USN Universitetet
i Sørøst-Norge

Department strategy
Department of Science and Industry Systems (IRI)

Faculty of Technology, Natural Sciences and Maritime Sciences (TNM)

Key information

The Department of Science and Industrial Systems is located at campus Kongsberg. Norway's oldest industrial city has an international business community with exciting career opportunities for our students.

We offer studies at all levels within software engineering, cybernetics, product development and systems engineering.

We offer doctoral education in natural sciences and technology, and we have a portfolio of doctoral subjects in computer science, quantum technology and systems engineering. We coordinate the national industrial research school in complex systems (INRESCOS).

The department has extended contact with industry, the public sector and business. We collaborate closely with national and international partners. We drive innovative research and development. Our research groups are leaders in several areas.

UN Sustainability Goals #4: quality education, #5 gender equality, #7 affordable and clean energy, #9 industry, innovation and infrastructure, #13 climate action, #17 partnership for the goals are important themes in our research and teaching.

493
Students (2023)

6
Study programs BSc,
MSc and PhD studies

6
PhD students

46
Employees (2022))

Study program BA and MA studies

We offer engineering education at bachelor's, master's and doctoral level.
We offer preparatory courses at secondary high school level.

Bachelor studies

Computer engineer (field of study cyber physical systems)
Electronics engineer (field of study cybernetics)
Mechanical engineer (field of study product development)

Master's studies

Systems Engineering (Industrial master)
Major in systems engineering in the the master's program in innovation and technology management (owned by the USN Business School)
Computer Science (full-time and industrial masters)
The master's programs offer an option for a 3 year industrial master's where the students work part-time 50% at a partner company.

We teach courses in Systems Engineering at one of the Master's programs at the University of Oslo.

We offer preparatory courses for engineering education, a three-semester mathematics and physics scheme and entry level programs for students with vocational background.

Lifelong learning

The department offers an experience-based Executive Master in Systems Engineering. The program is specially adapted to engineers with industrial experience. We offer tailored courses in Systems Engineering to companies in Norway and abroad.
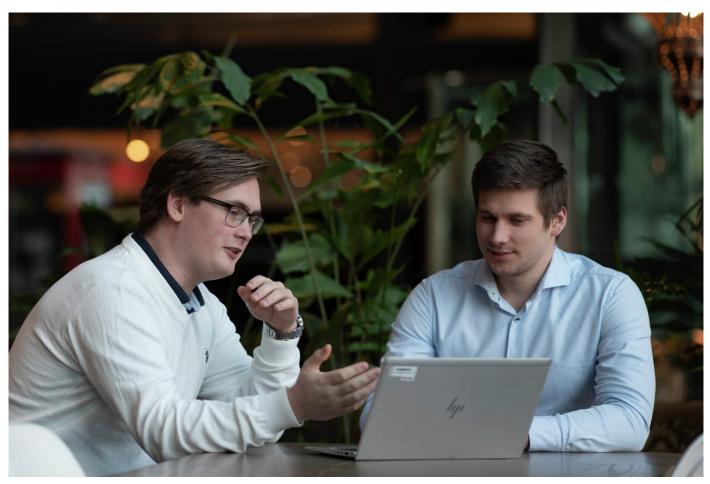
We offer lifelong learning education programs based on the needs of industry and society. We have developed our own courses through the industry programs, the Kongsberg Catapult Academy and continuing education in programming for teachers in high school.

We offer a one-year course in Software Development. The program has been developed in close collaboration with industry through "Industry pilot Kongsberg".

We represent the faculty in USN Flexible, where we contribute to developing USN's future study models within lifelong learning.

Priority research areas

- Systems Engineering

- Quantum technology

- Computer science

- Artificial intelligence

- Electronics

- Energy systems

- Advanced materials

- Engineering pedagogy and didactics

Research groups

Systems Engineering

The Systems Engineering research group is a national leader in systems engineering research. Research areas are changeability, credibility, applicability and sustainable development of complex technological systems.

Autonomy, digital transformation, and sustainable innovation are drivers in research. The research group has broad collaboration with industry within mobility, aerospace, maritime industry, energy, health and defense systems.

The research group strengthens the industrial master's program in Systems Engineering by connecting industry, research, and education. The research group also develops industrial education programs within systems engineering for bachelor's, master's, and doctoral level as well as lifelong learning education.

https://www.usn.no/english/research/our-research-centres-and-groups/technology/norwegian-industrial-systems-engineering-research-group/

Advanced Cognitive Systems And Data science

The research group Advanced Cognitive Systems and Data Science (ACSAD) promotes interdisciplinary research and education by creating new knowledge and practical, innovative solutions using artificial intelligence for applications in health, industry, energy and autonomy.

- Artificial intelligence
- Algebraic AI
- Autonomous and intelligent systems
- Operation of drones
- USPACE services
- Signal and image processing

https://www.usn.no/english/research/our-research-centres-and-groups/technology/advanced-cognitive-systems-and-data-science/

Quantum technology

The research group has the following topics:
- The foundations of quantum mechanics
- Quantum mechanical measurements
- Quantum reference systems Open quantum systems
- Quantum optomechanics and quantum electromechanics
- Superconducting quantum bits
- Topological phases
- Graphene
- Contextuality and general probability theories

https://www.usn.no/research/our-research/technology/quantum-technology/

Computer Science

The research group within computer science/informatics conducts research within a broad thematic area, both within basic research and applied research for industrial applications.

- Big data analytics and management
- Cyber-Physical Systems
- Distributed systems
- Cyber security
- Cryptography
- Gamification
- User interaction design
- XR/VR/AR
- Technology education

https://www.usn.no/english/research/our-research-centres-and-groups/technology/computer-science/

Electronics

The institute's research in electronics includes:

- Control systems
- Wireless communication
- Mechatronics
- Hardware and PCB design
- Signal processing
- Ternary systems

The research group within ternary systems challenges today's conventional use of binary technology by using new ground-breaking technologies such as trinary CPUs and software development for trinary architectures. https://ternaryresearch.com/.

Energy systems and advanced materials

The research group is being established.

- Polymer and composite
- Additive manufacturing
- Energy optimization
- Simulation-based design

Research and innovation center

National industrial research school in complex systems (coordinator)
Collaboration with University of Agder (UiA) and NTNU and supported by the Research Council of Norway 2022-2030.

Systems Engineering Research and Innovation Center
The center is under development.

External funding:
External funding has more than doubled from the level in 2019/2020 and is currently around NOK 10 million per year. The largest share of the turnover comes from the EU and the Research Council of Norway and through commissioned research for industry partners that is supported by the Research Council of Norway and Innovation Norway.

- 2022-2024: HSEIF II (IPN)
- 2022-2024: BATNET (Green platform)
- 2022-2025: MQSens - Quantum sensing with nonclassical mechanical oscillators (QuantERA)
- 2021- 2023: USEPE (EU HORIZON 2020, SESAR JU)
- 2023-2025: AI4HyDrop (HORIZON EUROPE, SESAR JU)

External interaction
The department collaborates closely with local and regionally rooted working and community life, and international industry with both national and international impact. The network represents a significant resource for further development in research, education and lifelong learning.

Local and regional interaction
- More than 80 industrial partners in systems engineering and computer science
- Kongsberg technology cluster, steering group member
- Kongsberg By&Lab, board member
- Systems Engineering Study Group, biannual gathering for the systems engineering community.
- Active contributor to national events Kongsberg Agenda and Arendalsuka
- Active partner in Kongsberg City of Technology
- University school agreement with Kongsberg high school, particularly in science
- Active participant in the collaboration project "Kongsbergskolen"(technology education from kindergarten to PhD)
- Cooperation with the Vocational College in Viken, especially in mechanical engineering, electrical engineering and systems engineering.

National interaction

Systems Engineering

- Coordinator for the national industrial research school, INRESCOS (UiA, NTNU, USN)
- Head of the Norwegian INCOSE association for Systems Engineering, NORSEC

- Annual international conference Kongsberg Systems Engineering Event

Quantum technology

- Norway's representative in the Quantum Community Network.
- Represented on the Publications Committee for Physicsan advisory body to the UHR.
- Organization of the international workshop "Foundations under the Midnight Sun 2023", summer 2023, Tromsø.

Internationally

- INTPART projects, e.g. DSYNE together with UiO, USN, Stevens Institute, the University of Houston, academic and industrial partners Brazil.
- Main committee participant for the November conference 2023, *Research and Innovation for the Energy Transition*, organized by Innovation Norway, the Ministry of Oil and Energy and Equinor.

Department strengths and strategic advantages

- Regionally recognized for high academic quality in engineering education, innovative thinking in technology education.
- Study program that gives students interdisciplinary competence and practical experience.
- Ambitious and professionally strong staff who will develop the institute to its potential.
- Strong professional environment in physics and mathematics.
- Interdisciplinary and innovative in collaboration with national industry, through the industrial master's program and industrial research school.
- Internationally recognized for research in Systems Engineering.,
- Internationally recognized for research in quantum technology.
- Internationally recognized for research in artificial intelligence and USPACE.
- Close collaboration with students and local community.

Vision, values and community assignment

Vision

Regionally rooted

and internationally recognized.

Values

Close to communities and working life, where people live and work

Sustainable

Innovative

Social mandate

Having wise, knowledgeable citizens is the key to good social development. The USN will develop and present new, groundbreaking knowledge and offer education of a high international standard. The university's
main profile is profession and work-oriented, providing socially relevant education. Its research and education are both characterized by close interaction with regional society and working life.
Our eight campuses provide us with unique strength and their locations shall enable the university to make higher education and research more
readily accessible. We shall be an active driving force behind knowledge-based development in partnership with society and working life.
The university shall highlight social challenges and contribute towards solving them by combining research, basic research, education, artistic development work, knowledge transfer and innovation. Challenges relating to climate change, energy, green value creation, social inequality, democracy, human rights, sustainability of the welfare state and the foundations for a vibrant local environment shall be met with knowledge
and expertise.
Institutional autonomy, academic freedom and the development and
transfer of knowledge based on scientific methods, objectivity norms,
formation, critical reflection, open research and allowing space for
opposing views are all decisive for the university's activities.

The department's long-term ambition

The Department of Science and Industrial Systems offers future-oriented studies and research that contribute to an increased rate of innovation in digitization and the green transition. The department's prioritized research is at a high international level.

We are nationally recognized for developing new and innovative forms of collaboration between industry, higher education, and research. We share our knowledge with society.

We have an active alumni network that helps us to further develop education for the future. We develop alternative study models and further and further education offers for flexible working lives.

Our studies inspire students with increased effort and hunger for knowledge.

The department's working environment is recognized for an open and generous working and professional environment that is promoted through critical reflection and academic freedom.

We develop further the student environment in collaboration with students and staff. We recruit students from a greater diversity, both nationally and internationally.

The department's values relate to USN's values

The department's values	
Close to social and working life	We are a connecting industry, research and education, and help society to develop and make use of new ideas.
Sustainable	Our research and education develop knowledge, expertise and perspectives that contribute to a better future through the UN's sustainability goals.
Innovative	We develop engineering and technology education at all levels in close collaboration with national industry.
Reflected	We promote and protect academic freedom.
Conveying	We are active communicators of knowledge and contribute to diversity, equality, and mutual understanding in society.

USN's overall goals

Ministry of education and research's sector goals

High quality in education and research

Sustainable social development, welfare, and innovation

Good access to education and skills throughout the country

Goals in the development agreement between KD and

To be an open University that offers work-life-integrated and flexible education.

To be a future-oriented university that contributes to a knowledge-based critically reflected and sustainable social development in collaboration with society and working life.

To be an innovative multi-campus university that collaborates with community and working life in the region.

USN's institutional goals

1. Research-based and work-life-integrated educations of high international quality that promote critical reflection and strengthen innovative skills.

2. Several outstanding and internationally competitive professional environments, and research at a high international level.

3. Student-active learning processes and digital competence in all educations.

4. Flexible courses for lifelong learning.

5. New knowledge, insight and solutions with relevance for social and working life in the short and long term.

6. Partnership with community and working life and become a role model for such cooperation.

7. Competence and knowledge for green transition and sustainable economic, social, and cultural innovation.

Deparment goals:

Goal 1	Relevant study programs IRI will offer education adapted to the industry's needs for future technical competence and for interdisciplinary skills requried for green transition and digitalisation. We will further develop the USN Engineer and Industrial Master programs so that they become the preferred technological education for regional industry. By 2026, we aim for at least 90% of our students to be in a relevant job within 6 months of completing their studies.	Based on business objective no: 1, 6, 7

Goal 2	Leading research IRI shall have well-functioning research groups that are recognized in their fields, either through collaboration with regional and national industry, or through strong Nordic and international networks. By 2026, IRI shall host at least one research center that is internationally recognized for its research activity.	Based on business objective no: 2, 5

Goal 3	Quality in education IRI will improve the students' completion rate by offering a variety in teaching and assessment forms and by ensuring research-based teaching methods.	Based on business objective no: 3	

Goal 4	Flexible further and further education IRI will develop and offer flexible, market-adapted study models for lifelong learning together with our partners and alumni. At least 10% of the department's turnover must come from lifelong learning education by 2025.	Based on business objective no: 4, 6, 7	

Goal 5	Visible and relevant in community IRI's research and education must be visible and relevant in society by the institute disseminating popular science material at least twice per month.	Based on business objective no: 5, 7

Goal 6	Good working environment The department's working environment shall be recognized for promoting collaboration, critical reflection and academic freedom. We will establish	General prerequisite for achieving the institute's development goals.

	and follow an action plan for equality and discrimination.	
Goal 7	Economic room for action The department's strategic development will give us financial stability and room forope for action. Our assignments and research projects must make a positive contribution to the institute. Our education programs must have twice as many applicants as study places.	General prerequisite for achieving the institute's development goals.
Goal 8	Attractive student environment on campusIRI shall ensure the development of an attractive student environment on campus in collaboration with students, line associations and local community life, and measured through improvement in the Studiebarometeret and the SHOT survey.	Based on business objective no:7

Selected areas of effort

Regional collaboration
Further develop regional collaboration with industry and community through research projects. Further develop the use of industry as a laboratory.

Clarify working life relevance in the studies by having more company visits, guest lecturers and relevant project tasks in collaboration with regional partners.

Strengthen the science and technology competence in children and young people, i.a. through collaboration in Kongsbergskolen.

Internationalization
Closer contact and more collaboration with universities that cover our research fields and areas of study. Increased employee development and joint publication with foreign researchers.

Increased international cooperation within Systems Engineering through EU projects, international industry and established international networks.

Strengthen our bachelor's programs through increased exchange of students.

Interdisciplinary ventures
Strengthen collaboration with other academic environments at USN and externally (nationally and internationally) by developing research projects and recruiting academic staff.

Strengthen our further education offer where we can present innovative solutions for lifelong learning in collaboration with USN Flexible, national and international partners.