communities.
- **Sustainability Focus: S**trong emphasis on sustainability and environmental awareness
- **International Educations:** Faculty and students from around the world. Integrated global perspectives.


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# Why take courses in battery technology?

- **Relevance to the Industry:** Battery technology is a rapidly growing field with applications in various industries.
- **Industries** are actively seeking expertise in batteries.
- **Sustainability and Environmental Concerns**: Battery technologies play a crucial role in enabling the transition to renewable energy sources and reducing the environmental impact.
- **Interdisciplinary Skills:** Battery systems involve a mix of electrical, chemical, materials, and mechanical engineering principles.
- **Problem Solving:** Battery technology challenges require creative problem-solving skills.
- **Long-term Relevance**: Battery technology is not a passing trend

Reuters

Volvo to end diesel car production by early 2024

Volvo Cars said on Tuesday that it will end production of any remaining diesel models by early 2024 as it heads towards becoming an...

4 days ago

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# N5T Extended Campus Programme

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Semester 1</td><td>Semester 2</td><td>Semester 3</td><td>Semester 4</td></tr>
<tr><td colspan="2">Home university</td><td colspan="2">Host university</td></tr>
<tr><td colspan="2" rowspan="2">60 ECTS MSc programme studies</td><td>15 ECTS Batteries</td><td rowspan="2">30 ECTS Master's thesis (final project) according to home university rules*</td></tr>
<tr><td>15 ECTS free electives</td></tr>
<tr><td colspan="3">Students apply to N5T Extended Campus Programme (Erasmus+ student exchange) at the end of semester 1 at home university</td><td></td></tr>
</table>

*As a rule, the students will complete the final semester doing their thesis at the host university. In some cases, the students may opt to complete the thesis at the third N5T university or at home university. The students in Sweden can not apply to Erasmus+ Student exchange to Sweden.

# Applying to N5T Extended Campus Programme

- Students apply for (Erasmus+) exchange according to the home university's guidelines and application period
- Students are expected to do and enclose a study plan (Erasmus+ Learning Agreement) to the application
- Fall: 15 ECTS Batteries courses (list) + 15 ECTS elective courses
  Spring: option for thesis work 30 ECTS
- Application rounds for the autumn term 2024:
  - Aalto: 10 January – 31 January 2024
  - Chalmers: 15 January – 15 February 2024
  - DTU: 1 February 2024 deadline
  - KTH: 9 – 30 November 2023, 10 – 24 February 2024
  - NTNU: 1 February 2024 deadline

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# Further information

- Aalto University: Exchange application periods and instructions | Aalto University
- Chalmers: Applying for exchange studies (chalmers.se)
- DTU: Exchange abroad - DTU Study Abroad
- KTH: Application for exchange studies | KTH
- NTNU: Study abroad - NTNU

- N5T Extended Campus Programme: Nordic Five Tech

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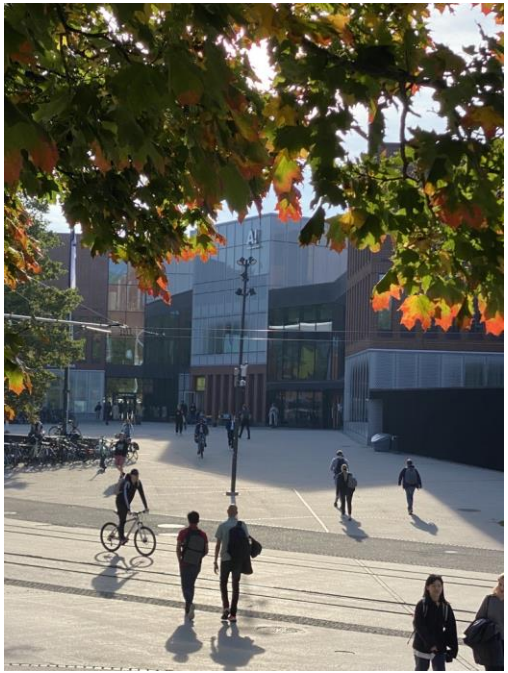
# Aalto University

- Founded in 2010 as a merger of Helsinki University of Technology, Helsinki School of Economics and University of Arts and Design Helsinki
- Today, all six Aalto Schools are on the same campus
- Campus easily reachable by public transportation (metro & tram), only 12 min. from the city centre of Helsinki!
- Entrepreneurial education & mindset
- University-Wide Studies (UWS) & Aalto cross-school courses (individual courses & minors) available for incoming exchange students
- Student benefits on campus & outside campus (e.g., lunch in student restaurants EUR 3.20, public transportation)
- Student-led associations, active student union (AYY)
- Student association for Swedish-speaking students *Teknologföreningen (TF)*

Aalto-yliopisto
Aalto-universitetet
Aalto University

# N5T Extended Campus Programme in Batteries: Aalto courses



| Title | ECTS | Semester | Period | Language of instruction | Level | Department |
|---|---|---|---|---|---|---|
| Circular Economy for Energy Storage D | 5 ECTS | Fall | II | English | Master, Doctoral | Department of Mechanical Engineering |
| Electrochemical Energy Conversion D | 5 ECTS | Fall | II | English | Master, Doctoral | Department of Chemistry and Materials Science |
| Fundamentals of Hydrometallurgy | 5 ECTS | Fall | I-II | English | Master | Department of Chemical and Metallurgical Engineering |
| Fundamentals of Pyrometallurgy | 5 ECTS | Fall | II | English | Master | Department of Chemical and Metallurgical Engineering |
| Metal Recycling Technologies | 5 ECTS | Fall | II | English | Master | Department of Chemical and Metallurgical Engineering |
| Fundamentals of Minerals Engineering and Recycling | 5 ECTS | Fall | I | English | Master | Department of Chemical and Metallurgical Engineering |
| Sustainable Electronics | 5 ECTS | Fall | I-II | English | Master | Department of Chemical and Metallurgical Engineering, |
| Power Electronics | 5 ECTS | Fall | I-II | English | Master | Department of Electrical Engineering and Automation |
| Electric Drives | 5 ECTS | Fall | I-II | English | Master | Department of Electrical Engineering and Automation |
| Distributed Generation Technologies | 5 ECTS | Fall | I-II | English | Master | Department of Electrical Engineering and Automation |

Aalto-yliopisto
Aalto-universitetet
Aalto University

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# Why Chalmers for N5T extended mobility studies?

- Chalmers exchange student satisfaction is among the highest in Europe*
- 40 Master´s programmes taught in English
- 700+ courses in English available for exchange students
- Education strongly linked to advanced research
- Close collaboration with industry and society. Gothenburg is center for automotive and manufacturing industry in northern Europe
- Tracks are challenge-driven courses in close collaboration with research, industry and society, which are closely connected to Chalmers' cutting-edge research and to global societal challenges.
- Entrepreneurial mindset and sustainability are essential parts of the learning process.
- Gothenburg is in the heart of Scandinavia, only 3 hours by train to Stockholm, Oslo and Copenhagen
- Very active student union with international welcome committee for incoming exchange students

** Results from the International Student Barometer 2019*

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# Chalmers: Battery focused and Battery related courses

| | | | |
|---|---|---|---|
| Lithium-ion battery systems for vehicles and large-scale energy storage | 7.5 ECTS | Fall, Q2 | Focused |
| Functional energy materials | 7.5 ECTS | Fall, Q2 | Focused |
| Structural batteries: Design, manufacturing and characterisation | 7.5 ECTS | Fall, Q1 & Q2 | Focused |
| Structural batteries: Design, manufacturing and characterisation | 15 ECTS | Fall, Q1 & Q2 | Focused |
| Battery materials and manufacturing | 7.5 ECTS | Fall, Q1 | Focused |
| Rechargeable batteries: From atom to cell | 7.5 ECTS | Fall/Spring Q 2 & Q3 | Focused |
| Introduction to propulsion and energy systems for transport | 7.5 ECTS | Fall Q1 | Related |
| Electric drive systems for vehicles and vessels | 7.5 ECTS | Spring Q4 | Related |
| Electric and hybrid vehicles | 7.5 ECTS | Fall Q2 | Related |
| Electrical machines - design and analysis | 7.5 ECTS | Fall Q1 | Related |
| Electric machines for vehicles and vessels | 7.5 ECTS | Spring Q3 | Related |
| Variation management in the electricity system | 7.5 ECTS | Spring Q4 | Related |
| Fuel cell systems | 7.5 ECTS | Spring Q3 | Related |
| Solar energy: From photons to future societal impact | 7.5 ECTS | Fall Q2 | Related |
| The synthesis, properties and structures of solid-state materials | 7.5 ECTS | Fall Q1 | Related |
| Green chemistry | 7.5 ECTS | Fall Q1 | Related |

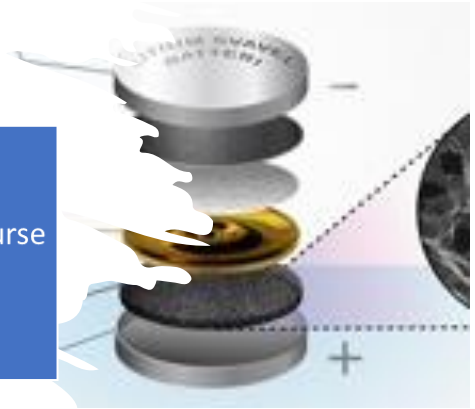
Master's level courses, all taught in English. Each semester is divided in to two quaters.

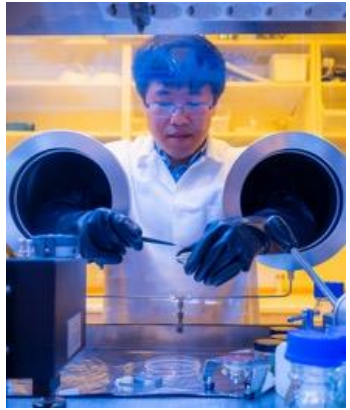
# Battery materials and manufacturing, 7.5 ECTS

Are you wondering

- Which materials that are used to make batteries?
- How does a battery work?
- How is the state-of-the-art lithium-ion battery fabricated in both lab scale and industry level?

Then this is the right course for you!





You will fabricate batteries in the lab

You will analyze battery performance in the lab

You will learn about the entire battery manufacturing process from raw materials to finished battery cells and battery packs.

# NTNU

- Main profile is Technology – but academic diversity
- Three campuses in Trondheim, Gjøvik and Ålesund
- Many student organizations: https://i.ntnu.no/studentorg
- NTNUI Sports, ISFIT, UKA, The Students' Society.....
- Receive around 2000 exchange students per year
- Orientation week
- Flexible exchange policy
- Many courses in English on Master's level
- Emphasis on entrepreneurship, student-active learning and innovation
- Easy to travel to, no cultural challenges, no language barriers, no homesickness, easy to match courses.....
- https://www.youtube.com/watch?v=22cHcGghvv4

# N5T Extended Campus Programme in Batteries: NTNU courses

A wide range of courses in English available to exchange students on Master's level:

https://www.ntnu.edu/studies/exchange

https://www.ntnu.edu/studies/exchange/courses

NTNU Energy Team Battery - NTNU Energy - NTNU

# DTU Charter: Creating value for the benefit of society

- Sustainable change
- Technology for everyone
- Social responsibility




## Key figures

**13,414** Students enrolled

(hereof int. MSc 2,315)
Number of PhD 1,683
33% of students women

From 114 countries

## Ranking

Leiden Ranking
Collaborative Publications
with Industry Indicator

**No. 4** in Europe
**No. 9** in the world

# N5T Extended Campus Programme in Batteries: DTU - Courses

| | | | | | | |
|---|---|---|---|---|---|---|
| Energy storage and conversion | 5 ECTS | Fall | Mon 9-12 | English | MSc | Energy Conversion and Storage |
| Electrochemical energy storage and Power2X | 5 ECTS | Fall | Thurs 8-12 | English | BSc | Energy Conversion and Storage |
| Electrochemistry | 5 ECTS | Spring | Tues 8-12 | English | MSc | Energy Conversion and Storage |
| Energy and Sustainability | 5 ECTS | Fall | Tues 18-22 | English | MSc | Chemical Engineering |
| Battery materials and chemistries: from fundamental mechanisms to battery cells | 5 ECTS | Fall | Wed 13-17 | English | Msc | Energy Conversion and Storage |
| AI-orchestrated self-driving labs | 5 ECTS | June | | English | MSc | Energy Conversion and Storage |
| Atomic-scale modelling of energy materials (online) | 5 ECTS | Spring | Fri 8-12 | English | Msc | Energy Conversion and Storage |
| Functional materials | 5 ECTS | Spring | mon 8-12 | English | Msc | Energy Conversion and Storage |
| Organic energy materials | 5 ECTS | Fall | wed 8-12 | English | Msc | Energy Conversion and Storage |
| Technology Entrepreneurship | 5 ECTS | Fall | Thurs 13-17 | English | Msc | Technology, Management and Economics |
| Innovation in Engineering (Polytechnical Foundation) Students with advanced innovation competences should take 42502/42505/42503. | 5 ECTS | Jan, June, August | | English | MSc | All |

**Ivano Eligio Castelli**
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•Department of Energy Conversion and Storage

# KTH Royal Institute of Technology

- Sweden's largest technical university established in 1827
- Five schools and exchange students can choose courses from all fields of studies
- Five campuses in and around Stockholm
- A dynamic and international environment
- KTH encourages innovative ideas and an entrepreneurial spirit among students
- KTH emphasizes the practical industrial applications of knowledge and courses have close ties to the latest research and industry

# Batteries

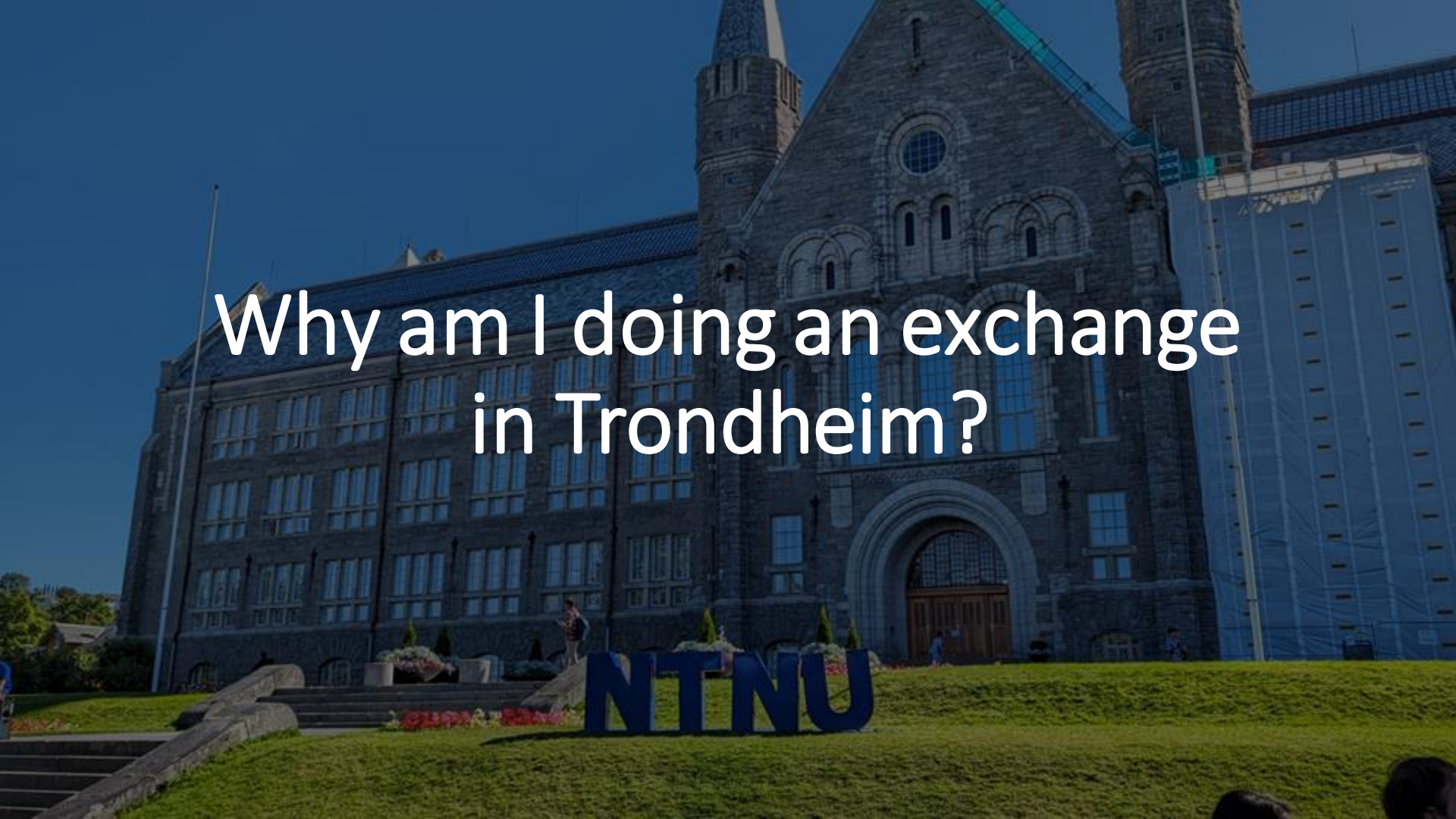
| | | | |
|---|---|---|---|
| EJ2201 | Electrical Machines and Drives | 6 ECTS | Fall |
| EJ2410 | Hybrid Vehicle Drives | 7,5 ECTS | Fall |
| KE2110 | Applied Electrochemistry | 7,5 ECTS | Fall |
| CK2300 | Batteries | 7,5 ECTS | Fall |
| CK2020 | Advanced Inorganic Chemistry | 7,5 ECTS | Fall |
| CK2320 | Hydrogen | 7,5 ECTS | Fall |
| EI2460 | Batteries for Energy Storage in Electrical Systems | 6 ECTS | Spring |
| EI2455 | Smart Electrical Networks and Systems | 7,5 ECTS | Full year |
| EG2230 | Electricity Pricing and Emissions | 6 ECTS | Fall |
| EG2240 | Power System Planning | 6 ECTS | Spring |
| EJ2440 | Electric Transportation | 6 ECTS | Spring |
| MJ2386 | Energy Storage Technology | 6 ECTS | Fall |

# Trondheim

My experiences doing
an exchange at NTNU, by Alexander Leijonhielm

# Who am I?

- Fifth year student at KTH, exchange student at NTNU
- Electrical Engineering, Master in Electric Power Engineering




# Why am I doing an exchange in Trondheim?

# Beautiful city

# Going on hikes – big and small

Lofoten 15 hours away, or
Storfossen 30 minutes away

# Many good and interesting courses!



# Active student life

Festivals and student organizations


Meet a lot of new people!

# Why go on an exchange so close to Sweden?

- Never been to Norway!
- Not too different – you can quickly feel at home
- Understand the language
- Easy (and cheap) to visit <3


Thank you for listening!

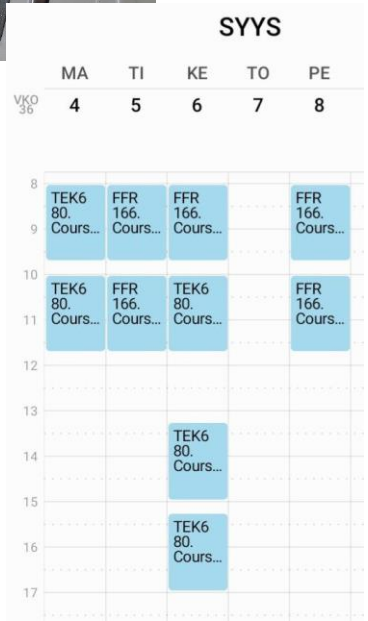
# My exchange from Aalto to Chalmers

Frida Mitts

# About Chalmers

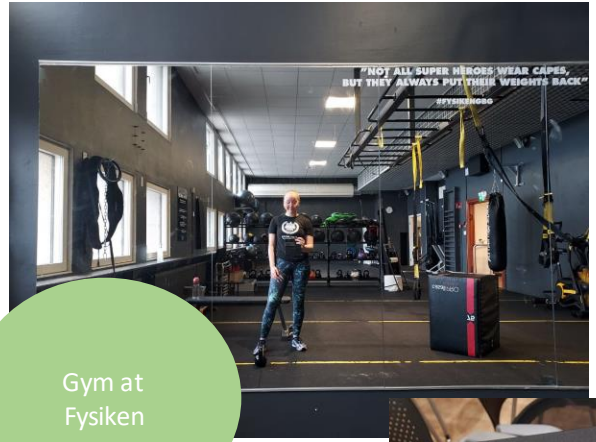
- Master's level courses taught in English
- Pretty much all courses are 7.5 ECTS
- All courses follow the same block schedule
- Every lecture is 45 min + 15 min break
- 1.5-hour lunch break
- Lot of group work, exams at the end of the study period, rarely individual assignments, lots of guest lecturers
- Fall term 28.8-14.1 (Study periods 1 and 2)
- Spring term 15.1-2.6 (Study periods 3 and 4)

Student lunch at the cafeteria (65 kr)




Example of what my course schedule looks like

# Life in Gothenburg




Gym at Fysiken


Fika

Activities and culture


Chalmers choir

Lots of hiking!

Also check out:

ESN
Erasmus Student Network
Göteborg

IRC
CHALMERS INTERNATIONAL RECEPTION COMMITEE

# Contact information

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# Questions? Comments? Feedback

**Presemo:** https://presemo.aalto.fi/nordicfivetechwebinar

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