Master’s Degree Program

Systems Engineering and Industrial Economics
Cohort 2013–2015

HiBu - Faculty of Technology

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Document history
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General description

In this program systems engineering is combined with the study of economical and industrial processes for engineers. The aim is to develop project managers and projects workers who have in-depth knowledge of the project as an industrial development tool as it is used in the Kongsberg industrial cluster.

The program is divided into four main parts:

- Systems engineering is a core subject (30 ECTS credits), and will establish a common systems engineering platform for students from different mono-disciplinary domains. From this common platform the courses will progress to more advanced systems engineering topics.
- The core subject of economics (30 ECTS credits), where students will gain industrial economical knowledge in business marketing, strategy, and business and project finance.
- The in-depth study of industrial processes (22.5 ECTS credits), where students gain knowledge of industrial development and manufacturing processes such as total quality management, innovation, and market-oriented product development.
- Research methodology and thesis (37.5 ECTS credits)

Systems engineering is an engineering discipline. The international organization INCOSE defines systems engineering as follows: “Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem: operations, cost and schedule, performance, training and support, test, manufacturing, and disposal. Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. Systems Engineering considers both the business and the technical needs of customers, with the goal of providing a quality product that meets user needs.”

Learning Outcomes

Students will acquire knowledge in multidisciplinary methods, techniques and formalisms, especially for requirements engineering, decomposition, interfacing, allocation, modeling and analysis. They will gain competence in eliciting requirements and constraints, analyzing problem and solution space, synthesizing solutions, and communicating and justifying solutions via models. The systems engineering skills that will be achieved focus on customer needs, sound decision-making, sound (robust, reliable, safe, well-functioning, maintainable, extendable, etc.) designs and the ability to maintain an overview in a development project at all times.

Professional objectives: The program will enable students to become junior systems engineers. The time required to progress to a full systems engineer is thereby reduced from an average of ten years to five. A junior systems engineer is a broad-based technical engineer who is capable of making multidisciplinary designs. The junior systems engineer must have insights into businesses, markets, applications, processes and organizations in order to be able to make designs that meet the needs of stakeholders.

Educational objectives: Students must learn to make designs in which multiple engineering disciplines are involved. The students have to develop insights into systems architecture (relate

1 INCOSE see website: http://www.incose.org/
system design to stakeholder needs, identify key drivers, make appropriate trade-offs) and competencies in system design (functional and physical decomposition, interface definition, allocation to monodisciplinary engineering disciplines, modeling and analysis).

Students will acquire knowledge in multidisciplinary methods, techniques and formalisms, especially for requirements engineering, decomposition, interfacing, allocation, modeling and analysis. They need competence in eliciting requirements and constraints, analyzing problem and solution space, synthesizing solutions, and communicating and justifying solutions via models. The systems engineering approaches will focus on customer needs, sound decision-making, sound (robust, reliable, safe, well-functioning, maintainable, extendable, etc.) designs and the ability to maintain an overview at all times.

**Admission requirements**

Admissions are regulated in the standard BUC requirements for master programs ([http://www.hibu.no/studenter/regler_og/](http://www.hibu.no/studenter/regler_og/)). Applicants must fulfill the academic requirements and have a grade average of C or above. Part-time applicants with sufficient relevant practical experience may have a lower grade average.

Academic requirements:

- Bachelor of Engineering following or equivalent to the Norwegian curriculum for a bachelor of engineering program (Link to curriculum at [http://www.uhr.no/organisering/nasjonale_rad/nrt/sentrale_dokumenter](http://www.uhr.no/organisering/nasjonale_rad/nrt/sentrale_dokumenter)).

- Bachelor of Science with a focus in meteorology and oceanography from the University of Oslo or a similar degree.

- Equivalent education in science and engineering may qualify for admission. Such evaluations will be made on an individual basis.

- Applicants over the age of 25 with sufficient competence may be admitted in accordance with circular F-55-00 from the Ministry of Education.

- Applicants must provide documentation of English language skills on a level equivalent to that of the Norwegian secondary school system.

**Qualification awarded**

Master of Systems Engineering and Industrial Economics
(Norwegian title: Master i Systems Engineering med Industriell Økonomi)

**Access to further studies**

Students who graduate from the program and who fulfill the requirements set by the Stevens Institute of Technology can be accepted for PhD studies there. PhD opportunities at other universities in Norway and/or abroad will be made available at a later date.

**Learning Strategy**

Teaching methods will be focused on providing students with relevant real-life cases and opportunities. A combination of lectures, group work, project work and supervision is used.
The main delivery method is a number of five-day intensive theoretical courses organized as a one-week course followed by 10 weeks of project work, which will be the first step towards applying theories and working on reflection. The scope of the project work is smaller than in other systems engineering programs so as to adapt to the structure of a program worth 7.5 ECTS credits. Weekly supervisory sessions with faculty staff and work in study groups will take place during this period.

**Final examination**
Assessment and grading is based on the student’s individual performance in all courses. The grading scale is from A to F. Details of the assessment method and duration is given in each course description. If a course assessment comprises two or more parts of an examination, project assignment or similar, the proportion awarded to each part is given as a percentage. A pass grade must be obtained for each course. Compulsory laboratory work, exercises and assignments must be approved before the student can take the final examination in a course.

During written examinations students are allowed to use any type of calculator except those equipped with wireless communication.

The criteria for assessment are based on group reports and individual reports with a focus on:
1. How theory is applied in the project.
2. Reflections made on theory and the project.

Each course will have its own set of individual assessment criteria. Courses requiring specific skills and knowledge will be assessed on the basis of a written or oral examination.

**Examination and assessment regulations**
Norwegian language regulations: [http://www.hibu.no/studenter/eksamen/eksamensforskrift/](http://www.hibu.no/studenter/eksamen/eksamensforskrift/)

**International programs**
Foreign exchanges and elective courses may be undertaken at the Stevens Institute of Technology in the USA, and at other approved universities. Erasmus and Norplus programs will be available at a later stage.

**ECTS Departmental Coordinator**
Kjell Enger
### Course structure – full time

**Table 2: Program Structure full time**

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
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<tbody>
<tr>
<td>1st semester (fall)</td>
<td>2nd semester (spring)</td>
</tr>
<tr>
<td>Fundamentals of Systems Engineering</td>
<td>Systems Supportability and Logistics</td>
</tr>
<tr>
<td>Project cost Accounting</td>
<td>Process Innovation</td>
</tr>
<tr>
<td>Strategic Management</td>
<td>Project management of Complex Systems</td>
</tr>
<tr>
<td>Product Innovation</td>
<td>Research Methods</td>
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<tr>
<td>3rd semester (fall)</td>
<td>4th semester (spring)</td>
</tr>
<tr>
<td>Systems Architecture and Design</td>
<td>Master- Thesis</td>
</tr>
<tr>
<td>Global Business Innovation</td>
<td>Master- Thesis</td>
</tr>
<tr>
<td>Financial Statement Analysis and valuations</td>
<td>Master- Thesis</td>
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**Notes:**
- Full-time students are expected to complete all courses within the specified semesters.
- The Master-Thesis course is offered during the 4th semester of both years.
<table>
<thead>
<tr>
<th>Course</th>
<th>ECTS credits</th>
<th>Assessment</th>
<th>Assessment scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEFS 6102 Fundamentals of Systems Engineering</td>
<td>7.5</td>
<td>100% individual report</td>
<td>A-F</td>
</tr>
<tr>
<td>BUS410 Product Innovation</td>
<td>7.5</td>
<td>First assignment is mandatory only, second 40%, third 40%, final oral presentation 20%</td>
<td>A-F</td>
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<tr>
<td>BBED4010K Project Cost Accounting</td>
<td>7.5</td>
<td>40% 4 hour mid-term exam 60% individual written exam</td>
<td>A-F</td>
</tr>
<tr>
<td>MET 420 Strategic Management</td>
<td>7.5</td>
<td>Individual written exam</td>
<td>A-F</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<th>ECTS credits</th>
<th>Assessment</th>
<th>Assessment scale</th>
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</thead>
<tbody>
<tr>
<td>SESL 6202 Systems Supportability and Logistics</td>
<td>7.5</td>
<td>20% group report 80% individual report</td>
<td>A-F</td>
</tr>
<tr>
<td>SEPM 6102 Project Management of Complex Systems</td>
<td>7.5</td>
<td>20% group report 80% individual report</td>
<td>A-F</td>
</tr>
<tr>
<td>BMET4010K Research Methods</td>
<td>7.5</td>
<td>First assignment 20%, second 30%, third 40%, final oral presentation 10%</td>
<td>A-F</td>
</tr>
<tr>
<td>BUS415 Process Innovation</td>
<td>7.5</td>
<td>First assignment is mandatory only, second 40%, third 40%, final oral presentation 20%</td>
<td>A-F</td>
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<td><strong>Total</strong></td>
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<th>Assessment scale</th>
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<tbody>
<tr>
<td>BUS420 Global Business Innovation</td>
<td>7.5</td>
<td>First assignment is mandatory only, second 40%, third 40%, final oral presentation 20%</td>
<td>A-F</td>
</tr>
<tr>
<td>BED420 Financial Statement Analysis and valuations</td>
<td>7.5</td>
<td>30% home exam 70% individual written exam</td>
<td>A-F</td>
</tr>
<tr>
<td>BED485 Strategic Management Accounting</td>
<td>7.5</td>
<td>40% home exam 60% individual written exam</td>
<td>A-F</td>
</tr>
<tr>
<td>SEAD 6102 Systems Architecture and Design</td>
<td>7.5</td>
<td>100% individual reports</td>
<td>A-F</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30.0</strong></td>
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<tr>
<th>Course</th>
<th>ECTS credits</th>
<th>Assessment</th>
<th>Assessment scale</th>
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<tbody>
<tr>
<td>SETH 6301 Master’s Thesis</td>
<td>30</td>
<td>Project paper</td>
<td>A-F</td>
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<tr>
<td><strong>And Total</strong></td>
<td><strong>30.0</strong></td>
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</table>
1. LEARNING OUTCOMES
After successfully completing this course the student shall:

- Have an understanding of the discipline of systems engineering and be able to use the core principles and processes for designing effective systems.
- Be able to determine customer needs and distinguish between needs and solutions.
- Be able to translate customer requirements into design specifications.
- Be able to analyze system requirements to make a system reliable, supportable and maintainable throughout the system’s life cycle.

2. COURSE CONTENT
Business Drivers for Systems Engineering – Technology, business, and organizational trends that are increasing system complexity and the importance of system integrators; benefits of a disciplined systems engineering process.

Overview of the Systems Engineering Process – Definition of systems engineering as a process which transforms a functional need into a complete set of system specifications; introduction of the in-class project.

Stakeholder Requirements and System Concepts – Active and passive stakeholders, voice of the customer, acceptance criteria and techniques for systematically evaluating and choosing between alternative concepts.

System Capabilities and Characteristics – System scope, context diagrams, use case scenarios, checklists, input/output matrices and quality function deployment.

Completing the System Requirements – Integrating the desired characteristics and capabilities into well-written requirements that are suitable for detailed design purposes; using a requirements management tool (CORE).

Developing a Functional Architecture – The nature of functions in systems engineering, the distinction between a function and the physical component to which it is allocated, functional decomposition and use of a functional modeling tool.

Fundamentals of Life Cycle Analysis – The concept of operational effectiveness, introduction to supportability engineering processes, and integrating life-cycle considerations into the system design process.

Risk Management and Other Program Issues – Risk as an integral component of technical, cost and schedule performance, risk management and mitigation, and the relationship between systems engineering and program and project management.
Systems Requirements Review (SRR) – Presentations by each project team of a modified SRR for their class project.

3. **TEACHING METHODS**
The course combines lectures and readings to develop an understanding of key systems engineering concepts and principles. Students will be exposed to numerous case studies and illustrative examples. A team project will allow students to integrate their knowledge and apply it in a team environment. The course is designed to facilitate the sharing of experiences among the professionals who participate in the program.

4. **PREREQUISITES**
   Master’s degree entry level.

5. **ATTENDANCE**
   Full attendance during the intensive course week is compulsory.

6. **ASSESSMENT METHODS**
   **Continuous Assessment**
   Approval of in-class team project. Class and project participation is compulsory.

   **Final assessment**
   Individual report from 10-week homework period after the course counts for 100%.

   **Assessment type/scale**
   Letters, A - F

   **Aids allowed**
   All

7. **LITERATURE/READINGS**

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<tr>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Publisher</th>
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<tr>
<td>Clayton M. Christensen</td>
<td>2005</td>
<td>The Innovator’s Dilemma</td>
<td>Collins</td>
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<tr>
<td>Henry Petroski</td>
<td>1996</td>
<td>Invention by Design</td>
<td>Harvard</td>
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</table>

8. **NAME OF LECTURER**
Professor Alberto Sols
1. **LEARNING OUTCOMES**

After successfully completing this course the student shall:

- Be able to perform and understand the practical heuristics for developing good architectures.
- Be able to analyze the relationship between early architecture decisions driven by customer requirements and the concept of operations, and system operational and support costs.
- Be able to analyze the implications of open system architectures and the use of commercial technologies and standards (COTS).
- Be able to perform a functional analysis, decomposition and requirements flow-down.

2. **COURSE CONTENT**

Introduction to System Architecture; Strategic Role of Architectures – The architecture metaphor; technology, business, and organizational trends that are increasing system complexity and the importance of architecture to system integrators.

Review of SE Fundamentals – Review of the systems engineering process from customer needs to system requirements; benefits of a disciplined systems engineering process; introduction of the hands-on case study which students will model during the class.

Developing the Functional Architecture – Overview of the architecture process and developing a logical architecture; scenario tracing.

Functional Architecture Tradeoffs – Extending the decomposition process; architectural considerations and trade-offs.

Developing the Physical Architecture; Interface Architectures – The distinction between functional and physical architectures; developing a physical architecture that implements a logical design; the role and importance of interfaces; specifying an interface architecture.

Completing the System Model; Functional Modeling – Integrating functional and physical views into a comprehensive system model, linking requirements to models and the flow-down of requirements to every level of the system design; building and using executable functional models.

Architecture Assessment; Object Oriented Methods; Architecture Frameworks – Characteristics of a good architecture, architectural metrics, examples of system architectures and trade-offs; object-oriented design and its relation to functional decomposition; the Zachman, DoDAF and other frameworks for describing system architectures.
System Integration and Testing; Completion of the Hands-On Case Study – The qualification process and its relationship to requirements development; preparation of PDR presentations for the in-class projects.

Preliminary Design Review (PDR) – Presentations by each project team of a modified PDR for their in-class case study.

3. TEACHING METHODS
The course will comprise a combination of lectures and readings to develop an understanding of key systems engineering concepts and principles. Students will be exposed to numerous case studies and illustrative examples. A team project will allow students to integrate their knowledge and apply it in a team environment. The course is designed to facilitate the sharing of experiences among the professionals who participate in the program.

4. PREREQUISITES
Core course in Systems Engineering

5. ATTENDANCE
Full attendance during the intensive course week is compulsory.

6. ASSESSMENT METHODS

Continuous Assessment
Approval of in-class team project. Class and project participation is compulsory.

Final assessment
Individual report from 10-week homework period after the course counts for 90%. Individual 3-5 page paper reviewing one of the provided papers counts for 10%.

Assessment type/scale
A-F

Aids allowed
All, included provided papers

7. LITERATURE/READINGS

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<th>Author</th>
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<tr>
<td>Dennis M Buede</td>
<td>2000</td>
<td>The Engineering Design of Systems</td>
<td>Wiley</td>
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<tr>
<td>Friedenthal, Moore,</td>
<td></td>
<td>A Practical Guide to SysML</td>
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<td>Steiner</td>
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<td>(Booch, Maksimchuk,</td>
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<td>Object-Oriented Analysis and Design with</td>
<td></td>
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<tr>
<td>Engle, Young, Conallen,</td>
<td></td>
<td>Applications</td>
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<td>Houston)</td>
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8. NAME OF LECTURER
Professor Robert Cloutier
1. LEARNING OUTCOMES
After successfully completing this course the student shall:

- Be able to analyze and use the project as a tool to meet a given set of requirements.
- Be able to develop their project manager’s role as the application of knowledge, skills, tools, and techniques through the five phases of initiating, planning, executing, controlling and closing work in a project.
- Be able to practice the tools and methodologies useful for effective management of systems engineering and engineering management projects.
- Be able to use advanced concepts of project management and understand the building blocks for managing complex systems.
- Be able to understand and implement proper business ethics in their project manager role.

2. COURSE CONTENT
What is a project and project management? What is program management? Benefits and obstacles of project management; basic concepts of project management; defining roles of leadership in a project; what are complex systems?

Bounding project scope – Creating the project charter; project classification frameworks.

Leading and managing the project team – The difference between management and leadership; power and the influencing of behavior; Situational aspect of leadership styles and follower readiness; team-building and conflict resolution techniques; successful motivation practices; effective leader communications.

Work breakdown and organizational structures – Work breakdown structures; organizational structures; selecting the organizational form; selecting the project manager; building the project team; complex systems: organizational issues.

Task planning – Introduction to estimation; time estimates; equipment driven activities; labor-driven activities; software estimates.

Project network modeling – Introduction to networks; creating the network; determining the critical path; Gantt charts; fast-tracking the project schedule.

Project management software – MS Project and other software packages; Gantt charts; MS project tutorial.

Resource leveling and project budget – Resource leveling; generating a project budget; management reserve/contingency funds; budget estimation tips.
Project control – Elements of project control; earned value analysis; change control and configuration management.

Project quality management – Project metrics; calculate performance metrics; quality control; quality assurance.

Contracting and subcontracting – The project manager’s role in supplier and subcontractor management.

Risk management – Risk management process; identifying risks; qualitative and quantitative techniques; risk mitigation.

Evaluating, directing, and closing out a project – Independent assessments; project close-out; lessons learned.

Business ethics – The importance of ethics in the project management profession.

3. TEACHING METHODS
This modular course combines lectures, classroom activities, case studies, and readings to develop an understanding of project management concepts and principles for complex systems. A project assignment allows students to integrate and apply their knowledge.

4. PREREQUISITES
Core course in Systems Engineering

5. ATTENDANCE
Full attendance during the intensive course week is compulsory.

6. ASSESSMENT METHODS

Continuous Assessment
Team report from in-class project counts for 20%. Class and project participation is compulsory.

Final assessment
Individual report from 10-week homework period after the course counts for 80%

Assessment type/scale
A-F
Aids allowed
All

7. LITERATURE/READINGS

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<tr>
<th>Author</th>
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<th>Title</th>
<th>Publisher</th>
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<tbody>
<tr>
<td>A J Shenar &amp; D Dir</td>
<td>2007</td>
<td>Reinventing Project Management</td>
<td>Harvard</td>
</tr>
<tr>
<td>Harold Kerzner</td>
<td>2006</td>
<td>Project Management Case Studies</td>
<td>Wiley</td>
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8. NAME OF LECTURERS
Professor Alberto Sols, Industry Professor Jan Erik Korssjøen
SESL 6202  
**SYSTEMS SUPPORTABILITY AND LOGISTICS**  
7.5 ECTS

<table>
<thead>
<tr>
<th>Language of instruction:</th>
<th>Masters Systems Engineering; Industrial Economy</th>
<th>Semester:</th>
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<tbody>
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<td><strong>English</strong>*</td>
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<td><strong>SPRING</strong></td>
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</table>

1. **LEARNING OUTCOMES**

After successfully completing this course the student shall:

- Have a thorough view of the aspects of support and sustainment of systems from early stages to the eventual phase-out, and be able to use these aspects in their own systems designs.
- Be able to understand and analyze the logistic support elements and their inter-relationships and contributions to system supportability.
- Be able to understand and analyze the supply chain’s effect on systems supportability.
- To be able to communicate effectively through professional documentation and configuration management.
- To be able to determine manpower, personnel, and training requirements and be able to manage these dimensions in systems supportability.

2. **COURSE CONTENTS**

The course is divided into the following sections:

1. Introduction to integrated logistics support. The transition of logistics to integrated logistics support, under the advent of the systems approach. Logistics support elements and related disciplines.
6. Inventory management. Concept and types of inventory. Advantages and disadvantages of inventories.
7. Transportation. Concept and types of transportation; advantages of each transportation means. Methods for planning transportation.
8. Facilities. Concept and types of facilities. Criteria to be used in the selection of facilities.
11. Manpower, personnel, training and knowledge management. Determination of manpower, personnel and training requirements. Concept of data, information and knowledge; knowledge management. Knowledge maps. Use of knowledge maps for manpower, personnel and training-related purposes.

12. Performance based logistics. Concept of performance-based logistics (PBL); reasons for evolving the outsourcing paradigm to contracting results and not resources. Main barriers to implementing a PBL contract. Selected examples of PBL contracts.

3. TEACHING METHODS
Lectures, plenary discussions and group work on cases.

4. PREREQUISITES

5. ATTENDANCE
Students must participate in group work on cases.

6. ASSESSMENT METHODS

7. Continuous Assessment
8. Team report from in-class project counts for 20%. Class and project participation is compulsory.
9. 
10. Final assessment
11. Individual report from 10-week homework period after the course counts for 80%

Assessment type/scale
A-F
Aids allowed
All

12. LITERATURE/READINGS

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<th>Author</th>
<th>Year</th>
<th>Title</th>
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<tbody>
<tr>
<td>Garret Hardin</td>
<td>1968</td>
<td>The Tragedy of the Commons</td>
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</table>

13. NAME OF LECTURERS
Professor Alberto Sols
1. **LEARNING OUTCOMES**

After successfully completing this course the student shall:

- Be able to undertake a real-life systems engineering project from problem formulation through reporting.
- Be able to use and evaluate methods and techniques from the systems engineering body of knowledge and from scientific theory and methodology in industrial projects.
- Be able to report their project through industrial and academic publication channels.

2. **COURSE CONTENT**

   Scientific theory and methodology. In their project definition students must demonstrate an understanding and application of scientific methodology before thesis project is approved. The work may be carried out on an individual basis or in groups. The work must be documented scientifically through reports according to recognized guidelines. The final project will be concluded with a presentation of the work. The final project is an independent systems engineering development project. The project may include the entire process of systems engineering development, but may alternatively focus on selected areas of systems engineering. The final project should be carried out in collaboration with industry but may also be carried out in collaboration with a research institution in Norway or abroad.

3. **TEACHING METHODS**

   Project work.

4. **PREREQUISITES**

   It is recommended that most of the program courses are completed and passed before starting work on thesis.

5. **ATTENDANCE**

   Students must participate in supervisory sessions with members of the teaching staff.

6. **ASSESSMENT METHODS**

   **Final assessment**
   Project report and presentation 100%.

   **Assessment type/scale**
   A-F

   **Aids allowed**
   All

7. **LITERATURE/READINGS**

```mermaid
<table>
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<tr>
<th>Author</th>
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<tr>
<td></td>
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<td>Literature on Scientific Theory and</td>
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```
1. **LEARNING OUTCOME**
   To be able to compete in an ever changing market, companies have to create new products and services. This course takes the candidate through the product design process from need finding to prototyping. The aim of the course is to give the student knowledge to discover business opportunities within the fields of new products and services.

2. **Competence**
   After graduation the candidate are acquainted with the newest theories, interpretations, methods and techniques within the field.

   The candidates have profound view of the social science to be able to deal with boundaries between NPD (new product development) and other disciplines within theory and practise.
   The candidates have profound view of various methodological and analytical tools match related decision problems, theories and context in a valid and efficient way (empery).
   The candidates are acquainted with the newest theories, interpretations, methods and techniques (depth).
   The candidates have “performance management”- understanding related to his/her topic specialization giving her/him a good view of how a contribution to a company's value creation is influenced and subject to various circumstances in the research-, decision- and implementing process.

3. **Skills**
   After graduation the candidate should have a good command of needfinding, prototyping, documentation and presentations within the discipline at an advanced level. This means in practice:

   The candidates are qualified to make an original, albeit limited, contribution within the canons of the discipline, e.g. final thesis.
   The candidates are qualified to communicate both with specialists and other co-workers and reflect on ethical topics and social responsibility.
   The candidates are qualified to expert- and management employment within the topic. They should be able to conduct strategically analyzes, prepare plans and organize recourses in an effective manner.
   The candidates are able to show originality and creativity with regard to the handling of the discipline within the frames of critical realism and prevailing ethical norms.
   The candidates are able to contribute effectively within a team and as leader of a project process.
   The candidates are independently able to constantly refresh his/her knowledge within this specific topic and utilize new acquired knowledge through the whole professional career.

4. **General Competence**
   Candidates have acquired a broad platform to be able to contribute within private and public business and other organizations with a focus on innovation and value creation as experts, advisors, management or education and training.
   Candidates have a profound platform of competence to be able to follow critically and interpret the newest development in theory and practice within business related situations.
   Candidates are competent to proceed with PHD-studies locally as well as overseas.

The design process thought in this course, unlike many other design and development processes, is cyclical. By going through the process multiple times, not only does it maximize candidate learning, it maximizes project insights for the candidate teams. The iterative nature assures that teams are not stuck on one idea for too long and that ideas are being continuously tested through rapid prototyping and testing. Throughout the project, candidate teams repeatedly diverge, expand their horizons to
discover new ideas, and converge, realize their ideas to develop new insights. “Fail early and fail often so you can succeed faster,” is one of the mantra for this course.

By continuously weaving back and forth between the different phases of the design process, candidate teams are continuously challenged to move the design forward through prototypes, record their discovered knowledge through documentation, and preserve and communicate their vision through presentations.

5. 2.COURSE CONTENTS

Topics
These are examples of topics to be covered during the course.
Opportunity findings and evaluation
Need findings
Stakeholder Analyses
Triz
Trend Prediction, Foresight Methods
Idea generating processes
Robust design.
Development processes like Set Based Development /Stage Gate
Barriers to Innovation in Organizations

6. Case from Corporate partners
I vital part of the course will be real development NPD projects coming from global companies small and large in various industries including consumer electronics, automotive, telecommunications, healthcare, aeronautics, software, households products, transportation, even cosmetics. Increasingly focused 3-5 years in the future, project topics are often broad enough so that candidates must not only solve but define the problem while delivering surprise and delight to the corporate partners. At the same time, projects should be well defined so that candidates are working within a realistic context, the best training ground for innovators of tomorrow.

Each corporate project will attended by 3-4 master candidates,

7. TEACHING METHODS
Lectures and group assignments will be a vital part of the teaching methods. Through the projects, candidates go through an intense and iterative process of need finding, ideation, and rapid prototyping to create and evaluate new concepts. Company involvement provides the reality check necessary for teams to improve their innovation abilities. In the end, teams deliver functional proof-of-concept prototypes along with in-depth documentation that not only capture the essence of designs but the learnings that led to the idea.

8. PREREQUISITES
Finished bachelor degree.

9. ATTENDANCE
Voluntary attendance during lectures. Partly voluntary participation in group processes.

10. ASSESSMENT METHODS
Continuous Assessment and Final assessment
Mandatory group tasks (max 5 students per group) and presentations. There will be 3 written group assignments through the course. First assignment is mandatory only, second counts 40 %, third 40 %, while final oral presentation counts 20 % of the final grade.

Assessment type/scale
Graded marks between A and F. A is best mark while F is "not passed". All 3 assignments as well as final presentation need a "pass".
Aids allowed
No limitations.

11. LITERATURE/READINGS

Handouts and written material presented by lecturers during the course.
Statutory and Cursory textbooks as well as articles to be announced at course start-up

12. NAME OF LECTURERS

To be announce at start-up.
1. **LEARNING OUTCOMES**

The students shall

- Develop an understanding of the fundamentals of cost accounting.
- Develop skills in cost allocation and cost-volume-profit analysis.
- Develop an understanding of cost behavior.
- Develop skills in capital investment analysis and budgeting.

2. **COURSE CONTENTS**

3. Fundamentals of cost accounting
4. Cost allocation
5. Cost-volume-profit analysis
6. Determining cost behavior
7. Budgeting
8. Capital investment analysis
9. Analysis of profitability
10. Sensitivity analysis
11. Discount rate

3. **TEACHING METHODS**

Lectures and class discussions, case work and group presentations. Working with cases will be an important part of the learning activity.

4. **PREREQUISITES**

None

5. **ATTENDANCE**

6. **ASSESSMENT METHODS**

The students must pass a mid-term home exam and a final 4-hour written exam.

**Continuous Assessment**

Mid-term home-exam counts for 40% of the total grade.

**Final assessment**

Written final exam counts for 60% of the total grade.

Support materials for written exam:

Calculator
Grading scale
Grades A to F, where A denotes the highest pass grade and F denotes a fail.

7. LITERATURE/READINGS

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<th>Author</th>
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List of articles will be available at the start of the semester.

8. NAME OF LECTURERS

Eskil Le Bruyn Goldeng
9. LEARNING OUTCOME
The aim of the course is to give the student knowledge to discover business opportunities within the fields of new and better business processes. We adopt a holistic approach to enterprise transformation.

Competence
After graduation the candidate are acquainted with the newest theories, interpretations, methods and techniques within the field.

1. The candidates have profound view of the social science to be able to deal with boundaries between Business Processes and other disciplines within theory and practise.
2. The candidates have profound view of various methodological and analytical tools match related decision problems, theories and context in a valid and efficient way (empery).
3. The candidates are acquainted with the newest theories, interpretations, methods and techniques (depth).
4. The candidates have “performance management”- understanding related to his/her topic specialization giving her/him a good view of how a contribution to a company’s value creation is influenced and subject to various circumstances in the research-, decision- and implementing process.

Skills
After graduation the candidate should have a good command of Process Mapping, Documentation and Presentations within the discipline at an advanced level. This means in practice:

1. The candidates are qualified to make an original, albeit limited, contribution within the canons of the discipline, e.g. final thesis.
2. The candidates are qualified to communicate both with specialists and other co-workers and reflect on ethical topics and social responsibility.
3. The candidates are qualified to expert- and management employment within the topic. They should be able to conduct strategically analyzes, prepare plans and organize recourses in an effective manner.
4. The candidates are able to show originality and creativity with regard to the handling of the discipline within the frames of critical realism and prevailing ethical norms.
5. The candidates are able to contribute effectively within a team and as leader of a project process.
6. The candidates are independently able to constantly refresh his/her knowledge within this specific topic and utilize new acquired knowledge through the whole professional career.

General Competence
1. Candidates have acquired a broad platform to be able to contribute within private and public business and other organizations with a focus on innovation and value creation as experts, advisors, management or education and training.
2. Candidates have a profound platform of competence to be able to follow critically and interpret the newest development in theory and practice within business related situations.
3. Candidates are competent to proceed with PHD-studies locally as well as overseas.

The design process thought in this course, unlike many other design and development processes, is cyclical. By going through the process multiple times, not only does it maximize candidate learning, it maximizes project insights for the candidate teams. The iterative nature assures that teams are not stuck on one idea for too long and that ideas are being continuously tested by the corporate partner. Throughout the project, candidate teams repeatedly diverge, expand their horizons to discover new ideas, and converge, realize their ideas to develop new insights. “Fail early and fail often so you can succeed faster,” is one of the mantra for this course.
By continuously weaving back and forth between the different phases of the design process, candidate teams are continuously challenged to move the design forward through process sketches, record their discovered knowledge through documentation, and preserve and communicate their vision through presentations.

10. COURSE CONTENTS

Topics
These are examples of topics to be covered during the course.
- Identify relevant stakeholders and determine their value propositions
- A-3
- Traditional’ manufacturing processes and process variability
- Problem-solving using a QI-story format - QFD
- Ensure stability and flow within and across the enterprise
- Process flow, takt time, and balance
- Demand pull, Supply chain management
- Value Stream Mapping
- Visual management S
- Product customization
- Focus on enterprise effectiveness before efficiency
- Address internal and external enterprise interdependencies
- Cultivate leadership to support and drive enterprise behaviours
- Emphasize organizational learning

Corporate partners
A vital part of the course will be real process development projects coming from global companies small and large in various industries including consumer electronics, automotive, telecommunications, healthcare, aeronautics, software, households products, transportation, even cosmetics. Increasingly focused 3-5 years in the future, project topics are often broad enough so that candidates must not only solve but define the problem while delivering surprise and delight to the corporate partners. At the same time, projects should be well defined so that candidates are working within a realistic context, the best training ground for innovators of tomorrow.

11. TEACHING METHODS

Lectures and group assignments will be a vital part of the teaching methods. A real industrial case is used as a tool for teaching complex lean concepts. At its most basic, it is a mode of active learning. More specifically, the goals for the case include 1) increased comprehension of the curriculum, 2) better understanding of the context and holistic, system-spanning nature of the process, 3) learning through experience via use of the case as a practice field, and 4) increased student involvement and enthusiasm for the material.

12. PREREQUISITES

Finished bachelor degree.

13. ATTENDANCE

Voluntary attendance during lectures. Partly voluntary participation in group processes.

14. ASSESSMENT METHODS

Continuous and Final Assessment
Mandatory group tasks (max 5 students per group) and presentations. There will be 3 written group assignments through the course. First assignment is mandatory only, second counts 40 %, third 40 %, while final oral presentation counts 20 % of the final grade.

Assessment type/scale
Graded marks between A and F. A is best mark while F is “not passed”. All 3 assignment as well as final presentation need a “pass”. 
Aids allowed
No limitations.

15. LITERATURE/READINGS
Handouts and written material presented by lecturers during the course.
Statutory and Cursory textbooks as well as articles to be announced at course start-up.

16. NAME OF LECTURERS
To be announces at start-up.
1. LEARNING OUTCOMES

After completion of the course the student shall:

- Possess comprehensive knowledge about research methods that are relevant to industrial economics and technological management.

- Be able to conduct an independent study and data analysis, with advisory support from faculty members, and which is consistent with research ethical norms.

- Be able to apply industrial economics and technological management knowledge to conduct advanced analysis in new areas of analyses and projects.

- Be able to contribute to innovative processes and innovations in industrial economics and technological management.

2. COURSE CONTENTS

- Decision-making problems and research problems related to industrial economics and technological management.

- Basic elements of research.

- Philosophy of science and ethics in research.

- Research designs.

- Measurement.

- Sampling and data collection.

- Data analysis with SPSS.

- Interpretation, validity, and applications of results.

- Writing and presenting research reports.

3. TEACHING METHODS

The research methods course will include lectures, discussions, assigned readings, in-class and take-home exercises, individual and small group problem-solving exercises, presentations by
students, and hands-on use of SPSS. This variety provides opportunities for students to learn in different ways.

Both the students and the professor are challenged equally to make the learning experience a success. Each and every person draws upon his or her own experiences and talents to help others understand the course materials and accomplish the learning objectives. The students are expected to come to class prepared to participate in all activities that are scheduled in the course calendar.

The course will include in-class and take-home exercises, individual and small group problem-solving exercises, presentations by students, and hands-on use of SPSS. The course calendar will schedule the different exercises.

4. PREREQUISITES

None

5. ATTENDANCE

No requirement

6. ASSESSMENT METHODS

Continuous Assessment

None

Final assessment

The exam paper counts for 100% of the course grade. The paper assignment will challenge the students to conduct an advanced independent study/analysis where they also are expected to apply industrial economics and technological management knowledge in a productive and innovative fashion to solve decision and research problems. The paper can be written individually, or in groups of no more than 4 students. Two paper-based copies of the paper must be submitted to the exam office by the deadline set in the course calendar.

Assessment type/scale

Grades A-F

Aids allowed

N/A

7. LITERATURE/READINGS

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
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<tbody>
<tr>
<td>Janina Jolley</td>
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8. NAME OF LECTURER

Eskil Le Bruyn Goldeng
1. LEARNING OUTCOMES

After completion of the course the student shall:

- Possess comprehensive knowledge about strategic management concepts, theories, processes, and methods.
- Be able to conduct strategic analyses at business unit level and for specific product concepts.
- Be able to apply industrial economics and technological management knowledge to conduct and implement advanced strategic decisions.

2. COURSE CONTENTS

- Strategy and performance.
- Environmental and industrial analysis.
- Firm boundaries and TCE.
- Value chain and resource-based theory.
- Expansion.
- Innovation.
- Organization learning.
- Strategic process, methods and implementation.

3. TEACHING METHODS

The research methods course will include lectures, discussions, assigned readings, in-class and take-home exercises, individual and small group problem-solving exercises and presentations by students. This variety provides opportunities for students to learn in different ways.

Both the students and the professor are challenged equally to make the learning experience a success. Each and every person draws upon his or her own experiences and talents to help others
understand the course materials and accomplish the learning objectives. The students are expected to come to class prepared to participate in all activities that are scheduled in the course calendar.

The course will include in-class and take-home exercises, individual and small group problem-solving exercises and presentations by students. The course calendar will schedule the different exercises.

4. PREREQUISITES
None

5. ATTENDANCE
No requirement

6. ASSESSMENT METHODS

Continuous Assessment
One compulsory paper must be passed in order to qualify for final assessment.

Final assessment
The school exam counts for 100% of the course grade.

Assessment type_SCALE
Grades A-F

Aids allowed
None

7. LITERATURE/READINGS

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<th>Year</th>
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8. NAME OF LECTURERS
BED485  Strategic Management Accounting  7.5 ECTS

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<tr>
<th>Language of instruction’</th>
<th>Semester:</th>
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<tr>
<td>English*</td>
<td>FALL</td>
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1. **LEARNING OUTCOMES**

The student shall:

- Develop an advanced understanding of how firms can gain competitive advantages by making strategic investment and capital budgeting decisions.
- Be able to develop and apply tools for performance management.

2. **COURSE CONTENTS**

   Analysis of profitability
   - Cost drivers
   - Activity-based costing
   - Pricing and target costing
   - Cost of quality
   - Customer profitability analysis

   Performance management/scorecard
   - Kaplan and Norton’s Balanced Scorecard
   - Tableau de Bord and other scorecards
   - Value-based performance management
   - Management compensation and incentives
   - Beyond budgeting

3. **TEACHING METHODS**

Lectures and class discussions, case work and group presentations.

4. **PREREQUISITES**

None

5. **ATTENDANCE**

6. **ASSESSMENT METHODS**

The students must pass a mid-term home exam and a final 4-hour written exam.

- The take-home exam counts for 40% of the total grade.
- The final written exam counts for 60% of the total grade.

Grading scale: A–F.
7. LITERATURE/READINGS

<table>
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<tr>
<th>Author</th>
<th>Year</th>
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<tbody>
<tr>
<td>Anthony A. Atkinson</td>
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A list of articles will be distributed at the start of the semester.

8. NAME OF LECTURERS
1. **LEARNING OUTCOME**

To be able to compete in an ever changing market, companies have to create new Business Models. The aim of the course is to give the student knowledge to discover business opportunities within the fields of new, future oriented and global Business Models.

**Competence**

After graduation the candidate are acquainted with the newest theories, interpretations, methods and techniques within the field.

5. The candidates have profound view of the social science to be able to deal with boundaries between Business Modelling and other disciplines within theory and practise.
6. The candidates have profound view of various methodological and analytical tools match related decision problems, theories and context in a valid and efficient way (empery).
7. The candidates are acquainted with the newest theories, interpretations, methods and techniques (depth).
8. The candidates have "performance management"- understanding related to his/her topic specialization giving her/him a good view of how a contribution to a company's value creation is influenced and subject to various circumstances in the research-, decision- and implementing process.

The course equips students with skills to build new Business Models that can operate locally as well as in other cultures. Learning the tools and techniques for working globally, students apply this knowledge practically by working on business projects with industry contacts in different countries, further enhancing their understanding of international business.

**Skills**

After graduation the candidate should have a good command of needfinding, prototyping, documentation and presentations within the discipline at an advanced level. This means in practice:

7. The candidates are qualified to make an original, albeit limited, contribution within the canons of the discipline, e.g. final thesis.
8. The candidates are qualified to communicate both with specialists and other co-workers and reflect on ethical topics and social responsibility.
9. The candidates are qualified to expert- and management employment within the topic. They should be able to conduct strategically analyzes, prepare plans and organize recourses in an effective manner.
10. The candidates are able to show originality and creativity with regard to the handling of the discipline within the frames of critical realism and prevailing ethical norms.
11. The candidates are able to contribute effectively within a team and as leader of a project process.
12. The candidates are independently able to constantly refresh his/her knowledge within this specific topic and utilize new acquired knowledge through the whole professional career.

**General Competence**

4. Candidates have acquired a broad platform to be able to contribute within private and public business and other organizations with a focus on Business Modell Innovation and value creation as experts, advisors, management or education and training.
5. Candidates have a profound platform of competence to be able to follow critically and interpret the newest development in theory and practice within business related situations.
6. Candidates are competent to proceed with PHD-studies locally as well as overseas.
The design process thought in this course, unlike many other design and development processes, is cyclical. By going through the process multiple times, not only does it maximize candidate learning, it maximizes project insights for the candidate teams. The iterative nature assures that teams are not stuck on one idea for too long and that ideas are being continuously tested through Model Presentation and testing. Throughout the project, candidate teams repeatedly diverge, expand their horizons to discover new ideas, and converge, realize their ideas to develop new insights. “Fail early and fail often so you can succeed faster,” is one of the mantra for this course.

By continuously weaving back and forth between the different phases of the design process, candidate teams are continuously challenged to move the design forward through new Business Models, record their discovered knowledge through documentation, and preserve and communicate their vision through presentations.

2. COURSE CONTENTS

Topics
These are examples of topics to be covered during the course.

- Global brand success
- Joint ventures/alliances/partnerships
- Product liability laws; retail regulations
- Global supply chain management, Offshoring
- Emerging Markets; Family Conglomerates
- New Venture Leadership, Financial Management, Marketing
- The Iceberg Principle of Culture, Cultural stereotypes, idioms, metaphors . Cultural Dimensions (High Context; Collectivism, Power distance, Uncertainty avoidance, Masculinity)
- Language as the expression of culture
- Negotiation patterns
- Overseas visits
- Business modelling (Osterwalder)
- Market entry, expansion, segmentation
- Standardization /adaptation

Case from Corporate partners
I vital part of the course will be real development Business Model projects coming from global companies small and large in various industries including consumer electronics, automotive, telecommunications, healthcare, aeronautics, software, households products, transportation, even cosmetics. Increasingly focused 3-5 years in the future, project topics are often broad enough so that candidates must not only solve but define the problem while delivering surprise and delight to the corporate partners. At the same time, projects should be well defined so that candidates are working within a realistic context, the best training ground for innovators of tomorrow.

Each corporate project will attended by 3-4 master candidates,

3. TEACHING METHODS

Lectures and group assignments will be a vital part of the teaching methods. One visit abroad is part of the course.

PREREQUISITES

Finished bachelor degree.

4. ATTENDANCE

Voluntary attendance during lectures. Partly voluntary participation in group processes.
5. ASSESSMENT METHODS

Continuous and Final Assessment
Mandatory group tasks (max 5 students per group) and presentations. There will be 3 written group assignments through the course. First assignment is mandatory only, second counts 40 %, third 40 %, while final oral presentation counts 20 % of the final grade.

Assessment type/scale
Graded marks between A and F. A is best mark while F is “not passed”. All 3 assignment as well as final presentation need a “pass”.

Aids allowed
No limitations.

6. LITERATURE/READINGS

Handouts and written material presented by lecturers during the course.
Statutory and Cursory textbooks as well as articles to be announced at course start-up.

7. NAME OF LECTURERS

To be announced at start-up.
**BED420**  
**BED425**  
**BED430**  
**Finansiell regnskapsanalyse med verdивurdering**  
- individuell hjemmeeksamen  
- skriftlig eksamen  
7,5 studiepoeng

| Norsk | Spesialisering i bedriftsøkonomisk analyse | HØST |

### 1. LÆRINGSMÅL

Etter avsluttet emne skal studentene

- ha innsikt i bruk av regnskapet som informasjonskilde.
- kunne vurdere hvilke forhold som kan true kvaliteten på regnskapet slik som regnskapsmanipulering og svakheter i regnskapsregelverket.
- kunne bruke regnskapet til analyse av lønnsomhet, soliditet, likviditet og finansiering.
- ha kjennskap til bruk av regnskapet til verdivurdering, konkursprediksjon og kredittitrating.

### 2. INNHOLD

Emnet skal gi en grundig innsikt i regnskapsanalyse og forhold som skaper regnskapsmessig støy. Temaet regnskapsmessig støy vil omfatte svakheter i regnskapsregelverket (norsk og internasjonalt regelverk) og manipulering. Empirisk forskning på regnskapets informasjonsverdi har en sentral plass her. I faget presenteres også ulike teknikker for verdivurdering slik som verdimodeller og bruk av multipler. Under temaet regnskapsbasert måling av risiko presenteres modeller for konkursprediksjon og kredittitrating samt studier som har fokus på regnskapsbasert måling av systematisk risiko.

### 3. LÆRINGSAKTIVITETER

Undervisningen skjer i form av forelesninger og oppgavegjennomgang. Studentene må delta aktivt i undervisningen, og de må påregne og sette seg inn i deler av lærestoffet på egen hånd eller i kollokviegrupper. Høgskolen har ikke ansvar for organisering av eventuelle kollokviegrupper i faget.

### 4. FORKUNNSKAPSKRAV

Emnet krever minst forkunnskaper tilsvarende grunnleggende regnskap og finansregnskap med analyse som er obligatoriske kurs på høgskolekandidatstudiet i økonomi og ledelse.
5. VURDERING

Vurdering gjennom studietiden

Det kan bli gitt en obligatorisk oppgave i løpet av semesteret. Denne oppgaven må være vurdert til bestått for å kunne få avsluttende karakter i emnet.

Avsluttende vurdering

Avsluttende evaluering av emnet skjer i form av to eksamener. En individuell hjemmeeksamen som teller 30 prosent av avsluttende karakter i emnet. Denne hjemmeeksamenen avholdes midtveis i semesteret og må være vurdert til karakteren E eller bedre for at studentene skal kunne gå opp til individuell, skriftlig eksamen.

Individuell, skriftlig eksamen avholdes ved slutten av semesteret og er på 4 timer. Eksamen teller 70 prosent av den avsluttende karakteren i emnet.

Vurderingsuttrykk


Hjelpemidler til eksamen

Ikke-kommuniserbar kalkulator.

6. LITTERATUR

Obligatorisk litteratur

Pensumlitteraturen består av en lærebok (Antall pensumrelaterte sider rundt 450) og et artikkelkompendium (rundt 300 sider).

Bøker


Kompendium med artikler (foreligger ved studiestart)
1. LEARNING OUTCOMES

Quality issues are of increasing importance in an increasing number of business sectors. The development of total quality management (TQM) began in the products industry (cars), spread to the private service sectors, and has today become an issue in the public sector, too. Improved quality in products and services is necessary to compete for customers in a globalized market and is also a key to better profitability for most industries.

After successfully completing this course the student shall:

- Understand and communicate all aspects of quality issues in a corporation
- Know how to develop and apply methods and tools for developing four pillars of any TQM company - customer focus, continuous improvement, total participation and network learning.
- Be able to participate in all kind of TQM activates in their own company or institution and to supervise TQM development in selected areas.
- Have knowledge about theories and practical cases and industrial experience
- Understand how to design and assure quality – do things right the first time and every time.
- Know how to implementing quality and forever improve the quality system.
- Act as TQM manager and responsible for the TQM system.

2. COURSE CONTENTS

The module will cover the following topics:

Understanding quality concepts

- Different perspectives on quality
- Quality theory
- Global supply chain quality and international quality standards

Designing and assuring quality

- Strategic quality planning
- Voice of the customer
- Voices of the market, society and future
- Quality in innovation and in product and process design
- Designing quality services
- Managing supplier quality in the supply chain

Implementing quality
The tools of quality
Statistically based quality improvement for variables
Six sigma management and lean tools

Forever improving the quality system
Managing quality improvement teams and projects
Implementing and validating the quality system

3. TEACHING METHODS
Lectures, group work, cases and term papers

4. PREREQUISITES
Basic knowledge of statistics

5. ATTENDANCE
Students must attend group work sessions.

6. ASSESSMENT METHODS
Course assessment is based on term papers (20%), a group report (3-5 members per group) (30%), and an individual exam (50%).

Continuous assessment
The term papers are after each of 2 modules with instructor feedback.

Final assessment
Individual exam (4 hours) (50%)

Assessment type/scale
Grades A to F, where A denotes the highest pass grade and F denotes a fail.

Aids allowed
None for individual exam.

LITERATURE/READINGS

7. NAME OF LECTURERS
Associate Professor Rolf Qvenild.
This course is part of an accredited degree in the Norwegian Latvian Master’s Degree in Innovation and Entrepreneurship at Riga Technical University, Latvia.