

# **PROGRAMME DESCRIPTION FOR THE PhD PROGRAMME IN INDUSTRIAL ECONOMICS AND TECHNOLOGY MANAGEMENT 2017/2018**

**The programme description is based on the Regulations for the Philosophiae Doctor degree (PhD) at the Norwegian University of Science and Technology (NTNU), hereby called PhD Regulations, passed by the Board of NTNU on 23 January 2012. The programme description is revised and approved by the Faculty of Economics and Management, NTNU, on 28 March 2017.**

## **ADMISSION** (§ 5 in the PhD Regulations)

Applicants must have documented previous knowledge equivalent to a Master of Technology degree from the Department of Industrial Economics and Technology Management, within the main subject area of the PhD thesis. For applicants who do not hold a Master of Technology degree from the Department of Industrial Economics and Technology Management, an individual evaluation will be made concerning additional courses needed to meet the academic requirements of the PhD programme. The admission is not valid unless the candidate passes the additional course with the grade B or higher within the given deadline.

Applicants must also have a weighted average grade for the last two years of their master's or equivalent education (equivalent to 120 credits) of B or higher in terms of NTNU's grading scale. Applicants who are unable to meet these criterias may be admitted only if they can document that they are particularly suitable candidates for education leading to a PhD degree.

As a rule, an application for admission to the PhD programme must be submitted within three (3) months of the start-up of the research project that will lead to award of the PhD degree. The application for admission is to be submitted on the standardized form from NTNU, together with project description and other necessary attachments. The PhD plan, including the project description, should be written in consultation with the main supervisor. The main supervisor should, as a rule, be employed at the Department of Industrial Economics and Technology Management.

Requirements for the project description: If the project description is not approved as final, when it is considered together with the application for admission, a final project description according to the Department's standards for formalities, must be submitted within six (6) months after the admission to the PhD programme. It is important that the main research themes are defined early in the study period. Such themes (e.g. research questions to be presented in the scientific articles) should be presented in the final project description.

The Department of Industrial Economics and Technology Management considers applications to the PhD programme on an ongoing basis.

## **INTRODUCTION**

The Department of Industrial Economics and Technology Management places high priority to offering a premier PhD programme that prepares candidates for research and teaching careers at leading educational institutions and for careers where advanced research and analytical capabilities are required. The programme is designed to educate researchers who can contribute in improving and developing the value creation in private and public organizations, emphasizing the interface between management, business and HSE subjects, and technology.

## **LEARNING OUTCOME**

A candidate who has completed the education is expected to have achieved the following learning outcomes, defined in knowledge, skills and competence:

### **Knowledge**

- is at the forefront of knowledge in their field of study
- masters the methods of the field and is familiar with relevant issues of philosophy of science
- is able to consider the usefulness and application of various methods and processes in research and scientific projects

### **Skills**

- is able to present problems for, plan and conduct research and scientific development
- is able to conduct research and scientific development within their area of specialization on an advanced international level
- is able to manage complex scientific issues and challenge established knowledge and practice within the field of study
- is able to contribute to development of new knowledge, new theories and methods within the field

### **Competence**

- is able to identify new relevant ethical issues and conduct their research with academic integrity
- is able to disseminate research and development through recognized national and international channels
- is able to participate in discussions in international forums within the field
- is able to assess the needs for and initiate innovation

## **DURATION, SCOPE AND LEVEL**

Candidates who successfully complete the PhD programme in Industrial Economics and Technology Management are awarded the degree of Philosophiae Doctor, as stated in *Forskrift om grader og yrkesutdanninger, beskyttet tittel og normert studietid ved universiteter og høyskoler*, approved 16 December 2005.

The PhD education programme has a prescribed duration of three (3) years of full-time study (180 ECTS credits). One year of full-time study has a prescribed scope of 60 ECTS.

The PhD programme is hosted by Department of Industrial Economics and Technology Management, Faculty of Economics and Management, Norwegian University of Science and Technology.

Estimated workload per academic year amounts to minimum 1 600 hours and normally not more than 1 800 hours of work for the PhD candidate.

Philosophiae Doctor is a qualification in Third Cycle/Level 8 of *Norwegian Qualifications Framework for Lifelong Learning*, established by the Ministry of Education and Research on 15 December 2011.

## STRUCTURE OF THE STUDY PROGRAMME

### Areas of study

PhD candidates who are submitted to the PhD programme in Industrial Economics and Technology Management can choose one of the following areas of study:

- Strategy and Management
- Operations Management
- Finance and Managerial Economics
- Operations Research
- Health, Safety and Environment

Within each area of study, there will be a number of subjects where the Department's academic staff is qualified to supervise doctoral candidates. The following are examples of subject areas supervised by the Department's staff.

- **Strategy and Management:** Technology Based Entrepreneurship and Industrial Innovation, Marketing and Internationalization.
- **Operations Management:** Industrial Applications of Organization Theory and Organization Development. Operations Management and Technology Management. Knowledge Management, Team Management and Project Management in Technology Based Companies. Business Relationship, Network Management, Purchasing and Logistics Management.
- **Finance and Managerial Economics:** Quantitative analyses and industrial applications within Capital Budgeting, Finance, Business Economics, Financial Management and Game Theory.
- **Operations Research:** Optimization applied to energy systems, production, transportation and logistics by use of linear, non-linear and discrete models with and without stochastic parameters.
- **Health, Safety and Environment:** HSE Management, Safety Management, Environmental Management and Social Responsibility, Occupational Health and Indoor Air Quality.

### Research schools

**Norwegian Research School in Innovation (NORSI):** The main objective of the Norwegian Research School in Innovation is to provide high quality PhD degrees in innovation. A total of ten institutions cooperate on designing the course programme. In addition, a number of experts and lecturers from prestigious international institutions and universities contribute to the course programme. The research school NORSI is funded by the Research Council of Norway. More information can be found on NORSI's website: <http://www.ntnu.edu/innovation/>

### Required course work – Structure and implementation (§ 8 in the PhD Regulations)

The organized academic course work component must cover at least 30 credits in total, of which at least 20 credits must be taken from established PhD level courses. If a master's course is to be included in the required coursework, the passing grade is equivalent to B or higher in terms of NTNU's grading scale.

The PhD course plan must be approved by the Department. Any applications for change of the approved PhD course plan should be submitted on a separate application form and considered by the Department after a recommendation from the main supervisor. The candidate is responsible for signing up for evaluation in courses within the given deadlines.

**Courses that will be offered in the programme and the individual areas of study:**

<b>Code</b>	<b>Title</b>	<b>Credits</b>	<b>Semester</b>	<b>First lecture</b>
<i>Philosophy of Science/Methodological Courses:</i>				
SFEL8000	Philosophy of Science for the Social Sciences	10	A/S	Autumn - 17
<i>Strategy and Management</i>				
IØ8100	Innovation and Entrepreneurship	10	A/S	Autumn - 17
IØ8204	Methods for Research and Consulting of Teams Emphasizing SPGR	10	A	Autumn - 18*
IØ8902	Innovation Research – From Origin to Current Frontier	7,5	A	Autumn – 18*
<i>Operations Management</i>				
IØ8200	Organizational Theory, Technology and Change	20	A	Autumn - 17 / Spring - 18 (duration of the course will be two semesters)
<i>Finance and Managerial Economics</i>				
IØ8303	Energy Markets	10	A	Autumn - 17
IØ8304	Market Risk Analysis	7,5	A	Autumn - 17
<i>Operations Research</i>				
IØ8400	Mathematical Programming	10	S	Spring - 18
IØ8401	Stochastic Optimization	10	A	Autumn - 18 *
IØ8402	Optimization in Maritime Transportation	10	A	Autumn - 18 *
IØ8806	Introduction Course in Complementarity Models and Equilibrium	2,5	A	Autumn - 17
IØ8807	Advanced Course in Complementarity Models and Equilibrium	2,5	S	Spring - 18
<i>Health, Environment and Safety</i>				
IØ8500	Work and Health	10	S	Spring - 18
IØ8502	The Understanding and Management of Safety in Organizations	10	A	Autumn - 18 *
IØ8504	Theory and methods in systems approaches to sustainability	10	S	Spring - 19 *

\*) Lectures will not be given in the academic year 2017/2018.

**Individually selected syllabus for doctoral students**

In addition to the courses in the PhD course catalogue, individually selected syllabus within each subject area is offered, specially designed for each candidate.

**The PhD thesis** (§ 10 in the PhD Regulations)

The thesis is to be an independent piece of academic work that meets international standards with regard to ethical requirements, academic standards and method in the subject area. The thesis must contribute to the development of new scientific knowledge and must achieve a level meriting publication as part of the literature in its field. Specific requirements for the thesis are found in § 10 in the PhD Regulations.

**Doctoral examination** (§ 19 in the PhD Regulations)

When the PhD candidate has submitted an application for assessment of the PhD thesis, there will be appointed an assessment committee, cf. § 14 and § 15 in the PhD Regulations. Faculty of Economics and Management decides, based on the assessment committee's report, whether or not the PhD thesis is worthy of a public defence, cf. § 16 in the PhD Regulations. Regulations concerning PhD theses that have been found *not* worthy of being defended for the PhD degree, are described in the PhD Regulations, § 15.2 and § 17.

When a PhD thesis has been found worthy of being defended for the PhD degree, the candidate must successfully deliver a trial lecture and a public defence the thesis (disputation).

**Assessment** (§ 12 in the PhD Regulations)

The PhD degree is to be awarded on the basis of:

- an approved and published academic thesis
- approved completion of the required coursework or other academic training
- an approved trial lecture on an assigned topic
- an approved public defence of the PhD thesis (disputation)

**METHODS FOR LEARNING****Required coursework**

PhD candidates must pass all courses in the approved PhD course plan, cf. § 8 in the PhD Regulations. The evaluation form will be adapted to the content in each course.

**Reporting** (§ 9 in the PhD Regulations)

During the agreement period, the PhD candidate and main supervisor are to submit separate written reports to the Faculty, describing the candidates progress in the PhD education. The procedure for submission and treatment of these reports are described by Faculty of Economics and Management.

**Academic dissemination** (§ 5.2 in the PhD Regulations)

It is expected that the main results of the thesis are published in international scientific publication channels with referee system. This is considered to be a joint responsibility of both candidate and supervisor. The publication of articles may take place after the completion of the PhD studies.

**Trial lecture and public defence**

An assessment committee will be appointed in order to assess the quality of PhD thesis, the trial lecture and the public defence of the thesis (disputation), cf. § 14 in the PhD Regulations. Based on the assessment committee's evaluation, the Faculty considers if the PhD degree is to be awarded, cf. § 16 and § 20 in the PhD Regulations.

## **INTERNATIONALIZATION** (§ 2 and § 5.2 in the PhD Regulations)

The PhD education is to contribute to internationalization of the research, the academic community and the PhD candidates themselves. The PhD candidates are encouraged to participate in international cooperation in which a stay abroad is included, if this is possible and desirable.

## **ENTREPRENEURSHIP AND INNOVATION**

The PhD programme in Industrial Economics and Technology Management intend to promote innovation across all the areas of study, for the organizations and the practices that the research aims to contribute to.

## **CAREER OPPORTUNITIES**

The PhD programme in Industrial Economics and Technology Management aims to qualify the candidate for research activity and for other work that requires advanced scientific insight. The programme aims to qualify the candidate to carry out independent research within a specialized field as well as undertake advanced professional promotion, including international scientific publication.

## **SPECIAL REQUIREMENTS AND CONDITIONS**

### **Residency requirement** (§ 5.3 in the PhD Regulations)

As a rule, the PhD programme is to be completed at the Department of Industrial Economics and Technology Management, so that the candidate and the Department's staff mutually contribute to the Department's academic environment to the greatest possible extent. The residency requirement is 1 year. An individual assessment of the residency requirement will be made for each application.

## **OTHER RELEVANT INFORMATION**

In the case of changes to the procedures and rules of the PhD programme that can have a bearing on the progress of admitted candidates, the department is responsible for making sure that progress is not unduly delayed.