AALBORG UNIVERSITET

BACHELOR (BSC) I TEKNISK VIDENSKAB (PRODUKTIONSUDVIKLING) 2017

BACHELOR (BSC) I TEKNISK VIDENSKAB
KØBENHAVN

MODULER SOM INDGÅR I STUDIEORDNINGEN

INDHOLDSFORTEGNELSE

CLASSIC PRODUCTION AND SERVICE TECHNOLOGIES 2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Students who complete P0 project unit will have gained their first experience in using the problem-based learning method. Furthermore, students will be introduced to the discipline of production and service development.

The students will be required to present a basic analysis of a production process and the social and technical process innovations that made the process possible. The concept must include the basic considerations of business aspects, considerations of simulation vs. physical execution, a trade-off analysis of technological choices and a basic actor analysis. An example application could be an analysis of a classic production technology or of a technology central to a service system. Furthermore the students will be required to prepare a written P0 process analysis of group processes and learning achievements.

LEARNING OBJECTIVES

KNOWLEDGE

- Knowledge about typical work processes in a problem based project.
- Knowledge about the basic principles in scientific work e.g. academic honesty.
- Must have knowledge of what the subject of production development includes.
- Must have knowledge about the concept of contemporary production and services vs. the classic approaches to production and services.
- Must be able to understand the concept of problem based learning.

SKILLS

- Analyze individual as well as organizational learning processes
- Organize a short period (less than a moth) of collaboration in-group and with supervisor
- Communicate the reflections and results of the problem based project work; orally, graphically and in writing
- Must be able to apply problem based learning in group work
- Must be able to perform a trade-off analysis of technological choices

COMPETENCES

- Be able to reflect on the problem-oriented and project-oriented study form and work process.
- Be able to communicate the results obtained from the project work in a project report.
- Be able to collaborate on the problem area's project work and submit a joint presentation of the project work results.
- Be able to reflect on ways of communicating information to others (written, verbally and graphically)

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 7 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS project module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Project in Classic Production and Service Technologies
Type of exam	Oral exam based on a project
ECTS	5
Assessment	Passed/Not Passed
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Klassisk produktion og service teknologi
Module code	M-MOE-B1-1
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Peder Veng Søberg

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

FROM THE CLASSIC TO MODERN PRODUCTION AND SERVICE

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Project in Classic Production and Service Technologies (P0).

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with practical experience defining a project within the area of manufacturing and operations engineering, which includes use innovative and agile production methods and services, to implement the project by working in groups and to document the solution in a project report. To give the students a common understanding of key challenges and developments in the field and to induce a shared feeling of belonging to the study programme.

LEARNING OBJECTIVES

KNOWLEDGE

- Knowledge about manufacturing and operations engineering in order to identify relevant contextual perspectives of a given technology
- Knowledge about project management in a long-term problem based project (in this case 2-3 months)
- Knowledge of methodological consideration to describe the theoretical and empirical foundation of the project
- Must have knowledge about how modern innovation, production and service technology can be used to solve a specific problem
- Must have knowledge about commonly used technologies and approaches for innovative and agile production and service
- Must have knowledge about commonly occurring production and service processes.
- Must have knowledge about the use of modern innovation, production and service technologies
- Must know how to use a programming language to control mechanic or electronic components
- Must know how to use typical programming syntaxes such as conditional branching, loops, etc.

SKILLS

- Analyze individual as well as organizational processes by scientifically recognized concepts and methods
- Organize and manage a longer-term project considering group and supervisor collaboration
- Structure and communicate the reflections and results of the problem based project work; orally, graphically and in writing
- Must be able to work in a team
- Must be able to identify and define a problem suitable for a project involving innovation, agile production and service technologies
- Must be able to identify classic approaches in existing production and service implementations and compare these with modern approaches.
- Must be able to choose and use specific approaches for innovative and agile production and service
- Must be able to plan a systematic test of a chosen production or service technology
- Must be able to discuss/assess the quality of the technology choice in a wider context
- Must be able to program basic programs

COMPETENCES

- Take responsibility of one’s own learning during a longer-termed project period and be able to generalize the gained experiences
- Must have competencies for discussing and comparing classical production and service technologies vs. modern technological approaches
- Must have competences in document and discuss the wider market related implications of a real life application
- Must have competences to coordinate the project, to present the results and communicate the results

- Shall have basic programing skills.

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 7 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 10 ECTS course module the expected workload is 300 hours for the student.

EXAM

EXAMS

Name of exam	Project in From the Classic to Modern Production and Service
Type of exam	Oral exam based on a project
ECTS	10
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Fra klassisk til moderne produktion og service
Module code	M-MOE-B1-2
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	10
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Peder Veng Søberg

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

FUNDAMENTALS OF OPERATIONS MANAGEMENT AND PROCESS MODELLING AND CONTROL

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The objective of the course is to provide the student with a foundation of operations management and process modelling. The student should acquire an understanding of basic principles of operations management and process modelling. This provides a foundation for students for choosing a suitable operations management approach and for modelling and systematically describing the work flow of a production process. Finally, the course will use a relevant computer programming language for modelling a process

LEARNING OBJECTIVES

KNOWLEDGE

- Knowledge about basic organizational theory.
- Must have obtained basic knowledge of transformation processes.
- Must have obtained basic knowledge of operations concepts applicable in manufacturing as well as service contexts.
- Must have obtained basic knowledge of basic mapping tools.
- Must have knowledge about how to model and analyse a simple process.
- Must have knowledge about how to design simple process control using a relevant computer programming language.
- Must have knowledge about how to describe and model a process through, e.g., flow charts.

SKILLS

- Can use basic organizational concepts such as vertical and horizontal specializations.
- Can carry out basic calculations in relation to transformation processes.
- Can map an operations process using process mapping tools.
- Must be able analyse or design a process and describe it in form of, e.g., a flow-chart.
- Must be able to design a computer program for process control based on a flow-chart.

COMPETENCES

- Can problematize operations processes and map out and improve these at different levels.
- Can decide suitable mapping tools for operations challenges at hand in different situations.
- Must have competencies to find the right level of abstraction when designing a flow-chart for a given process.
- Must have competencies to identify the different steps of a process and relate them to the corresponding flow-chart and computer program.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Fundamentals of Operations Management and Process Modelling and Control

Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Grundlæggende operations management og proces modellering og styring
Module code	M-MOE-B1-3
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Peder Veng Søberg

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

PROBLEMBASERET LÆRING I VIDENSKAB, TEKNOLOGI OG SAMFUND

2019/2020

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Viden der gør den studerende i stand til at:
  - Redegøre for den grundlæggende læringsteori
  - Redegøre for teknikker til planlægning og styring af projektarbejde
  - Redegøre for forskellige tilgange til problembaseret læring (PBL); herunder Aalborg modellens udgangspunkt i problemer, der indgår i en samfundsmæssig og/eller humanistisk sammenhæng
  - Redegøre for forskellige tilgange til analyse og vurdering af ingeniør, natur og sundhedsvidenskabelige problemstillinger og løsninger i et videnskabsteoretisk, etisk og samfundsmæssigt perspektiv
  - Redegøre for konkrete metoder inden for fagområdet til at udføre denne analyse og vurdering

FÆRDIGHEDER

- Færdigheder der gør de studerende i stand til at:
  - Planlægge og styre et problembaseret studieprojekt
  - Analysere projektgruppens organisering af gruppesamarbejdet med henblik på at identificere stærke og svage sider, og på den baggrund komme med forslag til, hvordan samarbejdet i fremtidige grupper kan forbedres
  - Reflektere over årsager til og anvise mulige løsninger på eventuelle gruppekonflikter
  - Analysere og vurdere egen studieindsats og læring med henblik på at identificere stærke og svage sider, og der ud fra overveje videre studieforløb og studieindsats
  - Reflektere over de anvendte metoder i et videnskabsteoretisk perspektiv
  - Udpege relevante fokusområder, begreber og metoder til at vurdere og udvikle løsninger under hensynstagen til de samfundsmæssige og humanistiske sammenhænge i hvilke løsningen skal indgå

KOMPETENCER

- Kompetencer, som gør den studerende i stand til at:
  - Indgå i et teambaseret projektarbejde
  - Formidle et projektarbejde
  - Reflektere og udvikle egen læring bevidst
  - Indgå i og optimere kollaborative læreprocesser
  - Reflektere over sit professionelle virke i relation til det omgivende samfund

UNDERVISNINGSFORM

Kurset er organiseret som et mix af forelæsninger, seminarer, workshops, gruppekonsultation og selvstudie.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Problembaseret læring i videnskab, teknologi og samfund

Prøveform	Skriftlig Kurset eksamineres individuelt på baggrund af en skriftlig opgave.
ECTS	5
Bedømmelsesform	Bestået/ikke bestået
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Problem-based Learning in Science, Technology and Society
Modulkode	N-EN-B1-5
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg, Campus København
Modulansvarlig	Annette Grunwald, Søren Rosenlund Frimodt-Møller

ORGANISATION

Studienævn	Studienævn for Energi
Institut	Institut for Energiteknik
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

LINEAR ALGEBRA

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Use of derived functions
- Integrals and integration techniques
- Indefinite, definite and improper integrals
- Use of definite integrals
- Polar coordinates and parametric equations
- Function series
- Ordinary 1st and 2nd order differential equations
- Partial differential equations
- Linear algebra and analytical geometry
- Vectors and vector spaces
- Determinant and linear systems
- Matrices, determinants and linear equation systems

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Understand differentiation and integration of simple mathematical functions
- Understand and interpret simple mathematical problems including solutions to differential equations
- Understand simple problems in linear algebra

SKILLS

- Calculate differentials and integrals of simple functions
- Solve ordinary 1st and 2nd order differential equations
- Solve systems of algebraic equations

TYPE OF INSTRUCTION

Lectures and exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Linear Algebra
Type of exam	Written exam 4 hours
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Lineær algebra
Module code	K-BBT-B1-19
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Location of the lecture	Campus Copenhagen
Responsible for the module	Johan Rønby Pedersen

ORGANISATION

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering
Department	Department of Chemistry and Bioscience
Faculty	Faculty of Engineering and Science

PRODUCT AND SERVICE DEVELOPMENT

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

For students to develop key competences in how to use innovation technologies and simulation tools for the development of products and services. Overall the project balances around possibilities and limitations of innovation technologies, virtualization technologies, concepts, user and employee driven innovation and the necessary modelling of processes, products and services.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about methods for planning and developing products in order to identify, analyze and assess the contextual impacts and perspectives of a given product through virtualization and rapid prototyping and the impact for manufacturing.
- Must have knowledge about how to model the interaction between a potential user and a product through virtualization
- Must have good knowledge about the most important concepts in innovation technology such as for example VR, rapid prototyping, and design and a basic understanding of state-of-art production technologies.
- Must have knowledge about central innovation development models such as lean innovation, agile development, etc.
- Must have knowledge about development of requirement specifications as a basis for developing a product of service
- Must have basic knowledge about how to compose teams, how to involve and motivate peers, and how to organize projects systematically
- Must know how to program production related problems and how to visualize results
- Must have knowledge of the scientific method and approach used in the project - as well as possible alternative methods / approaches

SKILLS

- Analyze and model individual as well as organizational learning processes based on experiences from P0 and P1
- Must be able to apply product development models to an actual case
- Must be able to apply end-user interaction models as a basis for requirements specifications
- Must be able to apply innovation technologies and design and production technologies
- Must be able to develop a requirement specification for a given product or service
- Must be able to link user requirements with the requirement specification for a given product
- Must be able to evaluate a development project based on requirements
- Reflect on the construction and reconstruction of science and technology in a user and society perspective
- Relate the professional practice within the discipline to the needs of humans and different societies
- Analyze technical or natural scientific problems by use of social science methodology
- Assess the impacts on human and society from the proposed solutions
- Assess team competencies and project plans and risk
- To perform a stakeholder analysis
- Must be able to communicate the project ideas, goals and results to individuals with non-engineering background
- Must be able to use programming techniques to solve and visualizing production related problems.
- Must have gained an understanding of the methodological and science-related approach to the management of the project's problem as well as its advantages and disadvantages.

COMPETENCES

- Manage a longer termed project independently
- Generalize the gained experiences with project management and put them into perspective of the future course of study
- Reflect on the ethical perspective of engineering and science and discuss implications of a responsible professional practice
- Must have competencies in development of a requirements specification

- Must have competencies in elicitation of end-user requirements and to translate these into the requirement specification for a specific product/service
- Must have competencies in user interaction models
- Must have competencies in product and/or service development by use of the innovation technologies and design and production technologies.
- Must have the competence to oversee and model the entire process from the innovation to the potential production.
- Must have the competence to coordinate an interdisciplinary project.
- Must have the competence to communicate with interdisciplinary project partners.
- Shall have programing skills to solve and visualize production related problems based on mathematical models.

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 7 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS course module the expected workload is 450 hours for the student.

EXAM

EXAMS

Name of exam	Product and Service Development
Type of exam	Oral exam based on a project
ECTS	15
Assessment	7-point grading scale
Type of grading	External examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Produkt- og serviceudvikling
Module code	M-MOE-B2-1
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Anders Paarup Nielsen

ORGANISATION

Study Board	Study Board of Industry and Global Business Development
Department	Department of Materials and Production

Faculty	Faculty of Engineering and Science

INNOVATION TECHNOLOGY: PRODUCT DEVELOPMENT & PRODUCT SERVICE DESIGN

2018/2019

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Linear Algebra.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of modern technologies that support innovation and product and service development.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have basic knowledge about organizational theory and design.
- Must have knowledge about innovation technologies and approaches such as rapid prototyping, virtual reality and modelling and simulation
- Must have basic knowledge about design and state-of-art production technologies

SKILLS

- Must be able to use innovation technology within the innovation process
- Must be able to identify the key advantages of the different technologies and use them to optimally support the innovation process
- Must be able to combine different technologies as necessary
- Must be able to communicate the innovation results
- Must be able to involve end-users and stake holders into the virtualized innovation process
- Must be able to related innovation processes to organizational designs

COMPETENCES

- Must have the competence to optimize the innovation process using innovation technology to proto-type, simulate and virtualize the innovated product and service

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Innovation Technology: Product Development & Product Service Design
Type of exam	Written or oral exam
ECTS	5

Assessment	7-point grading scale
Type of grading	Internal examination

FACTS ABOUT THE MODULE

Danish title	Innovationsteknologi: Produktudvikling & produkt-service-design
Module code	M-MOE-B2-2
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Jens Christian Moesgaard Rauhe

ORGANISATION

Study Board	Study Board of Industry and Global Business Development
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

INTRODUCTION TO PROBABILITY THEORY AND STATISTICS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To introduce the student to concepts and ideas within statistics and how statistics can be applied to problems relevant to engineers in “ITCOM”.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about fundamental concepts in probability, including conditional probability and independence.
- Must have knowledge about discrete and continuous random variables and relevant properties of these
- Must have knowledge about various examples of descriptive statistics, e.g. histograms and scatterplots.
- Must have knowledge about statistical inference, including estimation, confidence intervals and hypothesis testing.
- Must have knowledge about important statistical models, like linear regression (simple and multiple), analysis of variance, logistic regression and log-linear models (in particular contingency tables).

SKILLS

- Must be able to, given specific data, specify a relevant statistical model and account for the assumptions and limitations of the chosen model.
- Must be able to use relevant software for carrying out the statistical analysis of given data and be able to interpret the results of the analysis

COMPETENCES

- Must be able to judge the applicability of statistics within own area.
- Must be capable of performing a critical judgement of the results of a statistical analysis.
- Must be capable of communicating the results of a statistical analysis to people with no or little background within statistics.

TYPE OF INSTRUCTION

Lectures in combination with practical exercises and self-study or similar.

EXAM

EXAMS

Name of exam	Introduction to Probability Theory and Statistics
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Introduktion til sandsynlighedsregning og statistik
Module code	ESNITCOB4K3
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

MATERIALS AND MANUFACTURING PROCESSES

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with a foundation for the properties and applications of different materials and manufacturing processes.

The student should acquire an understanding of basic properties of materials and typical manufacturing processes. This provides a foundation for students to select materials and manufacturing processes bridging idea and production.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about commonly used materials, and their related properties and the required manufacturing processes.
- Must have knowledge about commonly used manufacturing processes

SKILLS

- Must be able to choose and use a specific material according to a specified product and production requirement.
- Must be able to choose and use the right manufacturing processes for a given material and desired outcome.
- Must be able to discuss/assess the quality of process outcome.

COMPETENCES

- Must have competencies in choosing and using the right material and manufacturing process for a specific desired outcome.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Materials and Manufacturing Processes
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Materialer og mekaniske processer
Module code	M-MOE-B2-4
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Jesper de Claville Christiansen, Erik Appel Jensen

ORGANISATION

Study Board	Study Board of Mechanical Engineering and Physics
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

PRODUCT, PROCESSES AND AUTOMATION

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Linear Algebra and the project module From the Classic to the Modern Production and Service.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

While the focus of the previous project module was on the development of products and services as well as on the tools to support the innovation process, the purpose of this project module is to acquire knowledge, skills and competencies regarding the realization of these innovations.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about computer networks
- Must have knowledge about distributed information technology systems including protocol design and system architecture
- Must have knowledge about key components of manufacturing, production and service processes
- Must have knowledge about the most important concepts of state-of-art production technologies.
- Must have knowledge about the most important state-of-art networking and coordination technologies.
- Must know about the differences between digital models of manufacturing, production and service processes and their physical counterparts.

SKILLS

- Must be able rationalize about existing manufacturing, production and service processes
- Must be able to digitally model manufacturing, production and service processes
- Must be able to map the digital models into reality.
- Must have basic knowledge about key concepts of computer science, incl. logic, syntax, automation theory and programming.
- Must be able to use a programming language to implementing basic approaches in manufacturing technologies and distributed information technology systems, incl. robots, databases

COMPETENCES

- Must demonstrate competences in performing analyses of organizational requirements for production, manufacturing and service implementation
- Must have competences in presenting manufacturing, production and service scenarios based on specific needs
- Must have competences in choosing relevant technology systems meeting organizational needs for manufacturing, production and services.
- Must have the principal competence to program relevant technological systems
- Must have the competence to summarize and present the results and consequences of such a technological project to non-engineers
- Must be able to relate technical details to non-technical project partners.

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 6 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS course module the expected workload is 450 hours for the student.

EXAM

EXAMS

Name of exam	Product, Processes and Automation
Type of exam	Oral exam based on a project
ECTS	15
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Produkt, processer og automation
Module code	M-MOE-B3-1
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Evangelos Boukas

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

NEW MATERIALS AND PROCESSES

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Materials and Mechanical Processes.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The objective of the course is to provide the student with the use of new materials and mechanical processes. The student should acquire an understanding of the properties of new materials and their manufacturing processes to apply this knowledge during innovation and production processes.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about new materials, and their related properties and their manufacturing processes.
- Must have knowledge about the manufacturing processes used with new materials.
- Must have knowledge about **innovation – advanced materials development**.

SKILLS

- Must be able to choose and use a specific material according to a specified product and production requirement.
- Must be able to choose and use the right manufacturing processes for a given material and desired outcome.
- Must be able to discuss/assess the quality of process outcome.

COMPETENCES

- Must have competencies in choosing and using the right material and mechanical process for a specific desired outcome.
- Must be able to identify opportunities offered by new materials for the production innovation process as well as for the manufacturing and production process.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	New Materials and Processes
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination

Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Nye materialer og processer
Module code	M-MOE-B3-2
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Erik Appel Jensen, Jesper de Claville Christiansen

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

MANUFACTURING PROCESSES, AUTOMATION AND ROBOTS

2018/2019

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To introduce the student to a number of different technologies for manufacturing and automation, incl. robots.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about key technologies for manufacturing and automation
- Must have knowledge about robots in particular
- Must have knowledge about relevant manufacturing and automation processes
- Must have basic knowledge about state-space modelling and control of automation processes

SKILLS

- Must be able to choose the right manufacturing and automation technologies for a given product type and product material.
- Must be able identify the right robot technology for a given automation problem
- Must be able to relate the key technologies for manufacturing and automation to the relevant digital models.
- Must be able to program automation technologies and robots

COMPETENCES

- Is able to map a product innovation into an automation process
- Is able to outline a manufacturing and automation process based on given needs
- Is able to program automation technologies and robots

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Manufacturing Processes, Automation and Robots
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination

FACTS ABOUT THE MODULE

Danish title	Fremstillingsprocesser, automatisering og robotter
Module code	M-MOE-B3-4
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Volker Kurt Carl Krüger

ORGANISATION

Study Board	Study Board of Industry and Global Business Development
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

DIGITAL MANUFACTURING TECHNOLOGY

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Linear Algebra, Fundamentals of Operations Management and Process Modelling and Control and Innovation Technology: Product Development & Product Service Design.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of modelling of processes and information flows. The course will introduce the students to basic techniques of digital manufacturing including logic, syntax, programming languages, and relational databases based on cases from manufacturing, service sector and the game industry.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have basic knowledge about relational database theory
- Must have knowledge about programming logic, syntax and languages
- Must have knowledge about virtualization technologies used for manufacturing processes

SKILLS

- Must be able to perform logic and syntax analysis and descriptions.
- Must be able to use design and modelling tools for process description
- Must be able to discuss and evaluate digital prototypes
- Must be able to program basic robot control in simulation
- Must be able to implement simple robot control within an automation process
- Must be able to model manufacturing and automation processes using virtualization technologies.

COMPETENCES

- Must have the competencies to apply modelling techniques to cases of service and manufacturing processes and to develop simple robot applications.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Digital Manufacturing Technology
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale

Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Digitalisering af produktionsprocesser
Module code	M-MOE-B3-5
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Evangelos Boukas

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

JOB DESIGN

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Fundamentals of Operations Management and Process Modelling and Control.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of job design, ergonomics, and sustainable jobs.

From scientific management (Taylor) over human factors and human relations to sociotechnical design and after sociotechnical design: the good work, developmental work, high performance work systems, lean, micro ergonomics, macro ergonomics

How to design a sustainable job: time and motion studies, involvement of workers, ergonomics, well-being, division of work, job enrichment and enlargement, psychological job demands, meaning

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about organizational theory and industrial relations
- Must have knowledge about classical job design theory and ergonomics
- Must have knowledge about sustainable jobs,
- Must have knowledge about psychosocial and physical working environment theory

SKILLS

- Must be able to explain the classical history from scientific management to sociotechnical design and after.
- Must be able to use apply time and motion study techniques
- Must be able to explain theories of worker involvement
- Must be able to use job design techniques
- Must be able to discuss and evaluate the working environment of a workplace
- Must have the skill to communicate with individuals in an interdisciplinary setting.
- Must have the skill to communicate and motivate

COMPETENCES

- Must have the competencies to apply job design theories to create sustainable jobs

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Job Design

Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Job design
Module code	M-MOE-B3-3
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Christian Uhrenholdt Madsen

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

DIGITAL MANUFACTURING AND SERVICE

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Linear Algebra, Fundamentals of Operations Management and Process Modelling and Control and Innovation Technology: Product Development & Product Service Design.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of modelling of processes and information flows. The course will introduce the students to basic techniques of digital manufacturing including logic, syntax, programming languages, data mining, and relational databases based on cases from manufacturing, service sector and the game industry.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about relational database theory
- Must have knowledge about programming logic, syntax and languages
- Must have understand the relation between virtual and physical products/services
- Must understand the possibilities in crowd sourcing and open source

SKILLS

- Must be able to explain relational database theory
- Must be able to use common database programming languages
- Must be able to perform logic and syntax analysis and descriptions.
- Must be able to use design and modelling tools for process description
- Must be able to explain theories of technological convergence across sectors
- Must be able to use techniques for user involvement and to evaluate digital prototypes
- Must be able to use a programming language to solve related problems

COMPETENCES

- Must have the competencies to apply modelling techniques to cases of service and manufacturing processes and to develop simple database applications.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Digital Manufacturing and Service
Type of exam	Written or oral exam
ECTS	5

Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Digitalisering af produktions- og serviceprocesser
Module code	M-MOE-B3-6
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Evangelos Boukas

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

INTELLIGENT MANUFACTURING AND SERVICE DESIGN

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the project module Products, Processes and Automation.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To introduce the student to advanced technologies for manufacturing and service that go beyond the classic technologies, and give the student the ability to get familiar with new developments.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about key technologies for intelligent manufacturing and service design.
- Must have knowledge about sustainable and modularized manufacturing.
- Must have knowledge about innovative and sustainable service design.

SKILLS

- Must be able to discuss the advantages and disadvantages of intelligent manufacturing and service design in relation to specific services and applications.
- Must be able to identify intelligent solutions and state-of-art technologies for intelligent manufacturing and service design.
- Must be able to familiarize him/herself with new manufacturing and service technologies.
- Must be able to explain the scientific method and approach used in the project as well as its advantages and disadvantages - also compared to alternative methods / approaches.

COMPETENCES

- Must have competencies in applying project- and team-based learning to complete a team project, including preparation of problem definition, coherent analysis and writing of a technical report with clear formulation of results and conclusions, and with proper use of source references.
- Must have competencies in assessing the usefulness of intelligent manufacturing and service design technologies in relation to different services and applications.
- Must have the competencies in deploying the knowledge, skills and competencies acquired in the course “Intelligent Manufacturing (and Service Design)” developing this project.
- Must have gained an understanding of the methodological and science-related approach to the management of the project's problem as well as its advantages and disadvantages.

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 6 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS course module the expected workload is 450 hours for the student.

EXAM

EXAMS

Name of exam	Intelligent Manufacturing and Service Design
Type of exam	Oral exam based on a project
ECTS	15
Assessment	7-point grading scale
Type of grading	External examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Intelligent manufacturing og service design
Module code	M-MOE-B4-1
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Matteo Fumagalli

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

CALCULUS

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Linear Algebra or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Should have knowledge about definitions, results and techniques within the theory of differentiation and integration of functions of two or more variables
- Should know trigonometric functions and their inverse functions
- Should have knowledge about simple surfaces in right-angled, polar and spherical coordinates
- Should have knowledge about complex numbers their calculation rules and representations
- Should have knowledge about factorization of polynomia of complex numbers
- Should have knowledge about the complex exponential function, its properties and its connection with trigonometric functions
- Should have knowledge about the theory for second order linear differential equations with constant coefficients

SKILLS

- Can visualize functions of two and three variables by means of graphs, level curves and level planes
- Can determine local and global extremes for functions of two and three variables
- Can determine area, volume, inertia moment by use of integration theory
- Can approximate functions of a variable by means of Taylor’s equation and use linear approximation for functions with two or three variables
- Are capable of calculations using complex numbers
- Can find the roots of the complex quadratic equation and perform factorization of polynomia in simple cases
- Can solve linear second order differential equations with constant coefficients, generally and with starting conditions
- Can reason with the concepts, results and theories of the course in simple concrete and abstract problems

COMPETENCES

- Can develop and strengthen the knowledge, understanding and application of mathematical theories and methods within other fields
- Can reason and argue using mathematical concepts from given prerequisites

TYPE OF INSTRUCTION

Lectures and calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Calculus
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Calculus
Module code	K-BBT-B2-14
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Bedia Akyar Møller

ORGANISATION

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering
Department	Department of Chemistry and Bioscience
Faculty	Faculty of Engineering and Science

INDUSTRIAL VISION, SENSORS AND QUALITY CONTROL

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Digital Manufacturing Technology or Digital Manufacturing and Service.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of state-of-art sensory devices for automation control (AC) and quality control (QC).

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about engineering design
- Must have knowledge about quality control principles
- Must have knowledge about state-of-art sensory devices, such as temperature, touch, vision

SKILLS

- Must be able to explain typical application of sensors for AC and QC
- Must be able to use common sensory devices for AC and QC, in particular visual sensors as the most general one.
- Must be able to rationalize and justify a specific choice of sensor for a given application w.r.t. technical capabilities and cost.
- Must be able to discuss and evaluate the use of a specific sensor choice for a given application problem.

COMPETENCES

- Must have the competencies to apply design rules, principles and guidelines

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 6 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Industrial Vision, Sensors and Quality Control
Type of exam	Written or oral exam
ECTS	5

Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Industriel billedbehandling, sensorer og kvalitetskontrol
Module code	M-MOE-B4-3
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Niels Gorm Malý Rytter

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

INTELLIGENT MANUFACTURING

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Digital Manufacturing Technology or Digital Manufacturing and Service and the modules Manufacturing Processes, Automation and Robots and Linear Algebra.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of advanced technologies for manufacturing and service that go beyond the classic technologies, and give the student the ability to get familiar with new developments.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about sustainable manufacturing and service development
- Must have knowledge about state-of-art in intelligent manufacturing technology
- Must be able to familiarize him/herself with new manufacturing and service technologies

SKILLS

- Must be able to explain principles of agile manufacturing
- Must be able to explain core principles of service development
- Must be able to rationalize about advances and disadvantages of intelligent manufacturing technology
- Must be able to use and optimize an intelligent manufacturing technology for a given problem
- Must be able to rationalize about costs and effectively of intelligent manufacturing technology
- Must be able to discuss and evaluate an existing use of intelligent manufacturing technology

COMPETENCES

- Must have the competencies to apply principles of agile and sustainable manufacturing to company cases
- Must be able to apply intelligent manufacturing technologies to a given problem at hand.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Intelligent Manufacturing
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale

Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Intelligent produktion
Module code	M-MOE-B4-5
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Volker Kurt Carl Krüger

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

ENGINEERING DESIGN AND QUALITY CONTROL

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Digital Manufacturing Technology or Digital Manufacturing and Service.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of the basic steps and activities involved in creating novel systems, solutions, concepts, products, or services - the student should have an understanding of the nature of engineering work and design processes. Furthermore, the student should have an understanding of the core principles of quality control and the way in which quality can be ensured throughout the design processes.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about engineering design.
- Must have knowledge about quality control principles typically used in the design process.
- Knowledge about the intersection between engineering design and quality related issues.

SKILLS

- Must be able to explain typical design principles, rules as well as quality control tools and techniques.
- Must be able to explain the typical quality controls tools and techniques used in the design process.
- Must be able to use common design principles and rules in connection with the design process.
- Must be able to use quality control tools and techniques in the engineering design process.
- Must be able to address key trade-offs in the design process.
- Must be able to discuss and evaluate the effectiveness, efficiency and value of design principles, rules, as well as quality control tools and techniques.

COMPETENCES

- Must have the competencies to apply design rules, principles and guidelines in connection with the creation novel systems, solutions, concepts, products, or services.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Engineering Design and Quality Control
Type of exam	Written or oral exam
ECTS	5

Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Engineeringdesign og kvalitetskontrol
Module code	M-MOE-B4-4
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Niels Gorm Malý Rytter

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

INTELLIGENT PRODUCTION AND SERVICE DESIGN

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Digital Manufacturing Technology or Digital Manufacturing and Service and the modules Manufacturing Processes, Automation and Robots and Linear Algebra.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of how contemporary technologies – for innovation, design, and manufacturing of products or delivery services – can be applied to create responsive, sustainable, and agile production and service delivery systems in a company.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about intelligent production and service development.
- Must have knowledge about organizational design facilitating intelligent production.
- Must have knowledge about the role of management and humans in intelligent production.
- Must have knowledge about communication protocols and software platforms.

SKILLS

- Must be able to explain principles of agile manufacturing and how they influence the design process.
- Must be able to explain core principles of service development and how they influence the design process.
- Must be able to use the principles, tool and techniques of agile manufacturing and service design in the process of intelligent production and service systems.
- Must be able to combine different principles tools and techniques to create intelligent production and service systems.
- Must be able to discuss and evaluate the appropriateness of a given intelligent production and service system and how to balance conflicting demands in the design process.

COMPETENCES

- Must have the competencies to apply principles of agile and sustainable production to company cases and design intelligent production and service systems.
- Must have competencies to establish involving, flexible processes involving stakeholders at all levels in innovation processes.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Intelligent Production and Service Design

Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Intelligent produktion og servicedesign
Module code	M-MOE-B4-6
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Volker Kurt Carl Krüger

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

OPERATIONS AND SERVICE MANAGEMENT

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules on the 4th Semester.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To enable students to develop models for advanced global, organizational and technical systems based on state-of-the-art virtualization technologies and the knowledge and skills acquired during the previous Semesters. The project should make use of solid skills in operations research and management, logistics, etc. based on the system and user requirements.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about operations and service management.
- have knowledge about product-service systems and servitisation.
- Must have knowledge about global systems, organizational and technical systems.
- Must have knowledge about operations research.
- Must have knowledge about interface management.

SKILLS

- Must be able to understand and overcome limitations of operations and service management.
- Must be able to develop operations procedures.
- Must be able to make qualified decisions for organizational and technical systems.
- Must be able to work with supply chains, inventory capacity management and logistics.
- Must be able to model global systems, organizational and technical systems using virtualization technologies.

COMPETENCES

- Must have competencies in modelling global, organizational and technical systems based on state-of-the-art virtualization technologies.
- Must have competencies to model and analyse supply chains, inventory capacity management and logistical needs of a given system.
- Muat have competences to apply operations research for forecasting, inventory capacity management and logistical processes.

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 6 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS course module the expected workload is 450 hours for the student.

EXAM

EXAMS

Name of exam	Operations and Service Management
Type of exam	Oral exam based on a project
ECTS	15
Assessment	7-point grading scale
Type of grading	External examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Operations og service management
Module code	M-MOE-B5-1
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Niels Gorm Malý Rytter

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

INTRODUCTION TO PRODUCTION AND SERVICE ECONOMICS

2018/2019

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Calculus.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of fundamentals of management accounting, business economics and finance in a manufacturing context.

Students who complete the module should understand the basics within management accounting, business economics and finance in a manufacturing context.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about principles of manufacturing and service economy at business level
- Must have knowledge about main principles of management accounting and business economics
- Must have knowledge about financial ratios and profitability analysis (du-pont pyramid, ROI, ROA, financial leverage etc.)
- Must have knowledge about quoting and pricing calculations
- Must have knowledge about budgeting and cash-flow analysis
- Must have knowledge about investment-theory and pay back analysis, also be familiar with Monte carlo and sensitivity analysis
- Must have knowledge about make-buy analysis to guide in- versus outsourcing decisions in a short but also long term context
- Must have an understanding of business models
- Must have an understanding of the balance between demand-pull and push

SKILLS

- Must be able to understand and contribute to annual report and balance sheet for a “constructed” business setup
- Must be able to analyze profitability and economic performance of businesses through review of financial ratios and underlying assumptions
- Must be able to produce a viable quote or offer a price for a customer on a particular product / service offering
- Must be able to make simple budgeting and cash-flow analysis of investments
- Must be able to produce cost-benefit analysis of “hard” and “soft” investments and calculate Net present value for these, also make scenario based analysis of returns
- Must be able to examine profitability of make buy-decisions for manufacturing / logistics chains in a global context, examining both short and long term benefits

COMPETENCES

- Must have the competencies to apply management accounting and business economics to systematize economic decision at the manufacturing, value chain or business level
- Must have the competencies to make financial plans for start-ups, price new products / services from a cost based perspective etc, and this to enable successful entrepreneurial activities among students

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Introduction to Production and Service Economics
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination

FACTS ABOUT THE MODULE

Danish title	Introduktion til produktions- og serviceøkonomi
Module code	M-MOE-B5-2
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Niels Gorm Malý Rytter

ORGANISATION

Study Board	Study Board of Industry and Global Business Development
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

SYSTEMS THINKING AND PROCESS IMPROVEMENT

2018/2019

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Introduction to Probability and Applied Statistics, and either Industrial Vision, Sensors and Quality Control or Engineering Design and Quality Control.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- A coherent and profound understanding of approaches, tools and techniques of systems thinking and business process improvement approaches, as Lean, Six Sigma, TPM, TQM to be used for continuous improvement, i.e. simplification, standardization, automation of business processes in industry and service organizations

SKILLS

- Master various principles, tools and techniques to be applied in business improvement projects, as e.g. SIPOCs, process mapping, value stream mapping, KPI and PPI analysis, root cause analysis, control charts, box plots, regression analysis, 5S, value, waste, 5Rs for process redesign, flow, pull, jidoka, pokayoke, cash flow analysis, stakeholder management etc.
- Skills in leading operations and business process improvement projects as well as kaizen activities according to Systems Thinking, PDCA or DMAIC methods
- Skills in leading operations and business improvement projects towards meeting deliverables and broader stakeholder objectives, also taking role of human resources into account
- Skills for designing and leading larger scale organizational transformations centered around lean-six sigma approaches towards sustainable practices of continuous improvement – also ability to identify enablers / barriers for success, e.g. the role that governance of IT investments play in enabling process improvement projects to succeed

COMPETENCES

- Be able to deploy knowledge and skills in relation to business process improvement (Lean-Six Sigma, TPM, TQM) challenges of manufacturing, transportation or service organizations
- Be able to deploy knowledge and skills in relation to larger scale organizational transformations targeting a kaizen / continuous improvement culture
- Develop abilities to do project and stakeholder management of business improvement projects in own organization

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Systems Thinking and Process Improvement

Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination

FACTS ABOUT THE MODULE

Danish title	Systemtænkning og procesudvikling
Module code	M-MOE-B5-3
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Niels Gorm Malý Rytter

ORGANISATION

Study Board	Study Board of Industry and Global Business Development
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

OPERATIONS PLANNING AND CONTROL

2018/2019

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Industrial Vision, Sensors and Quality Control or Engineering Design and Quality Control.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have gained knowledge about planning and control methods for production and service systems and the supporting IT-systems
- Have gained knowledge of a number of time series methods for forecasting
- Have gained knowledge of inventory management methods and their applications

SKILLS

- Be able to develop and evaluate the performance of a suitable time series forecasting model based on real data
- Be able to conduct a Material Requirements Planning break down
- Be able to choose planning and control methods depending on the context and composition of the production or service system
- Be able to design and redesign planning and control systems in production and service management companies adapted to a company’s specific situation

COMPETENCES

- Be able to combine a number of mathematical tools in an appropriate manner to design a comprehensive planning and control system

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Operations Planning and Control
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination

FACTS ABOUT THE MODULE

Danish title	Produktionsplanlægning og kontrol
Module code	M-MOE-B5-4
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Line Blander Reinhardt

ORGANISATION

Study Board	Study Board of Industry and Global Business Development
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

BSC PROJECT

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules at the 1st – 5th Semester.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To demonstrate the totally acquired knowledge, skills and competencies as described for this bachelor study programme.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge of how to design and develop solutions to Manufacturing and Operation Engineering related problem serving the needs of the stakeholder.
- Must know the role of innovation technologies for production development of manufacturing and/or service.
- Must know the advantages of both automation and manual work for sustainable operational efficiency.

SKILLS

- Must be able to identify and apply organizational, market and technical implications of a given solution to a problem.
- Must be able to develop new solutions or improve existing ones to new problems related to Manufacturing and Operation Engineering.

COMPETENCES

- Must be able to rationalize and scientifically justify the use of a specific model for a given problem.
- Must demonstrate competences in performing analyses of organizational requirements for production, manufacturing and service implementation.
- Must have competences in presenting manufacturing, production and service scenarios based on specific needs choosing relevant technology systems meeting those needs.
- Must have the competencies to apply job design theories to create sustainable jobs.
- Is able to map a product innovation into an automation process.
- Is able to program automation technologies (robots or service).
- Must have competencies in preparing a problem definition, a coherent analysis and writing of a technical report with clear formulation of results and conclusions, and with proper use of source references.
- Must have competencies in assessing the usefulness of intelligent manufacturing and service design technologies in relation to different production and services.
- Must have the competencies to apply design rules, principles and guidelines in connection with the creation novel systems, solutions, concepts, products, or services.
- Must have the competencies to apply modern principles of agile and sustainable manufacturing to company cases.
- Must have competencies in modelling global, organizational and technical systems based on state-of-the-art virtualization technologies.
- Will have competencies to model and analyse the most salient operations management needs of a given system.
- Must have the competencies to economically justify the solutions to a given problem apply.
- Be able to deploy knowledge and skills in relation to business process improvement (Such as Lean-Six Sigma, TPM, TQM, Agile) challenges of manufacturing, transportation or service organizations.
- Be able to combine mathematical tools in an appropriate manner if it is needed to solve a given problem.

TYPE OF INSTRUCTION

The module is carried out as group-based problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 4 members.

EXTENT AND EXPECTED WORKLOAD

Since it is a 20 ECTS course module the expected workload is 600 hours for the student.

EXAM

EXAMS

Name of exam	BSc Project
Type of exam	Oral exam based on a project
ECTS	20
Assessment	7-point grading scale
Type of grading	External examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Bachelorprojekt
Module code	M-MOE-B6-1
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	20
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Line Blander Reinhardt

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

GLOBAL SUPPLY CHAIN MANAGEMENT

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the module Operations, Planning and Control.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with an understanding of the theories and factors influencing the configuration of global supply chain. Students who complete the module should understand and design global value chains.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about theories about make-or-buy, transaction costs, relational view of the firm and the resource-based view of the firm outsourcing, offshoring, logistics, supplier selection and locational theories

SKILLS

- Must be able to explain the important factors behind outsourcing decisions
- Must be able to explain core principles in location theory
- Must be able to analyze and design global supply chains.

COMPETENCES

- Must have the competencies to apply theories in designing global supply chains

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Global Supply Chain Management
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Global Supply Chain Management
Module code	M-MOE-B6-2
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Line Blander Reinhardt

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

SELECTED TOPICS IN INTELLIGENT MANUFACTURING

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Systems Thinking and Process Improvement and Fundamentals of Operations Management and Process Modelling and Control, Digital Manufacturing Technology or Digital Manufacturing and Service and Manufacturing Processes, Automation and Robots.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about selected intelligent manufacturing technologies (IMTs).
- Must have knowledge about advantages and disadvantages of selected IMTs.

SKILLS

- Must be able to explain selected IMTs.
- Must be able to evaluate and rationalize about selected IMTs.
- Must be able to compute the costs and the profits from using a specific IMTs.
- Must be able to analyze organizations and stakeholders.
- Must be able to discuss and evaluate project plans.

COMPETENCES

- Must have the competencies to apply theories of organizational design and to use project management tools.

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Selected Topics in Intelligent Manufacturing
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Udvalgte emner i Intelligent Manufacturing
Module code	M-MOE-B6-3
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Casper Schou

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science

ADVANCED MANUFACTURING AND SERVICE INFORMATION SYSTEMS

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in the modules Introduction to Probability and Applied Statistics and either Digital Manufacturing Technology, or Digital Manufacturing and Service.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The objective is to provide the student with an understanding of information systems within application areas in manufacturing and service and provide theories and tools for modelling data architectures, designing databases and data- warehouses, prototyping, and data mining.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about advanced information systems design and applications
- Must have knowledge about the role of information systems in manufacturing and service

SKILLS

- Must be able to explain role of information systems in manufacturing and service
- Must be able to explain the interaction between information systems and business models
- Must be able to use advanced tools for programming databases
- Must be able to use tools for information and process modelling
- Must be able to discuss and evaluate the adequacy of information systems in specific application areas

COMPETENCES

- Must have the competencies to apply data analysis, modelling and programming techniques

TYPE OF INSTRUCTION

The teaching is organized in accordance with the general form of teaching. Please see the programme cirruculum §17.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course module the expected workload is 150 hours for the student.

EXAM

EXAMS

Name of exam	Advanced Manufacturing and Service Information Systems
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale

Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Avancerede informationssystemer i fremstillings- og servicesektoren
Module code	M-MOE-B6-4
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Line Blander Reinhardt

ORGANISATION

Study Board	Study Board of Production
Department	Department of Materials and Production
Faculty	Faculty of Engineering and Science