

# FACULTY OF INFORMATION TECHNOLOGY, MATHEMATICS AND ELECTRICAL ENGINEERING ([IME](#))

*The most important activities at the Faculty of Information technology, mathematics and electrical engineering are research and research-based teaching. The research is linked to relevant areas for Norwegian industry and society, and is on an international level.*

## The Faculty consist of:

- [Department of Computer and Information Science](#)
- [Department of Electronics and Telecommunications](#)
- [Department of Electric Power Engineering](#)
- [Department of Engineering Cybernetics](#)
- [Department of Mathematical Sciences](#)
- [Department of Telematics](#)

## The Faculty offers the following PhD programs:

- [Electric Power Engineering](#) (PHELKT)
- [Electronics and Telecommunication](#) (PHET)
- [Engineering Cybernetics](#) (PHTK)
- [Information Technology](#) (PHIT)
- [Mathematical Sciences](#) (PHMA)
- [Telematics](#) (PHTELE)

In addition the Faculty offers collaboration in the field of:

- [Medical Technology](#) (PHMEDT), <https://www.ntnu.edu/studies/phmedt>
- [Norwegian PhD Network on Nanotechnology for Microsystems](#), <http://www.nano-network.net/>
- [Research School of Computer and Information Security](#), <https://www.coinsrs.no/>

## About the PhD-study at the Faculty

The research at the Faculty is largely linked to the organised doctoral degree programs. If you are considering starting a PhD study, we would like to give you information and guidance about both the program and funding opportunities in person.

The following description includes:

- general information about the PhD program at the Faculty;
- a description of the PhD programs;
- an overview of PhD courses offered at the faculty;
- a brief description of the research groups at the Departments.

*Please stay up to date by visiting our webpages, <http://www.ntnu.edu/ime/research>. Changes to information given may occur during the academic year.*

### ***Information of particular importance***

The Faculty considers applications for admission to the PhD programs in a consecutive manner. When the complete application is received, the processing takes less than 1 month.

- Application for admission is completed in collaboration with a supervisor. The application shall clarify your academic plan, funding and schedule. The supervisor and the Department shall give their statement of the application before it is sent to the Faculty for consideration.
- In line with the requirements in the regulations regarding "strong academic background" it is required that the applicant documents the necessary basic theoretical competence from their previous studies, and that both the Bachelor's program and the Master program are completed with satisfactory results. For the Bachelor program, i.e. an average grade equal to C (ECTS) or better, and the required minimum average grade of B (ECTS) from the Master's program, or equivalent certified professional background.
- The workload of the PhD program is standardised to 3 years. In addition 1 year full-time position in teaching and another research assistant work at the Department may be required. The total period of the study will then be 4 years. In the case of additional work tasks these are normally distributed over the four year period in agreement with the Department when appointed as Research Fellow.
- The Faculty may evaluate whether you have sufficient scientific basis or not to begin the PhD program before you submit a complete application for admission.

### ***Integrated PhD education***

The integrated PhD education is an alternative curriculum from the 9th semester for students enrolled in one of the 5-year MSc programs in technology in Computer Science, Communication Technology (Telematics) and Electronics. Admission to the Integrated PhD education takes place after the 8th semester in the ordinary study program is concluded. Positions are announced annually, and financed by the department.

### **Academic training**

The academic training constitute of 30 ECTS, whereof 20 ECTS on PhD-level.

The organised academic training may include a maximum of one "tailor-made" course per candidate.

- This implies that either one individual study syllabus, or one topic or seminar course may be tailored for the candidate and accepted in the organised academic training.
- Topics and seminars are formally approved in the PhD catalogue and may be combined with master courses, but individual study syllabus may not be combined with a master course.

### **PhD courses at NTNU**

Description of courses is not available in this study handbook, but information and descriptions of are available on web, <http://www.ntnu.edu/studies/courses/>.

The courses are usually given every two years. If required courses may by arrangement with the teacher and with faculty approval, also be taught in the intervening years.

In addition courses at other universities, at home and abroad, may be accommodated in the curriculum for certain restrictions set in the PhD Regulation for NTNU.

### ***PhD courses within the field of technology at Nordic universities***

Nordic Five Tech (N5T) is an exclusive, strategic alliance of the five leading technical universities in Denmark, Finland, Norway and Sweden. PhD candidates at one of the five N5T universities do not have to pay for participating in courses registered in the database, <http://www.phdcourses.nordicfivetech.org/>.

External courses shall be documented in regards to number of ECTS, educational level, learning objectives and literature and attached the application for admission.

## The Faculty Research and Researchers Committee

[The Faculty Research Committee](#), is the consultative organ for matters concerning research and research training, and is delegated decision-making authority for matters concerning admission and research plans for PhD candidates.

### Members of the Research and Researchers Committee:

	Members	Alternate members
Chair	Vice-dean of Research, professor <a href="#">Bjarne E. Helvik</a>	Professor <a href="#">Agnar Aamodt</a>
Mathematical Sciences	Professor <a href="#">Sverre Smalø</a>	Professor <a href="#">Peter Lindqvist</a>
Information Technology	Professor <a href="#">Agnar Aamodt</a>	Professor <a href="#">Eric Monteiro</a>
Electronics and Telecommunication	Professor <a href="#">Thomas Tybell</a>	Associate professor <a href="#">Snorre Aunet</a>
Telematics	Professor <a href="#">Colin Boyd</a>	Professor <a href="#">Danilo Gligoroski</a>
Engineering Cybernetics	Professor <a href="#">Anton Shiriaev</a>	Professor <a href="#">Jan Tommy Gravdahl</a>
Electric Power Engineering	Professor <a href="#">Magnus Korpås</a>	Professor <a href="#">Ole-Morten Midtgård</a>
PhD-Cand.	<a href="#">Even Låte</a> <a href="#">Thea Bjørnland</a>	

## Contacts

The primary contact person is a teacher who covers the subject area you are interested in. See the list of employees in the Department section.

The Faculty provides general information concerning the admission, application form, and procedures:

Head for Section Jon Kummen, phone: 90821195, e-mail: [jon.kummen@ime.ntnu.no](mailto:jon.kummen@ime.ntnu.no)

Higher Executive Officer Anne Danielsen, phone: 73591465, e-mail: [anne.danielsen@ime.ntnu.no](mailto:anne.danielsen@ime.ntnu.no)  
(Electric Power Engineering, Electronics and Telecommunication, Engineering Cybernetics and Telematics)

Higher Executive Officer Lena Haugen, phone: 73593418, e-post: [lena.haugen@ime.ntnu.no](mailto:lena.haugen@ime.ntnu.no)  
(Information Technology, and Mathematical Sciences)

Senior Executive Officer Harald Lenschow, phone: 73593449, e-mail: [harald.lenschow@ime.ntnu.no](mailto:harald.lenschow@ime.ntnu.no)  
(Secretary for the Faculty Research Committee)

Questions regarding the PhD study may be directed to: [phd@ime.ntnu.no](mailto:phd@ime.ntnu.no)

## PhD programme in electronics and telecommunication (PHET)

### *Description of the programme's academic content*

#### Introduction:

The PhD programme in electronics and telecommunications is standardized to 180 credits (3 years). The final plan for the PhD programme is designed in consultation with the candidate, the supervisor and the department depending on the thesis subject area, the current research and individual circumstances.

### *Educational objectives*

#### *Knowledge*

Upon the completion of the PhD degree, the candidate should be at the forefront of knowledge in one or several of the programme's subject areas. The candidate should be able to evaluate the use of different methods in these subject areas, and should be able to contribute to the development of new knowledge, new theories and new methods in the subject area.

#### *Proficiency*

Upon completion of the PhD degree, the candidate should be able to formulate questions for, and plan and carry out research in one or more of the programme's subject areas. The candidate should be able to conduct research at an international level, and should be able to address complex technical questions and challenge established knowledge and practices in the area. The candidate will be able to evaluate the work of others at the same level.

#### *General Expertise*

Upon completion of the PhD degree, the candidate should be able to conduct research with professional and ethical integrity. The candidate will be able to participate in complex multidisciplinary assignments and projects, provide research and development via recognized national and international channels, participate in debates in the field in international forums and assess the need to take the initiative to drive innovation. The candidate should be able to quickly acquire new knowledge in the field.

### *Subject areas*

The PhD programme in electronics and telecommunications is academically linked to the following main areas:

- Acoustics
- Biomedical engineering
- Circuit and System Design
- Electronic Devices and Materials
- Photonics
- Radio Technology
- Signal Processing

Interdisciplinary areas may also be included.

**Admission requirements**, cf. section 5 and 8 in the PhD Regulation

Candidates are considered for acceptance on an ongoing basis upon application.

According to NTNU's PhD regulations, applicants must have a weighted average grade for the last 2 years of their master's programme (120 credits) or equivalent equal to B or better compared with NTNU's grading system.

In line with regulatory requirements for a "strong academic background", the applicant is required to document necessary theoretical basic competence from their earlier studies. Both the bachelor's degree (or the equivalent of the first 3 years of engineering studies) or the master's degree (or the equivalent of the last 2 years of engineering studies) must have been completed with satisfactory results. For the bachelor's programme, this means an average grade equal to C (GPA > 2.5) or better.

The faculty may require students who do not fully meet the admission requirements to be evaluated (via examination) in certain subjects before admission, or to include qualifying courses in the educational component of the programme. Examinations in these subjects must be passed with grade B or better for each of the mandatory topics.

**Project description requirements**, cf. section 5.2 in the PhD Regulation

An academic project description (½-1 page) shall be attached to the application (Appendix 4). A complete description of 5-10 pages can be attached to the application, and shall in all cases be submitted for approval within 6 months of the start of the study programme

**Funding-related requirements**, cf. section 5.2 and 5.5 in the PhD Regulation

Applicants who are admitted but who are not fully funded through scholarship schemes must devote 50% of the work time during the doctoral programme to organized research training, and that a minimum of one year should be allocated to full-time studies.

**Guidance**, cf. section 7 (and 8.1) in the PhD Regulation

No special requirements beyond those stated in the PhD programme regulations.

**Residency requirements**, cf. section 5.3 in the PhD Regulation

No special requirements beyond those stated in the PhD programme regulations.

**Active participation in national and international research environments**, cf. section 2 (and 5.3, 6 and 24) in the PhD Regulation

No special requirements beyond those stated in the PhD programme regulations.

**Professional outreach**, cf. section 2, 8.1, 10.1 and 11 in the PhD Regulation

Professional outreach requirements: The work will normally result in international publications subject to peer review during the PhD programme.

**Educational component**, cf. section 8 in the PhD Regulation

Courses should be selected in relation to the thesis. Subjects for which the exam was taken more than 5 years before admission cannot normally be included in the mandatory 30 SP. The same applies to courses where exams were included for a different degree. The IME faculty may approve up to one (1) course at the PhD level to be included as a part of the educational component of the PhD programme for which the examination was taken before the completion of a master's degree.

The candidate is required to take the faculty's introductory seminar for PhD students during the first full semester after acceptance.

**Reporting**, cf. section 9 in the PhD Regulation

The PhD candidate and his or her supervisor must both submit an annual report in a standardized format.

The candidate is required to provide an expanded report within 2 years to ensure the quality of the academic progress and that there has been satisfactory guidance (midterm evaluation). The department is responsible for the evaluation.

**Thesis requirements**, cf. section 10 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

## PhD programme in Electric Power Engineering (PHELKT)

### *Description of the programme's academic content*

#### Introduction:

The PhD programme in electric power engineering is standardized to 180 credits (3 years). The final plan for the PhD programme is designed in consultation with the candidate, the supervisor and department depending on the subject area for the thesis and the candidate's needs and preferences.

### *Educational objectives*

Organized researcher education will ensure academic breadth in selected subject areas, along with deep knowledge in the topics selected for the doctoral thesis.

#### *Knowledge*

Upon the completion of the PhD education, the candidate should be at the forefront of knowledge in one or several of the Department of Electric Power Engineering's subject areas. The candidate should be able to evaluate the application of different methods in these subject areas and will contribute to the development of new knowledge, new theories and new methods in the subject area.

#### *Proficiency*

Upon completion of the PhD degree, the candidate should be able to formulate questions for, and plan and carry out research in one or more of the Department of Electric Power Engineering's subject areas. The candidate should be able to conduct research at a high international level, and should be able to address complex technical questions and challenge established knowledge and practices in the area. The candidate will be able to evaluate the work of others at the same level.

#### *General expertise*

Upon completion of the PhD degree, the candidate should be able to conduct research with professional and ethical integrity. The candidate will be able to participate in complex multidisciplinary assignments and projects, provide research and development via recognized national and international channels, participate in debates in the field in international forums and assess the need to take the initiative to drive innovation. The candidate should be able to quickly acquire new knowledge in the field.

### *Subject areas*

The PhD programme in electric power engineering is academically linked to the department's main platforms, which are represented by the following academic groups:

- Power technology
- Power systems

See also supplemental information from the [Department of Electric Power Engineering](#).

**Admission requirements**, cf. section 5 and 8 in the PhD Regulation

Candidates are considered for acceptance on an ongoing basis upon application.

According to NTNU's PhD regulations, applicants must have a weighted average grade for the last 2 years of their master's programme (120 credits) or equivalent equal to B or better compared with NTNU's grading system.

In line with regulatory requirements for a "strong academic background", the applicant is required to document necessary theoretical basic competence from their earlier studies. Both the bachelor's degree (or the equivalent of the first 3 years of engineering studies) or the master's degree (or the equivalent of the last 2 years of engineering studies) must be completed with satisfactory results. For the bachelor's programme, this means an average grade equal to C (GPA > 2.5) or better.

The faculty may require students who do not fully meet the admission requirements to be evaluated (via examination) in certain subjects before admission, or to include qualifying courses in the educational component of the programme. Examination in these subjects must be passed with grade B or better for each of the mandatory topics.

The candidate is required to take the faculty's introductory seminar for PhD students during the first full semester after acceptance.

**Project description requirements**, cf. section 5.2 in the PhD Regulation

An academic project description (½-1 page) shall be attached to the application (Appendix 4). A complete description of 5-10 pages can be attached to the application, and shall in all cases be submitted for approval within 6 months of the start of the study programme.

**Funding-related requirements**, cf. section 5.2 and 5.5 in the PhD Regulation

The admission of applicants who are not fully funded through scholarship schemes requires that 50% of the work time during the doctoral programme be available for organized research training, and a minimum of one year should be allocated to full-time studies.

**Guidance**, cf. section 7 (and 8.1) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Residency requirements**, cf. section 5.3 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Active participation in national and international research environments**, cf. section 2 (and 5.3, 6 and 24) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.



**Professional outreach**, cf. section 2, 8.1, 10.1 and 11 in the PhD Regulation

Professional outreach requirements: The work will normally result in international publications subject to peer review during the PhD programme.

**Educational component**, cf. section 8 in the PhD Regulation

Courses should be selected in relation to the thesis. Subjects for which the exam was taken more than 5 years before admission cannot normally be included in the mandatory 30 SP. The same applies to courses where exams were included for a different degree. The IME faculty may approve up to one (1) course at the PhD level to be included as a part of the educational component of the PhD programme, where the examination was completed before the completion of a master's degree.

**Reporting**, cf. section 9 in the PhD Regulation

The PhD candidate and his or her supervisor must both submit an annual report in a standardized format.

The candidate is required to provide an expanded report within 2 years to ensure the quality of the academic progress and that there has been satisfactory guidance (midterm evaluation). The department is responsible for the evaluation.

**Thesis requirements**, cf. section 10 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

## Ph.d-programme in Information Technology (PHIT)

### *Description of the programme's academic content*

#### Introduction:

The PhD programme in information technology is standardized to 180 credits (3 years). The final plan for the PhD programme is designed in consultation with the candidate, the supervisor and department depending on the subject area for the thesis and the candidate's needs and preferences.

### *Educational objectives*

#### *Knowledge*

Upon the completion of the PhD education, the candidate should be at the forefront of knowledge in one or several of the Department of Computer and Information Science's academic areas. The candidate should be able to evaluate the application of different methods in these subject areas and will contribute to the development of new knowledge, new theories and new methods in the subject area.

#### *Proficiency*

Upon completion of the PhD degree, the candidate should be able to formulate questions for, and plan and carry out research in one or more of the Department of Computer and Information Science's subject areas. The candidate should be able to conduct research at a high international level, and should be able to address complex technical questions and challenge established knowledge and practices in the area. The candidate will be able to evaluate the work of others at the same level.

#### *General expertise*

Upon completion of the PhD degree, the candidate should be able to conduct research with professional and ethical integrity. The candidate will be able to participate in complex multidisciplinary assignments and projects, provide research and development via recognized national and international channels, participate in debates in the field in international forums and assess the need to take the initiative to drive innovation. The candidate should be able to quickly acquire new knowledge in the field.

### *Subject areas*

The PhD programme in information technology is academically linked to the Computer and Information Science main area. Interdisciplinary areas that have a main profile in IT are also included. For more information see the [overview](#) of the subject areas and disciplines at the Department of Computer and Information Science.

### **Admission requirements**, cf. section 5 and 8 in the PhD Regulation

Candidates are considered for acceptance on an ongoing basis upon application.

According to NTNU's PhD regulations, applicants must have a weighted average grade for the last 2 years of their master's programme (120 credits) or equivalent equal to B or better compared with NTNU's grading system.

In line with regulatory requirements for a "strong academic background", the applicant is required to document necessary theoretical basic competence from their earlier studies. Both the bachelor's degree (or the equivalent of the first 3 years of engineering studies) or the master's degree (or the equivalent of the last 2 years of engineering studies) must be completed with satisfactory results. For the bachelor's programme, this means an average grade equal to C (GPA > 2.5) or better.

The faculty may require students who do not fully meet the admission requirements to be evaluated (via examination) in certain subjects before admission, or to include qualifying courses in the educational component of the programme. Examination in these subjects must be passed with grade B or better for each of the mandatory topics.

**Project description requirements**, cf. section 5.2 in the PhD Regulation

An academic project description (½-1 page) shall be attached to the application (Appendix 4). A complete description of 5-10 pages can be attached to the application, and shall in all cases be submitted for approval within 6 months of the start of the study programme

**Funding-related requirements**, cf. section 5.2 and 5.5 in the PhD Regulation

The admission of applicants who are not fully funded through scholarship schemes requires that 50% of the work time during the doctoral programme be available for organized research training, and a minimum of one year should be allocated to full-time studies.

**Guidance**, cf. section 7 (and 8.1) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Residency requirements**, cf. section 5.3 in the PhD Regulation

No special requirements beyond those stated in the PhD programme regulations.

**Active participation in national and international research environments**, cf. section 2 (and 5.3, 6 and 24) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Professional outreach**, cf. section 2, 8.1, 10.1 and 11 in the PhD Regulation

Professional outreach requirements: The work will normally result in international publications subject to peer review during the PhD programme.

**Educational component**, cf. section 8 in the PhD Regulation

Courses should be selected in relation to the thesis. Subjects for which the exam was taken more than 5 years before admission cannot normally be included in the mandatory 30 ECTS. The same applies to courses where exams were included for a different degree. The IME faculty may approve up to one (1) course at the PhD level to be included as a part of the educational component of the PhD programme, where the examination was completed before the completion of a master's degree.

The PhD candidate shall participate in the obligatory PhD introductory seminar.

Candidates shall follow the course DT8108 IT in addition to the 30 credits that are required by the regulations. An overview of the PhD courses that are being taught at the Department of Computer and Information Science.

**Reporting**, cf. section 9 in the PhD Regulation

The PhD candidate and his or her supervisor must both submit an annual report in a standardized format.

The candidate is required to provide an expanded report within 2 years to ensure the quality of the academic progress and that there has been satisfactory guidance (midterm evaluation). The department is responsible for the evaluation.

**Thesis requirements**, cf. section 10 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

## PhD programme in Mathematical Sciences (PHMA)

### *Description of the programme's academic content*

The PhD programme in mathematical sciences is standardized to 180 credits (3 years). The final plan for the PhD programme is designed in consultation with the candidate, the supervisor and department depending on the subject area for the thesis and the candidate's needs and preferences.

### *Educational objectives*

#### *Knowledge*

After graduation, the candidate should be at the forefront of knowledge in his or her subject area. The candidate should be able to evaluate the use of different methods in the field, and should be able to contribute to the development of new knowledge, new theories and new methods.

#### *Proficiency*

After graduation, the candidate should be able to formulate questions for, and plan and carry out research at a high international level in his or her subject area.

#### *General Expertise*

After graduation, the candidate should be able to conduct his or her research with professional and ethical integrity. The candidate should be able to communicate his or her research via recognized national and international channels, and to manage complex interdisciplinary projects. The candidate should be able to assess the need for and take the initiative to drive innovation.

### *Subject areas*

The PhD programme in mathematics is related to six academic areas:

- Algebra
- Analysis
- Differential equations and Numerical Analysis
- Geometry & Topology
- Mathematics Education
- Statistics

Interdisciplinary areas that have a main profile in mathematical sciences are also included. See the [overview](#) of subject areas and disciplines at the Department of Mathematical Sciences.

### **Admission requirements, cf. section 5 and 8 in the PhD Regulation**

Candidates are considered for acceptance upon application on an ongoing basis.

According to NTNU's PhD regulations, applicants must have a weighted average grade for the last 2 years of their master's programme (120 credits) or equivalent equal to B or better compared with NTNU's grading system.

In line with regulatory requirements for a "strong academic background", the applicant is required to document necessary theoretical basic competence from their earlier studies. Both the bachelor's degree (or the equivalent of the first 3 years of engineering studies) or the master's degree (or the equivalent of the last 2 years of engineering studies) must be completed with satisfactory results. For the bachelor's programme, this means an average grade equal to C (GPA > 2.5) or better.

The faculty may require students who do not fully meet the admission requirements to be evaluated (via examination) in certain subjects before admission, or to include qualifying courses in the educational component of the programme. Examination in these subjects must be passed with grade B or better for each of the mandatory topics.

**Project description requirements**, cf. section 5.2 in the PhD Regulation

An academic project description (½-1 page) shall be attached to the application (Appendix 4). A complete description of 5-10 pages can be attached to the application, and shall in all cases be submitted for approval within 6 months of the start of the study programme.

**Funding-related requirements**, cf. section 5.2 and 5.5 in the PhD Regulation

The admission of applicants who are not fully funded through scholarship schemes requires that 50% of the work time during the doctoral programme be available for research education, and a minimum of one year should be allocated to full-time studies.

**Guidance**, cf. section 7 (and 8.1) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Residency requirements**, cf. section 5.3 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Active participation in national and international research environments**, cf. section 2 (and 5.3, 6 and 24) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Professional outreach**, cf. section 2, 8.1, 10.1 and 11 in the PhD Regulation

Professional outreach requirements: The work will normally result in international publications subject to peer review during the PhD programme.

**Educational component**, cf. section 8 in the PhD Regulation

Courses should be selected in relation to the thesis. Subjects for which the exam was taken more than 5 years before admission cannot normally be included in the mandatory 30 SP. The same applies to courses where exams were included for a different degree. The IME faculty may approve up to one (1) course at the PhD level to be included as a part of the educational component of the PhD programme, where the examination was completed before the completion of a master's degree.

In the context of interdisciplinary projects, students can take exams as needed in the doctoral courses from other departments. A maximum of one subject is allowed.

In addition to courses in the PhD catalogue, the following courses are recommended for students in the PhD programme in mathematical sciences. Please note that these courses cannot be included in the 20 credits required from PhD catalogue:

TMA4170 Fourier Analysis  
TMA4175 Complex Analysis  
TMA4225 Foundations of Analysis  
TMA4230 Functional Analysis  
TMA4305 Partial Differential Equations

MA3402 Analysis on Manifolds  
MA3403 Algebraic Topology I

TMA4250 Spatial Statistics  
TMA4285 Time Series Models  
TMA4295 Statistical Inference  
TMA4300 Modern Statistical Methods

TMA4205 Numerical Linear Algebra  
TMA4220 Numerical Solutions of Partial Differential Equations Using Element Methods  
TMA4280 Supercomputing, Introduction

MA3201 Rings and Modules  
MA3202 Galois Theory  
MA3203 Ring Theory  
MA3204 Homological Algebra

**Reporting**, cf. section 9 in the PhD Regulation

The PhD candidate and his or her supervisor must both submit an annual report in a standardized format.

The candidate is required to provide an expanded report within 2 years to ensure the quality of the academic progress and that there has been satisfactory guidance (midterm evaluation). The department is responsible for the evaluation.

**Thesis requirements**, cf. section 10 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

## PhD programme in Engineering Cybernetics (PHTK)

### *Description of the programme's academic content*

#### Introduction:

The PhD programme in engineering cybernetics is standardized to 180 credits (3 years). The final plan for the PhD programme is designed in consultation with the candidate, the supervisor and the department depending on the thesis subject area, the current research and individual circumstances.

### *Educational objectives*

#### *Knowledge*

Upon the completion of the PhD degree, the candidate should be at the forefront of knowledge in one or several of the Department of Engineering Cybernetics' subject areas.

The candidate should be able to evaluate the use of different methods in the Department of Engineering Cybernetics' subject areas, and should be able to contribute to the development of new knowledge, new theories and new methods in the subject area.

#### *Proficiency*

Upon completion of the PhD degree, the candidate should be able to formulate questions for, and plan and carry out research in one or more of the Department of Engineering Cybernetics' subject areas.

The candidate should be able to conduct research at an international level, and should be able to address complex technical questions and challenge established knowledge and practices in the area.

The candidate will be able to evaluate the work of others at the same level.

#### *General expertise*

Upon completion of the PhD degree, the candidate should be able to conduct research with professional and ethical integrity.

The candidate will be able to participate in complex multidisciplinary assignments and projects, communicate research and development efforts via recognized national and international channels, participate in debates in the field in international forums and assess the need to take the initiative to drive innovation.

The candidate should be able to quickly acquire new knowledge in the field.

### *Subject areas*

The Department of Engineering Cybernetics conducts research on cybernetics, which includes, among others: systems theory, linear and nonlinear control theory, estimation, system identification, implementation, mathematical modelling, simulation, optimization, customized computer systems, embedded systems, real-time computer technology, sensors, PLC DCS, human / machine communication and autonomous systems with applications in such movement control, robotics, navigation and vessel management, process cybernetics, oil, gas and new energy, industrial computer systems engineering, instrumentation, process control, automation, fisheries and aquaculture cybernetics and medical cybernetics.



**Admission requirements**, cf. section 5 and 8 in the PhD Regulation

Candidates are considered for acceptance upon application on an ongoing basis.

According to NTNU's PhD regulations, applicants must have a weighted average grade for the last 2 years of their master's programme (120 credits) or equivalent equal to B or better compared with NTNU's grading system.

In line with regulatory requirements for a "strong academic background", the applicant is required to document necessary theoretical basic competence from their earlier studies. Both the bachelor's degree (or the equivalent of the first 3 years of engineering studies) or the master's degree (or the equivalent of the last 2 years of engineering studies) must be completed with satisfactory results. For the bachelor's programme, this means an average grade equal to C (GPA > 2.5) or better.

The faculty may require students who do not fully meet the admission requirements to be evaluated (via examination) in certain subjects before admission, or to include qualifying courses in the educational component of the programme. Examination in these subjects must be passed with grade B or better for each of the mandatory topics.

**Project description requirements**, cf. section 5.2 in the PhD Regulation

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Applicants who are admitted but who are not fully funded through scholarship schemes must devote 50% of the work time during the doctoral programme to organized research training, and that a minimum of one year should be allocated to full-time studies.

**Guidance**, cf. section 7 (and 8.1) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Residency requirements**, cf. section 5.3 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Active participation in national and international research environments**, cf. section 2 (and 5.3, 6 and 24) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Professional outreach**, cf. section 2, 8.1, 10.1 and 11 in the PhD Regulation

Professional outreach requirements: The work will normally result in international publications subject to peer review during the PhD programme.

**Educational component**, cf. section 8 in the PhD Regulation

Courses should be selected in relation to the thesis. Subjects for which the exam was taken more than 5 years before admission cannot normally be included in the mandatory 30 SP. The same applies to courses where exams were included for a different degree. The IME faculty may approve up to one (1) course at the PhD level to be included as a part of the educational component of the PhD programme, where the examination was completed before the completion of a master's degree.

**Reporting**, cf. section 9 in the PhD Regulation

The PhD candidate and his or her supervisor must both submit an annual report in a standardized format.

The candidate is required to provide an expanded report within 2 years to ensure the quality of the academic progress and that there has been satisfactory guidance (midterm evaluation). The department is responsible for the evaluation.

**Thesis requirements**, cf. section 10 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

## PhD programme in Telematics (PHTELE)

### *Description of the programme's academic content*

The PhD programme in telematics is standardized to 180 credits (3 years). The final plan for the PhD programme is designed in consultation with the candidate, the supervisor and the department depending on the thesis subject area, the current research and individual circumstances.

### *Educational objectives*

#### *Knowledge*

- The candidate is at the forefront of knowledge in the dissertation's subject area.
- The candidate has advanced knowledge in the subject area related to his or her area of research.
- The candidate has extensive knowledge of the telematics subject area as a whole.
- The candidate has command of field research methods, and can assess the appropriateness of these methods in research and professional development within the field.

#### *Proficiency*

- The candidate can formulate questions and plan research and academic development.
- The candidate can use applicable subject area research methods to generate new knowledge, new theories and methods in an ethical manner.
- The candidate can conduct research and development in the field at a high international level, and publish scientific papers in reputable conferences and journals.
- The candidate can deal with complex technical questions and challenge established knowledge and practices in the field.

#### *General Expertise*

- The candidate can identify relevant ethical issues and exercise their research with ethical and professional integrity.
- The candidate can communicate research through recognized communication channels. This includes teaching at the master's and PhD level.
- The candidate can assess the need for and initiate innovation within their field of study.

### *Subject areas*

The PhD programme in telematics is academically related the research activities at the Department of Telematics.

Interdisciplinary areas may also be included with other departments at NTNU and/or with others institutions.

**Admission requirements**, cf. section 5 and 8 in the PhD Regulation

Candidates are considered for acceptance upon application on an ongoing basis.

According to NTNU's PhD regulations, applicants must have a weighted average grade for the last 2 years of their master's programme (120 credits) or equivalent equal to B or better compared with NTNU's grading system.

In line with regulatory requirements for a "strong academic background", the applicant is required to document necessary theoretical basic competence from their earlier studies. Both the bachelor's degree (or the equivalent of the first 3 years of engineering studies) or the master's degree (or the equivalent of the last 2 years of engineering studies) must be completed with satisfactory results. For the bachelor's programme, this means an average grade equal to C (GPA > 2.5) or better.

The faculty may require students who do not fully meet the admission requirements to be evaluated (via examination) in certain subjects before admission, or to include qualifying courses in the educational component of the programme. Examination in these subjects must be passed with grade B or better for each of the mandatory topics.

**Project description requirements**, cf. section 5.2 in the PhD Regulation

An academic project description (½-1 page) shall be attached to the application (Appendix 4). A complete description of 5-10 pages can be attached to the application, and shall in all cases be submitted for approval within 6 months of the start of the studies.

**Funding-related requirements**, cf. section 5.2 and 5.5 in the PhD Regulation

The admission of applicants who are not fully funded through scholarship schemes requires that 50% of the work time during the doctoral programme be available for research education, and a minimum of one year should be allocated to full-time studies.

**Guidance**, cf. section 7 (and 8.1) in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Residency requirements**, cf. section 5.3 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

**Active participation in national and international research environments**, cf. section 2 (and 5.3, 6 and 24) in the PhD Regulation

The department requires active participation in the research area's activities.

**Professional outreach**, cf. section 2, 8.1, 10.1 and 11 in the PhD Regulation

Professional outreach requirements: The work will normally result in international publications subject to peer review during the PhD programme.

**Educational component**, cf. section 8 in the PhD Regulation

Courses should be selected in relation to the thesis. Subjects for which the exam was taken more than 5 years before admission cannot normally be included in the mandatory 30 SP. The same applies to courses where exams were included for a different degree. The IME faculty may approve up to one (1) course at the PhD level to be included as a part of the educational component of the PhD programme, where the examination was completed before the completion of a master's degree.

**Reporting**, cf. section 9 in the PhD Regulation

The PhD candidate and his or her supervisor must both submit an annual report in a standardized format.

The candidate is required to provide an expanded report within 2 years to ensure the quality of the academic progress and that there has been satisfactory guidance (midterm evaluation). The department is responsible for the evaluation.

**Thesis requirements**, cf. section 10 in the PhD Regulation

No special requirements beyond those stated in the PhD regulation.

## Doctorate Courses at the Faculty of Information Technology, Mathematics and Electrical Engineering

The table below provides an overview of the faculty's own courses including next semester each course is offered. The PhD courses are usually offered every two years. Courses may be offered by appointment with the teacher and with faculty approval in intermediate years.

In addition, courses at other universities at home and abroad accommodated in the curriculum for certain restrictions stated in the PhD regulations for NTNU.

Complete description of PhD courses are given on the web: <https://www.ntnu.edu/studies/courses>

<b>Emnekode</b> <i>Course code</i>	<b>Emnetittel</b> <i>Course title</i>	<b>Neste semester</b> <i>Next semester</i> <b>H = Høst / Autumn</b> <b>V = Vår / Spring</b>	<b>Studiepoeng</b> <i>ECTS</i>
DT8101	Høy-parallele algoritmer <i>Highly Concurrent Algorithms</i>	H16	7,5
DT8103	Distribuerte databasesystemer <i>Distributed Database Systems</i>	H16	7,5
DT8105	Datamaskinarkitektur 2 <i>Computer Architecture 2</i>	V17	7,5
DT8106	Transaksjonsprosesseringsystemer <i>Transaction Processing Systems</i>	H17	7,5
DT8108	Informasjonsteknologiske emner <i>Topics in Information Technology</i>	V17	7,5
DT8109	Forretningssystemer <i>Business Systems</i>	H17	7,5
DT8110	Utvikling av informasjonssystemer <i>IS Development</i>	V16 etter avtale / by <i>appointment</i>	7,5
DT8111	Empiriske metoder i systemutvikling <i>Empirical Software Engineering</i>	V18 etter avtale / by <i>appointment</i>	7,5
DT8112	Forskningsemner i helseinformatikk <i>Research Topics in Health Informatics</i>	H16 og V17 etter avtale / by <i>appointment</i>	7,5
DT8114	PhD-seminar i datateknikk og informasjonsvitenskap <i>PhD Seminar in Computer and Information Science</i>	Etter avtale hvert semester <i>All semesters by</i> <i>appointment</i>	7,5
DT8115	Learning in Technology Rich Environments	H16 etter avtale / by <i>appointment</i>	7,5
DT8116	Web-gruvedrift <i>Web Mining</i>	Etter avtale hvert semester <i>All semesters by</i> <i>appointment</i>	7,5
DT8117	Gridteknologi og Heterogene Beregninger <i>Grid Technology and Heterogenous Computing</i>	V17	7,5
DT8118	Avansert samhandlingsteknologi <i>Advanced Cooperation Systems</i>	V17	7,5
DT8119	Klinisk beslutningsstøtte <i>Clinical Decision Support</i>	H18 Etter avtale / by <i>appointment</i>	7,5
DT8801	Doktorgradsseminar i databaseteknikk <i>PhD Seminar in Database Systems</i>	H17	7,5
DT8802	Virksomhets-arkitektur og -innovasjon <i>Enterprise Architecture for Enterprise Innovation</i>	V18	7,5

<b>Emnekode</b> <i>Course code</i>	<b>Emnetittel</b> <i>Course title</i>	<b>Neste semester</b> <i>Next semester</i> <b>H = Høst / Autumn</b> <b>V = Vår / Spring</b>	<b>Studiepoeng</b> <i>ECTS</i>
ET8100	Elektrisk ledningsevne, dielektrisk tap og gjennomslag i fast og flytende høyspenningsisolasjon <i>Electric Conductivity, Dielectric Losses and Breakdown of Solid and Liquid High Voltage Insulation</i>	V18	7,5
ET8101	Overspenninger i kraftnett <i>Transient Overvoltages in Electrical Power Systems</i>	V17	7,5
ET8102	Prøving av høyspenningsisolasjon <i>Testing of High Voltage Insulation</i>	H16	7,5
ET8104	Transformator design <i>Transformer Design</i>	H16	7,5
ET8202	Stabilitet og regulering i elkraftsystemer <i>Power System Stability and Control</i>	Etter avtale / By appointment	7,5
ET8206	Spenningskvalitet i kraftnett <i>Voltage Quality</i>	V16	7,5
ET8207	Pålitelighet i elkraftsystemer <i>Power System Reliability</i>	H17	7,5
ET8208	Kraftmarkedsteori <i>Power Market Theory</i>	H17	10,0
ET8209	Metoder for planlegging av kraftproduksjon <i>Methods for Power Production Scheduling</i>	H17	10,0
ET8300	Digital signalbehandling i kraftelektronikkssystemer <i>Digital Signal Processing in Power Electronic Systems</i>	V17	7,5
ET8301	Magnetisk konstruksjon av permanent magnetiserte maskiner <i>Magnetic Design of Permanent Magnet Machines</i>	H17	7,5
ET8303	Kraftelektronikk, halvlederfysikk og pålitelighet <i>Power Electronics, Power Semiconductor Physics and Reliability</i>	H17	7,5
ET8304	Effektteori og kompensering med kraftelektronikkomformere <i>Power Theories and Compensation with Power Electronics</i>	V18	7,5
ET8400	Planlegging av belyningsanlegg <i>Lighting Design</i>	H17	10,0
ET8500	Doktorgradsseminar i elkraftteknikk <i>PhD Seminar in Electric Power Engineering</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5

FE8100	Kvantedatamaskiner og kvantekommunikasjon <i>Quantum Computation and Quantum Communications</i>	H17	7,5
FE8109	Design og utnyttelse av minnehierarkier i multimedia applikasjoner <i>Design and Utilization of Memory Hierarchies in Multi-Media Applications</i>	V18	7,5
FE8111	Molekylstråleepitaksi <i>Molecular Beam Epitaxy</i>	H16	7,5
FE8117	Fotonikk, utvalgte emner <i>Photonics, Selected Topics</i>	H17	7,5
FE8119	Modelleringsteori for enbrikkesystemer og innvedde systemer <i>Modelling Theory for System on Chip and Embedded Systems</i>	H17	7,5
FE8121	VLSI testmetodikk <i>VLSI Test Methodology</i>	V18	7,5
FE8122	Doktorgradsseminar i krets- og systemdesign <i>PhD Seminar in Circuits and Systems Design</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5
FE8123	Doktorgradsseminar i nanoelektronikk og mikrosystemer <i>PhD Seminar in Nanoelectronics and Microsystems</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5

<b>Emnekode</b> <i>Course code</i>	<b>Emnetittel</b> <i>Course title</i>	<b>Neste semester</b> <i>Next semester</i> <b>H = Høst / Autumn</b> <b>V = Vår / Spring</b>	<b>Studiepoeng</b> <i>ECTS</i>
FE8125	Doktorgradsseminar i fotonikk <i>PhD Seminar in Photonics</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5
FE8126	Lavspenning/laveffekt analog CMOS <i>Low-Voltage/Low-Power Analog CMOS</i>	H17	5,0
FE8127	Anvendt fotonikk - videregående kurs <i>Applied Photonics - Advanced Course</i>	H16	7,5
FE8130	MEMS teknologi og design <i>MEMS Technology and Design</i>	H16	7,5
FE8135	Nanostrukturering <i>Nanostructuring</i>	Etter avtale / by <i>appointment</i>	7,5

IT8000	Videregående emner i casebasert resonnering <i>Advanced Topics in Case-Based Reasoning</i>	V17	7,5
IT8001	Kontekstsensitive systemer <i>Context-Sensitive Systems</i>	H18	7,5
IT8002	Videregående emner i menneske-maskin interaksjon <i>Advanced Topics in Human-Computer Interaction</i>	H17	7,5
IT8003	Videregående emner i Organisasjon og IKT <i>Advanced Topics in Organization and ICT</i>	H17	7,5
IT8802	Videregående informasjonsgjenfinning <i>Advanced Information Retrieval</i>	V18	7,5

MA8001	Doktorgradsseminar i matematikk <i>Mathematical Seminar for PhD-students</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5
MA8002	Doktorgradsseminar i biomodellering for brukere <i>Applied Biomodelling for PhD Students</i>	Etter avtale hvert vårsemester <i>Every spring semesters by appointment</i>	7,5
MA8102	Dynamiske systemer og ergodeteori <i>Dynamical Systems and Ergodic Theory</i>	V17	7,5
MA8103	Ikke-lineære partielle differensialligninger <i>Nonlinear Partial Differential Equations</i>	V18	7,5
MA8104	<i>Wavelets</i>	H17	7,5
MA8105	Distribusjonsteori og Sobolevrom med anvendelser <i>Distribution Theory and Sobolev spaces with Applications</i>	V17	7,5
MA8106	Harmonisk analyse <i>Harmonic Analysis</i>	V18	7,5
MA8107	Operatoralgebraer <i>Operator Algebras</i>	H16	7,5
MA8108	Videregående kompleks analyse <i>Advanced Complex Analysis</i>	H17	7,5
MA8109	Stokastiske prosesser i systemteori <i>Stochastic Processes and Differential Equations</i>	H17	7,5
MA8202	Kommutativ algebra <i>Commutative Algebra</i>	V17 etter avtale / by <i>appointment</i>	7,5
MA8203	Algebraisk geometri <i>Algebraic Geometry</i>	V19	7,5
MA8205	Representasjonsteori for algebraer <i>Representation Theory of Algebras</i>	V18	7,5
MA8403	Algebraisk topologi III <i>Algebraic Topology III</i>	H17	7,5
MA8404	Numerisk integrasjon av tidsavhengige differensialligninger <i>Numerical Integration of Time Dependent Differential Equations</i>	H17	7,5
MA8406	Videregående Algebraisk Topologi <i>Advanced Algebraic Topology</i>	V17	7,5



MA8502	Numerisk løsning av partielle differensialligninger <i>Numerical Solution of Partial Differential Equations</i>	H16	7,5
<b>Emnekode</b> <i>Course code</i>	<b>Emnetittel</b> <i>Course title</i>	<b>Neste semester</b> <i>Next semester</i> <b>H = Høst / Autumn</b> <b>V = Vår / Spring</b>	<b>Studiepoeng</b> <i>ECTS</i>
MA8701	Generelle statistiske metoder <i>General Statistical Methods</i>	V17	7,5
MA8702	Videregående moderne statistiske metoder <i>Advanced Modern Statistical Methods</i>	V18	7,5
MA8704	Sannsynlighetsteori og asymptotiske teknikker <i>Probability Theory and Asymptotic Techniques</i>	H16 etter avtale / by <i>appointment</i>	7,5

TK8102	Ulineær tilstandsestimering <i>Nonlinear State Estimation</i>	V18	7,5
TK8103	Ulineære systemer VK <i>Advanced Nonlinear Systems</i>	V17	7,5
TK8105	Ultralyd billedannelse i heterogent, ulineært vev <i>Ultrasound imaging in Heterogeneous, Non-Linear Tissue</i>	H16 etter avtale / by <i>appointment</i>	7,5
TK8107	Estimering i ulineære systemer <i>Estimation in Nonlinear Systems</i>	H16 etter avtale / by <i>appointment</i>	7,5
TK8108	Doktorgradsseminar i fiskeri og havbrukskybernetikk <i>Topics in Fisheries and Aquaculture Cybernetics for PhD students</i>	V17	7,5
TK8109	Videregående fartøystyring <i>Advanced Topics in Guidance and Navigation</i>	H16	7,5
TK8110	Doktorgradsseminar i estimering og datafusjon <i>PhD Seminar in Estimation and Data Fusion</i>	Etter avtale hvert semester <i>/ All semesters by appointment</i>	7,5
TK8111	System og reguleringsteori <i>Topics in System and Control Theory</i>	Etter avtale hvert semester <i>/ All semesters by appointment</i>	7,5
TK8112	Sanntidsteori <i>The Theory of Concurrency in Real-Time Systems</i>	Etter avtale hvert høstsemester <i>Every autumn semesters by appointment</i>	7,5
TK8115	Numerisk optimalregulering <i>Numerical Optimal Control</i>	H16 etter avtale / by <i>appointment</i>	7,5
TK8116	Multivariat data- og meta-modellering <i>Multivariate Data and Meta Modelling</i>	etter avtale / by <i>appointment</i>	7,5

TM8101	Pålitelighetsanalyse av informasjons- og kommunikasjonssystem <i>Dependability Analysis of Information and Communication Systems</i>	V17	7,5
TM8102	Trafikkanalyse av kommunikasjonsnett <i>Traffic Analysis of Communication Networks</i>	V17	7,5
TM8103	Formelle metoder <i>Formal Methods</i>	V17	7,5
TM8105	Avansert simuleringsmetodikk <i>Advanced Discrete Event Simulation Methodology</i>	V18	7,5
TM8106	Optiske nett <i>Optical Networking</i>	H16	7,5
TM8107	Kryptoprotokoller og anvendelser <i>Cryptographic Protocols and Their Applications</i>	V18	7,5
TM8110	PhD emner i Telematikk <i>PhD Topics in Telematics</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5
TM8111	Identitet-basert kryptografi <i>Identity-based cryptography</i>	H16	7,5

<b>Emnekode</b> <i>Course code</i>	<b>Emnetittel</b> <i>Course title</i>	<b>Neste semester</b> <i>Next semester</i> <b>H = Høst / Autumn</b> <b>V = Vår / Spring</b>	<b>Studiepoeng</b> <i>ECTS</i>
TT8001	Statistisk mønstergjenkjenning <i>Statistical Pattern Recognition</i>	V18	7,5
TT8106	Utvalgte emner i kommunikasjonsteori for trådløse kanaler <i>Selected Topics in Communication Theory for Wireless Channels</i>	H17	7,5
TT8108	Doktorgradsseminar i signalbehandling <i>PhD Seminar in Signal Processing</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5
TT8110	Visuell kommunikasjon og bildebehandling <i>Visual Communication and Image Processing</i>	H17	7,5
TT8111	Signal- og estimeringsteori <i>Signal and Estimation Theory</i>	H16 etter avtale / by <i>appointment</i>	7,5
TT8112	Informasjonsteori, koding og kompresjon, utvidet <i>Information Theory, Coding and Compression, extended</i>	V18	7,5
TT8201	Satellittnavigasjon <i>Satellite Navigation</i>	H17, Etter avtale hvert semester <i>All semesters by appointment</i>	15,0
TT8207	Videregående antennteknikk <i>Advanced Antenna Engineering</i>	H16	7,5
TT8208	Ulineære mikrobølge komponenter <i>Nonlinear Microwave Components</i>	H17	7,5
TT8209	Analyse av radarsystemer <i>Radar System Analysis</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	15,0
TT8210	Avanserte Mikrobølge Electromagnetisme <i>Advanced Microwave Electromagnetics</i>	H17 etter avtale / by <i>appointment</i>	7,5
TT8211	Doktorgradsseminar i radiosystemer <i>PhD Seminar in Radio Systems</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5
TT8302	Romakustikk <i>Room Acoustics</i>	H16 etter avtale / by <i>appointment</i>	7,5
TT8303	Numeriske metoder i akustikk <i>Numerical Methods in Acoustics</i>	H16	7,5
TT8305	Marin akustikk II <i>Marine Acoustics II</i>	V18 etter avtale / by <i>appointment</i>	7,5
TT8306	Modellering av Bølgeforplantning og Inversjon <i>Geoacoustic Modelling and Inversion</i>	V18	7,5
TT8307	Teoretisk akustikk <i>Theoretical Acoustics</i>	H16	7,5
TT8308	Doktorgradsseminar i akustikk <i>PhD Seminar in Acoustics</i>	Etter avtale hvert semester <i>All semesters by appointment</i>	7,5

## DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATIONS

Head of Department: Associate professor Ragnar Hergum  
PhD-programme coordinator: Professor Thomas Tybell

<http://www.ntnu.edu/iet/research>

The department's research covers microsystems like micro lasers, micro electronics, integrated optoelectronics and waveguides. Our newest field of research is Nanotechnology, where the dimensions are at atomic levels.

Our research also covers wireless technology in communication, navigation, radar and remote sensing.

With today's demands on information quantity, transmission and storage must be made as effective as possible. Signal- and image processing, speech technology, music technology and communication are also areas of our research.

The institute's research addressed the following research groups:

### Acoustics

The acoustics group studies the generation, propagation and reception of sound waves, as well as transducers and related signal processing, in a wide range of scenarios: sound for the communication between humans; the influence of sound on humans and animals; and technical uses such as remote sensing and underwater communication networks.

### Circuit and Radio Systems

The Circuit and Radio Systems group performs research on design, modeling, verification, and testing of individual electronic circuits and larger systems. These can be used, e.g., for radio communication, for embedded control of automotive and household equipment, for health and well-being, and for microprocessors and general computing systems.

### Nanoelectronics and Photonics

Focus is on developing novel materials and techniques with improved functionality and reduced energy consumption.

The research group develops nanoscale materials with tuneable properties, photonic sensors, and optical characterization techniques for biomedical and information technology applications. The group performs research on oxide electronics, semiconductor nanowires, periodic structures, photonic (bio)sensors, biomedical optics, and terahertz spectroscopy.

### Signal Processing

Signal processing, statistical signal theory, information and communication theory are the main academic topics that unite the activities within the group.

## DEPARTMENT OF ELECTRIC POWER ENGINEERING

Head of department: Professor Erling Ildstad  
PhD-coordinator: Professor Magnus Korpås

<http://www.ntnu.edu/elkraft/>

The Department contributes to research and teaching at graduate (master's) and doctoral (PhD) levels within its field. As a result, it makes a significant contribution to developing new methods and new technology for efficient and environmentally friendly energy systems.

The Department has a key role in the development of the interdisciplinary Energy and Environment engineering programme at the Norwegian University of Science and Technology. The Department with partners have made this into a high quality professional programme that is tailored to the needs of Norwegian energy utilities and industry.

A major research objective is the further development of environmentally friendly electrical energy technology.

### Power Technology

Power electronics, Electrical machines, Motor drives, Modelling and calculations of over-voltages, Components, Insulation materials, Cable technology, Life-cycle costs, Condition based maintenance, Economical utilization of electrical power components, Lightning technology

### Power Systems

Smartgrids, Offshore grid, Hydro power and markets

## DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE

Head of department: Professor Maria Letizia Jaccheri  
PhD-programme coordinator: Professor Agnar Aamodt

<http://www.ntnu.edu/idi/>

The Department of Computer and Information Science (IDI) conducts research in the fields of: artificial intelligence (AI), big data, computer architecture, computer graphics, computer security, databases, human computer interaction (HCI), information systems, operating systems, software engineering, and search—to name a few.

### **Algorithms, HPC, and Graphics (AHG)**

Our research focuses on algorithms with emphasis on bioinformatics, computer graphics, high-performance computing, and search.

### **Computer Architecture and Design (CARD)**

We conduct research in the fields of Computer Architecture and Computer Design. Areas of focus include hardware, hardware / software interfaces, processor technology, and system software.

### **Data and Information Management (DIF)**

The research group focuses on big data, database systems, search, and text mining.

### **Information Systems and Software Engineering (ISSE)**

Our research focuses on empirical information systems, human-computer interaction (HCI), component-based software development, software process improvement, software security, and cooperation technologies.

### **Intelligent Systems (AI)**

The research group focuses on logical, probabilistic and biologically-inspired methods in artificial intelligence (AI), and machine-learning (ML).

## DEPARTMENT OF MATHEMATICAL SCIENCES

Head of department: Professor Einar Rønqvist  
PhD-programme coordinator: Professor Sverre Smalø

<http://www.ntnu.edu/imf/research>

Mathematics is the language of technology and natural science, and an important part of our cultural heritage. It develops continually, and extensive research effort goes into both theoretical and applied mathematics.

The academic staff at the Department of Mathematical Sciences are organized into 5 research groups.

### Algebra

The group's research activity is mostly oriented towards theoretical studies of algebraic questions, but members of the group also work on more applied topics related to cryptography.

### Analysis

The group's research covers several and various disciplines in mathematical analysis: From the Complex analysis, Harmonic analysis and Functional analysis, to Operator algebras and Noncommutative geometry.

### Differential equations and Numerical Analysis (DNA)

The DNA group does research and education in pure and applied mathematics, with a special focus on theory and numerics for differential equations and optimization problems.

### Geometry & Topology

The research in geometry and topology spans problems ranging from fundamental curiosity-driven research on the structure of abstract spaces to computational methods for a broad range of practical issues such as the analysis of the shapes of big data sets.

### Statistics

The research activity includes computational statistics, extreme value theory, design of experiments, reliability analysis, spatial statistics, theoretical statistics, functional genomics, and stochastic and statistical modeling in ecology, evolution and conservation biology.

## **ENGINEERING CYBERNETICS**

Head of department: Morten Breivik  
PhD-programme coordinator: Professor Anton Shiriaev

<http://www.ntnu.edu/itk/>

Engineering Cybernetics is the interdisciplinary study and automatic control of dynamic systems like aircraft, marine craft, robots, automotive systems, electrical circuits, biological systems, process plants, etc. and their behavior. [Cybernetics](#) is closely related to control theory and systems theory. This includes the principles of feedback control and associated stability analysis.

### **Thesis**

The subject of the thesis will be related to the research and development work carried out at the department of engineering cybernetics and affiliated departments at NTNU, SINTEF institutions, and UNIK Kjeller.

### **Main Research Fields:**

#### **Robotics and autonomous systems**

Autonomous systems, robotics, inertial navigation systems and sensor fusion, mechanical systems, marine craft, spacecraft, automotive systems, unmanned vehicles.

#### **Process Control Systems**

Oil and gas production, new energy systems, control of process plants.

#### **Industrial Computer and Instrumentation Systems**

Real-time and embedded system for automatic control.

#### **Fisheries and Aquaculture Systems**

Fisheries and aquaculture cybernetics, monitoring and automation of aquaculture systems, ocean instrumentation, fish telemetry.

#### **Cybernetics in Biomedicine**

Biomedical instrumentation, glucose control, model-based methods, movement analysis, robotic rehabilitation.

## DEPARTMENT OF TELEMATICS

Head of department: Harald Øverby  
PhD-programme coordinator: Professor Colin Boyd

<http://www.ntnu.edu/telematics> Telematics research is the creation of new knowledge about networks and networked services, encompassing technology, society, and economics. Research at the Department of Telematics focuses on the technology aspects, which can be described in terms of a system dimension and a discipline dimension. The system dimension represents knowledge about the architecture of networks and networked services. The discipline dimension represents knowledge about the methods and tools - including mathematics and languages - needed for the specification, design, construction, implementation and validation of networks and networked services. For more information about the ongoing research activities and projects at the Department, please refer to <http://www.ntnu.edu/telematics/research>.

For information about available PhD scholarships please contact the Department or visit [http://www.jobbnorge.no/en/available-jobs/soer-troendelag?searchString=\(ITEM\).Thesis](http://www.jobbnorge.no/en/available-jobs/soer-troendelag?searchString=(ITEM).Thesis)

The subject will normally be related to the research activities that would otherwise take place in the department. The Department has research collaborations with other departments at NTNU, Norwegian and foreign universities as well as Norwegian and foreign telecommunications service providers, enterprises and research institutes.

### Research focus

Research at the Department of Telematics focuses on, but is not limited to, the following topics:

- Quantitative modelling of dependability and performance
- Applied cryptology
- Internet of Things
- Intelligent Transport Systems