SDC

The university partnership
Denmark – China

Course Catalogue Spring 2025

All courses related to the SDC programmes

Contents

Innovation Management

Business Models Innovation

12.5 ECTS

This includes Semester Project II

Course coordinator: Jesper C. Sort, Associate Professor, Aalborg University (jso@business.aau.dk)

CONTENT

The aim of the module is to provide students with insights into the concept of business models and how to design and implement business models. Special focus in the module is given to how to design and implement original, unique, and innovative business models. Concrete cases related to innovation and business modelling are used to experiment on and discuss the development of business models.

LEARNING OBJECTIVES

Following the successful completion of the module the students will be able to:

- understand and reflect on business models innovation and its underlying assumptions.
- link business model theories to innovation and creativity practices and use tools for business model innovation.

EXAMINATION

The examination in this course is integrated with the examination in *Semester Project II* and an overall grade will be given. For examination regulations please see *Semester Project II*.

Product Design and Development

7.5 ECTS

Course coordinator: Dmitrij Slepniov, Associate Professor, Aalborg University (ds@business.aau.dk)

CONTENT

The aim of the module is to provide the students with a systematic process, a set of tools and methods that will enable them to understand how design ideas may evolve into innovative solutions to marketplace needs, wants, and desires.

The creation of a new product or service is not a simple process. It takes place at various organisational levels, numerous functional areas, dispersed geographies and requires unique skills and competences of the individuals involved in it. This course combines the perspectives of marketing, design and process management. Furthermore, the course covers the aspects of strategic foresight, i.e., what it takes to develop a product that can withstand the test of time and uncertain environment.

LEARNING OBJECTIVES

Following the successful completion of the module, the students will be able to:

- acquire knowledge and understanding of the characteristics and origins of successful product design and development methodologies.
- apply their acquired understanding to comprehend what it takes to create a new product or service while having strategic foresight that enables the product to withstand the test of time and uncertain environment.
- develop ability and confidence to adopt, evaluate and implement design techniques and methodologies in various domestic and international organizational settings in both manufacturing and service environments.

EXAMINATION

An individual written reflection paper based on the syllabus of the course and the group assignment. The length of the reflection paper is 5-7 standard pages (excluding references, tables, etc.). It is performed during the module period and provides insights into their understanding of the material of the course and the design process.

As a prerequisite to participate in the exam, a written assignment about the design process is prepared by the students in groups (recommended group size is 4-5 members). It is performed during the module period. The assignment is not graded, feedback is provided.

RE-EXAMINATION

Re-examination is subject to the same regulations as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Innovation Systems and Government-Business Relations

5 ECTS

Course coordinator Stine Haakonsson, Associate Professor, Copenhagen Business School (stha.ioa@cbs.dk)

CONTENT

The module presents contemporary theories of innovation systems from different perspectives (Global, National, Regional, Sectoral, and Technological) and illustrates their interplay with innovation at business- and organizational levels.

Contrary to other modules focusing on the micro-dynamics of innovation at the firm and individual level, this module takes a meso- and macro perspective on innovation processes. The innovation system approach highlights how various actors in the system, such as firms, entrepreneurs, governmental organizations, and universities, interact in the process of creating, diffusing, and adopting innovation.

The module has a special focus on government-business relations, including innovation policies and university-business collaborations, and on how new technologies and innovations are developed in the context of such interactions. Based on the knowledge of innovation systems, we invite students to reflect on how firms are embedded in such innovation systems and how they can take advantage of the systems. We will also discuss the innovation systems and the interaction of the actors in the systems in the context of solving grand societal challenges such as climate change, inequality, and economic development.

The course will contain practical elements unfolded in exercises, seminars, and guest lectures.

LEARNING OBJECTIVES

Following the successful completion of the module, the students will be able to:

- understand and reflect on the concept of innovation systems and apply it at different analytical levels.
- conduct analysis and evaluation of innovation systems' development, dynamics and opportunities for change through policy formulation.
- understand and reflect on innovation management strategies within an innovation system perspective.
- account for and explain the roles of government in the innovation activities of firms.
- understand and critically assess different strategies that businesses can pursue in relation to governments in the context of developing new technologies and innovation.

EXAMINATION

The course is evaluated through a written assignment. The length of the essay is 5-7 standard pages (excluding references, tables etc.)

RE- EXAMINATION

Re-examination is subject to the same regulations as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Digital Innovation

5 ECTS

Course coordinator: Roman Jurowetzki, Associate Professor, Aalborg University (roman@business.aau.dk)

CONTENT

This module offers an in-depth exploration of the interplay between digitalization, data science, and innovation analytics. The course begins by establishing the foundational role of digitalization in shaping modern innovation strategies and then shifts its focus to the application of data science techniques for extracting actionable insights from diverse datasets, such as patents and research output.

The initial phase of the module centres on comprehending the strategic implications of digital transformation on innovation dynamics. Students will gain insights into how digitalization shapes innovation paradigms, fostering the need for data-driven strategies.

As the module progresses, the emphasis transitions towards data science techniques customized for innovation analytics. Participants will engage in hands-on learning, mastering data collection, preprocessing, analysis, and visualization methods, particularly applicable to innovation studies.

LEARNING OBJECTIVES

Upon successful completion of this module, students will be able to:

- understand the role of digitalization in influencing contemporary innovation strategies and practices.
- apply data science techniques to explore, visualize, and present data-driven insights for strategic decision-making.
- critically assess theories of innovation within the context of digital transformation and data-driven approaches.

EXAMINATION

The assessment for this module consists of:

Group Written Assignment: Collaboratively, students will engage in a comprehensive assignment that integrates concepts of digitalization, data science, and innovation analytics. The assignment will involve analyzing a real-world scenario using relevant datasets and proposing data-driven strategies. This assignment constitutes 30% of the final grade.

Individual Oral Exam: The oral exam will encompass the course literature, the group assignment, and individual understanding of data science techniques and their application in innovation analytics. Each student will present their insights and understanding in a 25-minute session. The oral exam contributes 70% to the final grade.

RE- EXAMINATION

An individual written assignment encompassing the course literature and individual understanding of data science techniques and their application in innovation analytics. The length of the paper is 5-7 standard pages (excluding references, tables etc.)

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GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Semester Project II

12.5 ECTS

This includes the course Business Models Innovation

Course coordinator: Dmitrij Slepniov, Associate Professor, Aalborg University (ds@business.aau.dk)

CONTENT

The aim of the module is to further develop (from Semester Project I) the students' skills in working problem-oriented in groups and solve real-life innovation problems.

The module is based on identifying and analysing real-life innovation problems. The identified problem must be addressed by an activation of the theoretical insights gained in other modules and the methodological learnings from the module Research Methods. The students will be provided with guidance/supervision throughout the project period.

The theme for Semester Project II is Business Models and the students are expected to apply in the project the business models perspective as presented in Business Models Innovation module.

Students work in groups and each group is assigned a supervisor for discussing the topic to work on and subsequently supporting the group in relation to data collection, analysis, theoretical reflections, and solutions.

The topic for the semester project is chosen by the students in consultation with supervisors. The topic must be a real-life problem to allow for theory-practice integration. Furthermore, it must be a problem that is scoped for the period of the Semester Project II.

LEARNING OBJECTIVES

Following the successful completion of the module, the students will be able to:

- formulate a problem related to the area of Business Model innovation.
- analyse the formulated problem using practical insights and theoretical reflections from the modules of the semester and Business Model Innovation module in particular.
- prepare and execute the empirical part of the project (data selection, collection, and analysis using the Methodology module.
- develop solutions to the problem and communicate these through a project document.
- experience and advance their understanding of working in diverse intercultural groups.

EXAMINATION

Individual oral examination based on a written project.

The project is prepared in groups (recommended group size is 4-5 students). The length of the project is min. 30 and max. 50 standard pages. The stipulated number of pages excludes annexes and reference list but includes tables and figures.

The individual oral exam is 25 minutes per student (incl. grading) based on the written project. The examination also includes the module in Business Models Innovation.

RE-EXAMINATION

Individual oral examination based on a written project. The project is an individual written mini-project of 10 standard pages. The stipulated number of pages excludes annexes and reference list but includes tables and figures. The oral exam is 25 minutes (incl. grading).

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Master's thesis (4. Semester)

30 ECTS

Course coordinator: Dmitrij Slepniov, Associate Professor, Aalborg University (ds@business.aau.dk)

CONTENT

The aim of the thesis work is to demonstrate that the student can work on a high theoretical level and in a systematic manner apply scientific methods to problems within innovation management that are theoretical or practical in nature. The thesis must demonstrate competence working with scientific theories and methods within a specified subject of innovation management. The subject must have a complexity and an extent that allows for it to be completed in course of one semester.

The thesis may be theoretical or theoretical/practical in nature. Students may establish a partnership with a company or an organisation with the purpose of identifying and solving problems within management of innovation using scientific procedures and methods. The students will be provided with guidance during the thesis, having a Danish as well as a Chinese supervisor.

LEARNING OBJECTIVES

After having completed the master's thesis, the student must be able to:

- identify and define a complex and relevant innovation management problem (theoretical or theoretical-practical in nature) with important practical (policy and/or strategic) implications and potential for theoretical contribution.
- identify and apply relevant theories that can be used for building a conceptual framework for the analysis of the identified innovation management problem.
- identify and compare relevant scientific methods and prepare a design for selection, collection and analysis.
- develop solutions and demonstrate implications based on the findings of the analysis.
- work independently and assume academic responsibility for the learning that the project has resulted in.
- demonstrate competence of and skills in scientific writing and oral presentation of the thesis and its findings.

EXAMINATION

The thesis is an individual written assignment.

The thesis has a length of a minimum of 60 and a maximum of 100 standard pages, excluding executive summary, references, and annexes. Students should add a summary to the thesis in English.

The examination (defence) is oral, based on the thesis. It consists of the thesis presentation followed by a dialogue between the student and the examiners that make up the Thesis Defence Panel.

The oral examination lasts 60 minutes (incl. assessment).

The grade awarded must reflect an overall assessment of the written thesis and the oral defence.

The assessment is made by the Thesis Defence Panel which includes an external examiner.

RE-EXAMINATION

Re-take examinations are subject to the same regulations as the ordinary exam. For more information, see SDC Thesis regulations 10 steps.

GRADING

For the Danish/international students, grades are given according to the Danish 7 step and the Chinese thesis grading scales.

For the Chinese students, grades are given according to the Danish 7-point grading scale grading scale only.

The details of the thesis procedure are described in SDC Thesis Regulation.

International Food Quality and Health

Food Toxicology

3.75 ECTS

Course responsible coordinator: Hanyong Peng, Professor, RCEES, CAS, hypeng@rcees.ac.cn

COURSE CONTENT

This course aims to provide a broad foundation of knowledge and overview of major existing and newly emerging items of concern within the field of food toxicology and food safety assessment. Food toxicology is the study of the nature, properties, effects, and detection of toxic substances in food, and their disease manifestation in humans. From health and economic consequences to exposure assessment and detoxification, this course comprehensively covers dose-response relationships, absorption, distribution and storage, biotransformation and elimination of toxicants, target organ toxicity, teratogenesis, mutagenesis, carcinogenesis, food allergy, and risk assessment. The chemical substances presenting in traditional and novel foods, including natural toxins, food supplements, substances derived from food processing, agricultural chemicals, persistent organic pollutants, engineered nanomaterials, food additives, and veterinary drugs, will be described, regarding how they are produced, tested and regulated. Various antioxidants and essential metals in food will be introduced, regarding their roles against or for free radical induced damage to macromolecules. The underlying mechanisms for the toxic substances in food and the related methodologies will be discussed. The related interesting references, as well as recent guidelines from U.S. Food and Drug Administration (FDA), World Health Organization and China regarding food hygiene and safety, will be included to facilitate the understanding of the current situation in food management and further research.

LEARNING OUTCOMES

Knowledge

During the course, the students will gain knowledge in and understanding of:

- basic concepts for toxicology and food toxicology.
- naturally occurring and man-made toxins in food.
- antioxidants and essential metals in food.
- toxicological effects of foodborne toxins.
- cell signalling pathways involved in food toxicology.

Skills

The students will be able to:

- help develop critical thinking skills about the risks of foodborne toxicants and understand the importance of the lessons learned for the scientific work and future career.
- identify the risky chemicals in food and their sources.
- understand the potential deleterious effect of food contaminants on human bodies.
- develop critical thinking skills for evaluating the risks of foodborne toxicants.
- learn the basic knowledge on the scientific work in the field of food safety control.

Competences

At the end of the course the students will be able to:

- understand the basic concepts in food toxicology and food safety evaluation and apply these on complex issues.
- analyse problems and issues related to food contaminants and the related health outcome.
- gain the research idea on how to perform the food toxicology-related research.

EXAMINATION

Each student must submit a 2-page essay during the course and perform a 15-minute oral presentation in class. During the oral presentation, the student will present a synopsis and perspectives of the essay and be asked questions. The questions will take a starting point in the essay and be broadened out to also cover general topics from the curriculum. Via the essay and the oral presentation, the student must demonstrate an understanding of the learning objectives of the course. At the end of the course, it will be assessed, on a pass/non-pass basis, if the student performed satisfactorily.

The purpose of the essay and presentation is to assess the students' ability to:

- use the basic knowledge on food toxicology to deal with the real problems related with food safety.
- develop research idea on exploring emerging problems in food toxicology.

RE-EXAMINATION

Students who fail to pass the course can take the re-exam. Re-examination contains a 5-page written essay on a fixed topic plus a 15-minute oral presentation. During the oral presentation, the student will present a synopsis and perspectives of the assignment and be asked questions. The questions will take a starting point in the assignment and be broadened out to also cover general topics from the curriculum, to check if the student demonstrates an understanding of the learning objectives of the course.

GRADING

Evaluation is based on both written and oral presentation and is to be graded on a passed/not passed basis.

Food and Society

5 ECTS

Course responsible coordinator: Wesley Dean, wesleydean@ifro.ku.dk.

COURSE CONTENT

The course introduces students to key aspects of social scientific analysis of food systems and to social science perspectives on food and health. The course will start with a short introduction to the history of the global, the Western and the Chinese food systems. Hereafter, the course will make an introduction to key actors in the Danish and Chinese food systems and how responsibility for food related health, safety and quality is distributed between actors in the two systems. Key concepts and understandings of risk and sustainability will be introduced and analyzed in relation to mainstream and alternative food systems. Further, the course introduces students to the different understandings of and perspectives on food quality, safety and health among actors in the food system, such as consumers, producers, manufacturers, retailers, experts and public authorities. Differences and contrasts between lay and expert perspectives on safety and health will be highlighted, as an avenue to understand the social construction of risk.

LEARNING OUTCOMES

Knowledge

During the course, the student will gain knowledge in and understanding of:

- historical development of global and local food systems.
- differences between food systems in Eastern and Western parts of the world (China & Denmark).
- interests, strategies and concerns of actors in the food sector.
- the significance of social contexts and societal framings of issues.
- the governance of health, safety, and quality, in relation to food.
- lay people's practices and concerns in relation to food.
- sociological concepts and theory related to food, health, and quality.

Skills

The students will be able to:

- demonstrate skills at basic level to analyse food systems.
- identify different perspectives on central issues in the food system.
- analyse differences in interests, strategies and concerns among food system actors.
- use sociological concepts to describe key issues in the food system.
- demonstrate understanding of and ability to use key sociological concepts related to the food area.

Competences

At the end of the course the student will be able to:

- understand complexity of societal issues related to food.
- analyse problems and issues related to food and health in a societal perspective.
- critically review existing policies and strategies related to food.
- map differences in interests and concerns related to challenges in the food system.
- use relevant sociological concepts and theory to understand food issues.

EXAMINATION

The final exam is an individual 24-hours written exam. The students will be presented to 2-3 problems related to the food sector. They are expected to choose one problem and write a short analysis of central social aspects of it (maximum 2000 words). In this, they should identify and use material from relevant sources, and draw on the course curriculum.

The purpose of the examination is to assess the students' ability to:

- integrate knowledge of food systems, food system actors' interests, different understandings of key issues in relation to food and health, in the analysis of a specific problem.
- utilize the above-mentioned knowledge in a coherent understanding of the complexities of the food system.

RE-EXAMINATION

The re-examination will have the same format as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Food Chain Management

5 ECTS

Course responsible coordinator: Professor Jørgen Dejgård Jensen, jorgen@ifro.ku.dk and Professor ZHU Xiaoyan

COURSE CONTENT

The aim of the course is to teach the fundamentals of economics in relation to the food supply chain, and thereby give the students an understanding of producers', suppliers' and customers' behaviours and economic incentives in relation to decision making in the food supply chain.

The course will address basic principles of microeconomic theory, the laws of supply and demand and their theoretical foundation, the roles of imperfect competition (such as monopoly, monopsony, oligopoly or monopolistic competition), economic risk and incentives, and information problems (imperfect or asymmetric information) on economic decision making in product or input markets for management of the food supply chain.

Focus in the course will be on management of food quality, food safety and sustainability in a supply chain perspective, with active use of economic theory in relevant empirical cases from the Chinese, European and international domains. This involves the role of market structure, risk and information on food supply chain decision makers' economic incentives vis-a-vis quality, safety and sustainability.

The module consists of seven main components:

- Economic theory of production, economies of scale, economies of scope
- Imperfect competition
- Product quality and product differentiation
- Management of economic risk (price risks, macroeconomic risks, risk of technical defaults...)
- Management of food quality, food safety and sustainability in the food supply chain
- Economic coordination in the food supply chain, contracts, economic incentives and asymmetric information (principal-agent relations, adverse selection, moral hazard)
- The demand side of food markets (consumers, business-to-business, international trade)

LEARNING OUTCOMES

The main learning of the course is to make the students familiar with the concepts of economic thinking in food production, food trade, and management of food quality and safety throughout the supply chain.

Knowledge

After completing the course, the students should be able to:

- describe the economic principles for firms' economic incentives in terms of the economic optimization of firms' output level and input use in production.
- describe the influence of the market competition environment on the economic optimization of firms' output and input use.
- reflect upon the influence of market competition environment on the economic decisions of companies' suppliers and customers.
- reflect upon the roles of risk, uncertainty and information for firms' economic incentives.

Skills

The students will be able to:

- apply economic theory to understand market phenomena.
- communicate and discuss concrete economic problems and solutions with different target groups.

Competences

The students will be able to:

- cooperate with fellow students in analysing and solving different economic problems in a food quality and food safety perspective.
- independently work with economic problems related to the food market.

EXAMINATION

Written 4-hour presence exam. At the written exam students will for example be asked to explain economic terms, principles and mechanisms, as well as conduct and analyse economic calculations.

Aids: calculator

RE-EXAMINATION

Same format as ordinary exam

Aids: calculator

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Food Business, Marketing and the Consumer

5 ECTS

Course responsible coordinator: Prof. Polymeros Chrysochou, polyc@mgmt.au.dk and Prof. Hong Zhao, zhaohong@ucas.edu.cn

COURSE CONTENT

This module aims to provide students with a general view of business, marketing, consumer, and social issues in the food industry. It first introduces the students to the fundamentals of the food industry and food consumers. This module then familiarizes the students with key marketing decisions in the food business. Finally, it offers the students a social perspective on food business.

The content of this module includes four parts:

- Part 1 offers an introduction to food business in terms of food business environment, economics of food production and food marketing.
- Part 2 explores food consumers with a focus on consumer decisions when buying food, as well as the research tools used to understand food consumers.
- Part 3 is centred on food marketing decisions, starting with marketing strategy, and dealing then with marketing mix, branding, marketing communication, pricing and food distribution.
- Part 4 covers several social issues in food marketing, such as health, sustainability, ethical marketing behaviour, and social responsibility of food companies.

LEARNING OUTCOMES

Knowledge

After this module, students should have knowledge on basic concepts of food marketing, notably:

- on the major constraints that a food business must operate in.
- on the way consumers make decisions when buying food, and what these decisions mean for the food business.
- on basic concepts and theoretical tools useful for planning and executing business on food markets, both at the strategic an operational level.
- on the major societal issues facing the food sector today.

Skills

After this module, students should have acquired the following skills:

- analyse the market conditions for a food company, both in terms of external and internal factors.
- develop an in-depth understanding of what drives the behaviour of food consumers.
- develop marketing strategies and plan and monitor their implementation.
- analyse possible combinations of marketing parameters and combine them into a marketing plan.

Competences

The student will, through the module, acquire the competencies that enable her/him to work in an outward-directed function in a food company, like marketing manager, brand manager, public relations officer, regulatory affairs officer.

EXAMINATION

The students need to submit an individual written assignment during the course to qualify for the exam. The assignment will involve describing the environment of a chosen food company and develop a marketing plan, 5-6 pages (completing this will also qualify the student for the re-exam). The report will be evaluated on a pass/ not-passed basis. In the case that a report is not passed, the report needs to be edited for the students to get a pass, so they can attend the final exam. The report does not form a part of the final grade but qualify the students for the final exam.

The final examination is 3 hours, open book (internet is not allowed).

RE-EXAMINATION

Students who do not get a pass for the report in due time for the ordinary exam or does not pass the written exam, can take the re-exam in the part(s) not passed. The re-exam will follow the same format as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Food Nutrition and Health

7.5 ECTS

Course responsible coordinator: Susanne Bügel, Department of Nutrition, Exercise and Sports (NEXS), University of Copenhagen, Denmark. e-mail: shb@nexs.ku.dk

COURSE CONTENT

The course covers the following thematic domains: 1. Nutrition physiology, 2. Nutritional quality of foods and diets, 3. Sustainable and healthy diets to meet nutritional requirements, and 4. Food and diets to meet requirements of specific population groups. 'Nutrition physiology' covers the introduction to basic human nutrition including energy, macro- and micronutrients, definitions, classifications, chemical structure, physical and chemical characteristics and physiological function. The basic physiological principles for digestion, absorption, transport and storage of nutrients and bioactive components in the human body is covered. 'Nutritional quality of foods and diets' covers the health implications and pathways of changing diets in populations. The pathways cover food-based dietary approaches to changing individual nutrient intakes, such as plant- vs animal-source foods; and public health approached such as mandatory and optional food fortification. 'Sustainable and healthy diets to meet nutritional requirements' covers the principles for setting nutritional requirements for different age and sex groups; an overview of international and national nutritional recommendations; the introduction to principles of setting food-based dietary guidelines; and an overview of the emergence of models for analyzing and understanding the sustainability of healthy diets. 'Food and diets to meet requirements of specific population groups' covers the introduction to methods to assess nutrition status (anthropometric measures, growth references, biochemical indicators) and public health aspects of over- and undernutrition, with specific focus on children and elderly.

LEARNING OUTCOMES

Knowledge

During the course, the student will gain knowledge in and understanding of:

- the role of nutrients (energy, macro-and micronutrients) for physiological functions in humans at different life stages.
- the relations between nutrients, food, diets and health from a public health perspective.
- the recent frameworks and methodologies for establishing the sustainability of diets in relation to human health.
- the strength and validity of evidence of impacts of foods and diets on human health.
- the principles of setting nutritional requirements, recommendations and dietary guidelines.
- nutritional status assessment indicators.

Skills

The student will be able to:

- demonstrate skills at a basic level related to the understanding of the general principles of the characteristics of micro- and macronutrients and human nutrition physiology.
- point to suitable methodologies utilized to assess and analyze diets for nutritional contribution in relation to human requirements and health.
- utilize a software-based tool to analyze diets for nutritional composition and contribution to human requirements.
- identify the relevance of different frameworks for sustainability of food systems and diets.
- identify pathways for optimizing and improving the contributions of nutrients to from various types of diets in the view of individual preferences, public health and sustainable food production.
- skills in oral and written presentation of evidence for nutrition and health aspects of foods and diets.

Competences

- work independently as well as in groups in relation to trans-cultural and interdisciplinary projects related to food, diets and health.
- critically review scientific literature related to human nutrition and health.
- understand and reflect on the evidence of nutritional and health impacts of food and diets.
- have a basic knowledge and a critical scientific approach to understanding the evolving of frameworks for sustainable and healthy diets.

EXAMINATION

The student must submit a project report made in groups of 3-4 students to qualify for an oral exam. The report must be submitted at a deadline set prior to the final exam. The length of the report is maximum 10 pages, plus illustrations and references. The topic of the project report is selected from a list of predefined topics and must follow a provided guideline for the outline.

After submission, each student will individually attend an oral exam. The total time allocated for the oral examination is 20 minutes. The student is examined for 15 minutes followed by 5 minutes for grading. The 15 minutes of examining the student is structured so the student first speak on aspects of the project report of the student's own choice, followed by questioning related to the project report and questions to the general course curriculum. The final grade will be based on the oral performance.

RE-EXAMINATION

In case of re-examination, an individual report must be submitted prior to the re-exam. The report will be minimum 5 pages on a topic decided by the course coordinator and informed to the student at least a week prior to the re-exam. The structure of the oral re-examination is the same as for the ordinary exam. The final grade will be based on the oral performance. Digital oral examination is allowed.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Chemical Food Safety and Health

3.75 ECTS

Course responsible coordinator: Ming XU, mingxu@rcees.ac.cn

COURSE CONTENT

This course aims to provide a broad foundation of knowledge and overview of the chemical risk in food and food safety assessment of chemicals. Preventing food contamination with various chemicals requires an understanding on how they can enter and pass along the food production and processing chain, as well as relevant issues in toxicology and risk management. Chemical Food Safety & Health offers understanding of different aspects of chemical risks in food products, provides current knowledge on the possible chemical contamination pathways during food production processes, introduces risk assessment concept and related methodologies, illustrates various kinds of chemical contamination in food and their potential health hazards, and reviews the related worldwide regulations as well. Moreover, case studies will also be included to facilitate the understanding of the current situation in chemical food safety and help in identifying the research gaps needed to be filled in.

The course includes 4 modules. Module I is the introduction to chemical food safety & health. Module II focuses on safety assessment methods for chemicals in food, covering the related topics as exposure and chemical cocktail in food, toxicity testing assays, population study and epidemiology, and computational methods as well. Module III briefly illustrates the typical types of unwanted chemical substance in food, such as naturally inherent plant toxicant and mycotoxins, metals, metalloids and other elements, pesticides, veterinary drugs, food additives and flavorings, and food allergies. Module IV is about guidelines and regulations for chemical food safety control and case study.

LEARNING OUTCOMES

Knowledge

At the end of the course the students will have gained the knowledge of:

- the concept of risk assessment and safety assessment.
- safety assessment methods for chemicals.
- typical categories of chemical contaminants in food.
- chemical contamination sources and pathways for food products.
- the potential risk of chemicals in food to the human health.
- guidelines and regulations for chemical food safety control.

Skills

The student will be able to:

- point to suitable methodologies utilized to evaluate the risk of chemical contaminants of food products.
- demonstrate the chemical risks in food at the basic level, incl. typical sources, contamination pathways, and health hazards.
- understand current regulations of toxic chemicals in food for safety control.

Competences

Through the course the student is expected to gain the competencies as follows:

- high-level understanding and interpretative capacity in the sources, contamination pathways of chemicals to food and their potential risk to the health of human beings.
- critical thinking skills in the risk assessment methodology and current regulations of toxic chemicals in food to ensure the health of human beings.

EXAMINATION

The student must submit a 2500-word assignment during the course + perform an oral presentation. The presentation is a 10-minute oral presentation made in class for each student. During the oral presentation, the student will present a synopsis and perspectives of the assignment and be asked questions. The questions will take a starting point in the assignment and be broadened out to also cover general topics from the curriculum. Via the assignment and the oral presentation, the student must demonstrate an understanding of the learning objectives of the course. At the end of the course, it will be assessed, on a pass/non-pass basis, if the student performed satisfactorily.

RE-EXAMINATION

Students who fail can take the re-exam. Re-examination contains a 2500-word written assignment on a fixed topic plus a 10-minute oral presentation During the oral presentation, the student will present a synopsis and perspectives of the assignment and be asked questions. The questions will take a starting point in the assignment and be broadened out to also cover general topics from the curriculum, to check if the student demonstrate an understanding of the learning objectives of the course.

GRADING

Passed/not passed.

Life Science Engineering and Informatics

Molecular Genetics and Epigenetics

5 ECTS

Course lead: Jie Ren (University of Chinese Academy of Science, Beijing Institute of Genomics): renjie@big.ac.cn

CONTENT

The course will provide the students with the skills to understand and explain the basic molecular architectures of plant and animal genomes as well, as the basic mechanisms that regulate genome functions. Furthermore, the course will provide the students with the ability to understand and discuss principles of molecular genetics including an insight into and the use of methods to identify complex traits and disease genes.

- The organisation of plant and animal genomes.
- Identification and characterization of DNA sequences, genes and molecular genetic variation.
- Molecular methods used to map Mendelian and complex traits.
- Basic mechanisms in genetic regulation of genome function.
- Basic mechanisms underlying epigenetic phenomena, including DNA methylation, chromatin modification, RNA methylation and noncoding RNA.
- Reading, understanding and oral presentations of scientific papers.

The teaching comprises lectures, discussion, student presentations and exercises.

LEARNING OBJECTIVES

By the end of the course, the student is expected to have the skills to:

- explain the architecture of animal genomes.
- discuss the mechanisms that regulate the functions of the genome.
- discuss the principles of molecular genetic methods and the techniques used to identify complex traits and disease genes.
- explain principles and mechanisms underlying epigenetic phenomena.
- critically read, understand, and orally present scientific papers.

EXAMINATION

1-week written individual assignment, assigned at the end of the course.

The assignment must have a minimum of 6 pages and maximum 7 pages, including 1 page with table/figure and legend and 1 page with references. The remaining 5 pages of the assignments should include an abstract/summary, Genetics, Phenotype description, Methods/analysis approach if appropriate.

RE-EXAMINATION

Re-exam will follow the same format.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Command Line and Python for Data Science

5 ECTS

Course lead: Marjan Mansourvar (DTU Bioengineering): marjma@dtu.dk

CONTENT

The course exposes the student to practical problems a data scientist may encounter in two main ways:

1) Utilizing the Unix command line for tasks like file manipulation, I/O redirection, file system manipulation (including path handling, file hierarchy, and file access control.

2) Using Python to cover fundamental concepts in data science and data processing, delving into various data types, data structures, and introducing the concepts and application of algorithms.

This course serves as an introduction to Unix and Python, placing a strong emphasis on practical problem-solving within the framework of basic programming principles and good programming practices. The problems presented will revolve around common bioinformatics issues, including parsing and manipulating bioinformatics data files. Additionally, considerations for performance and memory usage will be addressed.

LEARNING OBJECTIVES

Upon successful completion of the course, students will be able to:

- explain what an algorithm is and provide examples.
- demonstrate insight in how to design and implement an algorithm in Python.
- utilize various data types and built-in functions in Python.
- break down a computational task using sub-routines.
- identify and rectify errors in a program based on its behavior.
- define and use regular expressions (computational pattern recognition)
- write code that is understandable to others, and comprehend code written by others.
- analyse and plan the execution of a minor computational project.

EXAMINATION

The 5-day programming project will consist of a written report of up to 15 pages, followed by a 20-minute oral defense. The oral defense will be conducted without preparation and no aids will be allowed. During the defense, the student will present their source code and explain the program to the examiners. The final grade will be determined after the oral defense.

RE-EXAM

The re-exam will be the same as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Single Cell Technologies

5 ECTS

Course lead: **Lan Jiang, professor (Beijing Institute of Genomics (BIG)), jiangl@big.ac.cn .**

CONTENT

Single cell technologies are extremely powerful in unraveling heterogeneity within multicellular systems and are increasingly applied across all biological systems. Different cellular macromolecules (i.e. DNA, RNA, Chromatin accessibility, Proteins etc.,) within individual cells are profiled at high throughput through a combination of novel methods, different technologies and a strong data analysis component.

This course aims to build a basic understanding of different technologies and approaches used to isolate single-cells, perform different workflows to extract and measure cellular macromolecules (DNA, chromatin, peptides/proteins) at single-cell level through high-throughput technologies within mammalian cell systems. This course will also have a data analysis component and provide the students with skills to analyze, understand and interpret different data analysis steps (quality control, dimensionality reduction, clustering etc.). Students will obtain critical knowledge for evaluating the strengths and weaknesses of various single cell technologies, conduct independent data interpretation on highly multi-dimensional datasets, and appreciate the impact of such technologies in identifying cellular heterogeneity both in health and disease.

LEARNING OBJECTIVES

The student who has met the objectives of the course will be able to:

- understand and appreciate cellular heterogeneity within biological systems, and the need for single cell resolution.
- explain different approaches to isolate single-cells from complex tissues.
- explain underlying principles for extracting different macromolecules from single-cell assays incl. transcriptome, chromatin accessibility and proteomics.
- evaluate strengths and limitations of various adaptations of these technologies.
- conduct basic and advanced data analysis (python/jupyter-lab notebooks) on highly multi-dimensional single-cell omics datasets.

EXAMINATION

The course is evaluated based on two assignments to be solved individually by the students, within 48 hours (all aids allowed). The assignments include data science exercises and multiple-choice questions covering broader topics of the course. The final marks are given based on course assignments (50 % each) and evaluated by the internal censors.

RE-EXAM

Same as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Advanced Microfluids Technologies for Biological and Single-cell Analysis

5 ECTS

Course lead: Deyong Zhu (University of Copenhagen, Department of Biology): deyong.zhu@bio.ku.dk

CONTENT

Microfluidics, or Lab-on-a-Chip, is the science and technology that manipulates and analyzes fluids at sub-millimetre dimensions. It has been considered as the key enabling technology for many emerging applications, especially in the fields of biology, medicine, chemistry, and environmental sensing. With microfluidic technologies, researchers can manipulate and probe individual cells, and can precisely control their microenvironments, leading to new questions and new discoveries.

This course aims at introducing students to the cutting-edge concepts of microfluidics and the opportunities and challenges for manipulating biological matters and chemicals at the micro-scale. During the course students will acquire basic understanding of microfluidics in terms of design strategies, fabrication methods/materials, and computational simulation of fluid behaviour at the micro-scale. Students will be knowledgeable of microfluidic applications particularly in single-cell sequencing (i.e. by droplet-based microfluidics) and on-chip cell cultivation and characterization (i.e. by organ-on-a-chip). Finally, students will learn both the advantages and limitations of microfluidics-enabled technologies with case studies in order to achieve successful development and application in their future research.

LEARNING OBJECTIVES

The student who has met the objectives of the course will be able to:

- Understand and explain the fundamental principles of microfluidics technologies and their applications in diverse biological and single-cell analysis.
- Design and implement microfluidic systems by different microfabrication technologies, such as soft lithography and 3D printing using proper materials.
- Design and implement single-cell sequencing and on-chip cell culture experiments.
- Evaluate strengths and limitations of various microfluidics technologies.
- Recognize emerging trends and advancements in microfluidics for biological analysis.

EXAMINATION

The course will be evaluated by a written report followed by an oral defence. The students will have one week to submit a report based on one of the given tasks. The report should be approx. 10,000 characters in total (incl. titles and spaces) plus one page for references, figures, or tables. By the end of the course, each student will be invited to an oral defence. The final grade will be dependent on the overall performance of both the written report and oral defence.

RE-EXAM

Same as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Applied Omics

5 ECTS

Course lead: Antonios Petridis (Aarhus University, Department of Food Science): apetridis@food.au.dk

CONTENT

"Omics" represent an underexploited potential of technologies with great promise to gain insights at the molecular level into e.g. quality of foods, feed and raw materials, human and animal disease mechanisms, probiotics, processes in food and ingredients production, nutritional values, crop plant quality and breeding, biotechnology and fermentation.

The course aims to provide a broad knowledge on the use of "omics" in plant and food biotechnology, biomedicine and health, sufficient for formulating hypotheses and proposing research strategies. By critically reading recent scientific literature on relevant topics, the students will both familiarize with the topics and get an in depth understanding of strengths and weaknesses of experimental designs from sample preparation to qualitative and quantitative analysis of data.

The course will mainly focus on proteomics, transcriptomics and the use of relevant special techniques in the areas of food, biomedicine, biotechnology and agricultural sciences. Case stories on applied "omics" (probiotic and commensal gut bacteria, meat, dairy, cereal crops, vegetables, cellular agriculture, biomarker discovery) will be highlighting strategies from omics-based discovery of key proteins and enzymes to characterization of their structure and function, and how proteases play a key role in health and disease.

LEARNING OBJECTIVES

A student who has met the objectives of the course will be able to:

- extract information from scientific literature.
- formulate research questions, make hypotheses and propose research strategies related to applied omics.
- evaluate strengths and limitations of experimental plans.
- explain the use of various "omics" techniques for qualitative and quantitative characterization in biological systems.
- account for the preconditions of successful experimental designs.
- critically evaluate the application of "omics" techniques.

EXAMINATION

The exam is based on one individual written report (10-15 pages, with aids) handed in at the last day of the course.

The topic of the report will be decided by the students and should be related to omics technologies and how they are being applied in practice to answer research questions across disciplines within the life sciences. To ensure that the topic is relevant to the course and to get feedback, the students will pitch their topic in front of the whole class and the teachers. Details about the final exam report, relative to its content and its structure, will be discussed at the start of the course, and the students will be able to formulate their idea during the course.

RE-EXAM

Three hour written exam in the form of a short essay addressing a theme given by a paper (handed out at the day of the exam, but within a topic covered in the course). All aids are permitted except for internet and Generative AI.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Emerging Metabolic Engineering Strategies Towards New-to-Nature Bioproduction

5 ECTS

Course lead: Yong Zhang (University of Copenhagen, Department of Biology): yong.zhang@bio.ku.dk

COURSE AIM + CONTENT

Synthetic biology and microbial engineering are pivotal fields driving innovation. They empower us to engineer microorganisms like bacteria and yeast into efficient biofactories, producing valuable compounds from biofuels to pharmaceuticals. This technology addresses global challenges like sustainability and environmental impact by optimizing biological systems. It also presents solutions for biodegradable plastics, clean energy, and medical advancements. To dive into this exciting biotechnological field, one needs to learn basic molecular microbiology and bacterial physiology, since these knowledges build the crucial foundation for designing and developing novel genetic circuits and metabolic pathways, fine-tuning microbial hosts and optimizing bioproduction processes. Meanwhile, the field of microbial engineering has advanced significantly with transformative tools like CRISPR-Cas9 genome editing and omics tools, e.g., deep sequencing techniques. These tools enable precise, rapid genetic modifications and streamline the design, testing, and optimization of microbial strains for various applications. Advanced computational modeling and artificial intelligence predict and optimize microbial behavior, further enhancing the efficiency and versatility of microbial platforms.

This course comprises three overall schemes: 1) Fundamentals of Molecular Microbiology, covering the core principles of Molecular microbiology and two technical aspects, i.e. 2) State-of-the-Art Microbial engineering tools and 3) Systematic Tools. The course thus equips students with both the fundamental knowledge and state-of-the-art tools, to harness microbial systems for diverse industries and address global challenges.

The course consists of both Lectures delivered by the teachers, and Colloquia/Journal club, where the students form groups to read and practice how to present a research article to the whole class. For Lectures, the teachers will make slides to better cover the topics. For Colloquia/Journal Club, recent and classic research articles will be used to give a chance to read, understand, and present how research is conducted. You will also learn how to logically think about and address a scientific question through this theoretical exercise.

LEARNING OBJECTIVES

At the end of the course a student should be able to:

Knowledge

- describe and understand the genetics of model bacterial organisms, the molecular processes of transcriptional, translation, how bacteria reprogram the physiology upon stresses.
- describe and explain the cutting-edge computational and experimental techniques relevant to metabolic engineering in microbial cell factories.

Skills

- evaluate the stress response in relation to bacterial physiology.
- know how to construct and express mutant genes and proteins.
- read, understand and present cutting edge literature in the field of molecular microbiology.
- able to write concise reviews of state-of-the-art of a topic or protein.

Competences

- Ability to combine knowledge and skills to solve new problems.
- Be able to pinpoint inconsistent data or explanations in literature by using one's knowledge obtained and logical reasoning.

- Having a mindset to apply critical thinking on the project or literatures and formulate your own hypothesis regarding open questions in molecular microbiology and design experiments to test them.
- Explain the importance and impact of topics in cell factory and system biology to both non-specialists in STEM and to the public.

EXAMINATION

The exam is a 72-hour written assignment. The assignment must be 5-10 pages (approximately 2400 character, including spacing per page) covering the selected topic in depth. The topic of the assignment must be the same as that chosen for the student's oral presentation during the course.

Students must follow the assignment template, which will have detailed instructions along with a list of pertinent topics.

Re-exam

Same as the ordinary exam

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

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Nanoscience & Technology

Synthesis and Fabrication

10 ECTS

Course responsible: Zhongming Wei, zmwei@semi.ac.cn

CONTENT

The course will be taught based on recent reviews on the state-of-the-art nano-assembly and top-down/bottom-up nanofabrication. The student will learn different chemical methods used in construction of functional molecules and in surface and polymer modification as well as lithographic procedures for nanofabrication.

Throughout the course, the students will learn the fundamental synthesize method, characterization, properties and device applications for nano materials including self-assembled monolayers, organic semiconductors, grapheme and grapheme oxide, nanoporous and polymers. The study will help the students to understand the frontiers of functional nanomaterials.

LEARNING OBJECTIVES

Knowledge

Nanomaterials are fabricated by utilising modern chemistry design, technology and techniques. The student will be made familiar with these synthetical techniques, chemical/physical methods to characterize the nanomaterials and enable their applications.

A student that fully meets the requirements of the course should have knowledge about:

- fabrication of self-assembled monolayers.
- single-molecule devices.
- organic electronics: OLED, OFET, OSC.
- novel nanoporous materials.
- graphene, Chemical GO.
- graphene, CVD, properties, characterization, application in devices.
- polymer.

Skills
The student will get skills of the synthesis methods, analysis and utilizations (especially the device applications) for functional organic nanomaterials and apply the above knowledge for evaluating and calculating functional nanomaterials.

Competencies
The student will get the abilities of understanding frontiers of functional nanomaterials, the systematically training for the nanomaterials related synthesis and fabrication processes, write and evaluate specific literatures, techniques, and design a research proposal for functional nanomaterial.

EXAMINATION

Oral exam (80%) and assignments (20%). To qualify for the oral exam, students must hand in 2 assignments. The assignments will be referencing article reading and written reports.

The oral exam is 30 minutes, no aids, no preparation time.

RE-EXAMINATION

Re-exam same as ordinary. Assignments must be completed before the re-exam. Passed exams will be transferred to the re-exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales. Internal censorship.

Nanoelectronics

5 ECTS

Course responsible: Per Hedegård hedegard@nbi.ku.dk

CONTENT

The course will cover the following areas: concepts in electron transport, current flow in nanostructures, mesoscopic electron transport, the quantisation of charge, and conductance and their consequences for transport, Landauer (transmission) formalism. The chosen examples will include quantum wires, low dimensional semiconductor structures, quantum dots, graphene, carbon nanotubes, molecular transistors, and other timely subjects in nanoelectronics. One session will be devoted to nanofabrication.

The course also includes two laboratory experiments:

- Measurement of the Quantum Hall effect and Shubnikov de Haas oscillations in a two-dimensional electron gas at low temperatures (4 Kelvin).
- Fabrication or measurements of quantum dots.

The experimental results are to be analysed in context of the theory presented in the course and summarised in reports written in groups of 3-4 students.

We aim at giving a phenomenological introduction to selected topics in the physics of nanostructures. The general theme is current flow (electron transport) in (low-dimensional) nanoscale structures, where quantum effects are expressed clearly. The basic formalism, key concepts and real experiments will be discussed, rather than complete theoretical treatments, which are covered in other courses. The students will be provided with the background for understanding a wealth of recent experiments in the field which ranges from quantum Hall physics, single-electron transport through "artificial atoms" in semiconductor structures to real "molecular transistors" based on single molecules. In addition to the purely scientific interest, these phenomena are also of technological importance in nanoelectronics and potential future applications in quantum information processing.

LEARNING OBJECTIVES

After completing the course, the students should be able to:

Knowledge

- describe the differences between transport in bulk materials (metals, semiconductors) and nanostructures, i.e., transport in different dimensions.
- describe the functionality of selected nanoelectronic devices based on these principles.
- describe fabrication methods and materials used for making nanodevices.
- describe and sketch the key elements in realising an electron transport experiment on a nanostructure.
- explain the most prominent consequences of quantum effects in electron transport through nanostructures (limited to the contents of the course).
- explain the differences between ideal theoretical quantum phenomena and measurements under less ideal conditions.
- know basic low-temperature techniques for measuring of nanodevices.

Skills

- apply the acquired knowledge to analyse experimental data and extract relevant parameters, e.g., the essential length scales, energy scales, characteristic temperatures, quantized units etc.
- carry out experiments on simple experimental setups for measurements of nanodevices.

Competencies

- analyse experimental data and write a report presenting relevant theory, experimental results, and analysis.
- demonstrate understanding of the basic formalism and the key concepts within electron transport.
- read and understand relevant scientific literature on electron transport in nanodevices.

EXAMINATION

Oral examination, no preparation time (25 min + 5 min not including deliberation), 10-12 minutes presentation based on one of the experiments A or B (or other relevant topics if announced) followed by a discussion on material covered in the course.

RE-EXAMINATION

The same as the ordinary exam. The re-exam will be held as the ordinary exam, experiment (A or B) must be completed before re-exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Nano Energy Materials

5 ECTS

Course responsible: Torben René Jensen, trj@chem.au.dk

CONTENT

In the course, the students will gain understanding of fundamental concepts required to understand the technological developments of nanomaterials for energy applications. This includes introduction to both theoretical background, concepts and techniques associated with the research in the field. Furthermore, examples based on recent scientific literature will be included as well as mandatory weekly assignments.

LEARNING OBJECTIVES

KNOWLEDGE

At the end of the course, the students should be able to:

- describe fundamental concepts in the synthesis, physical properties, and applications of nano energy materials.
- explain basic nucleation and growth theory as well as nanoparticle interactions.
- relate surface physics and chemistry to nanoparticle morphology.
- relate nanoparticle morphology and size to its properties.
- explain the interrelationship between band structure and properties.
- explain the fundamental concepts of the following technologies, and the role and benefits of nanomaterials: photovoltaics, catalysts, super-capacitors, batteries, electrolysis and hydrogen storage.

SKILLS

- apply the acquired knowledge about nano energy materials to critically design and evaluate specific experimental model systems.
- analyse experimental data obtained in nano energy materials systems.

COMPETENCIES

- choose and evaluate protocols and systems for specific nano energy systems.
- express both verbally and in writing the nano energy material concepts in a scientifically clear, correct and engaging language.
- design synthesis of functional nanoparticles and thereby control their size distribution.

EXAMINATION

3-hour written exam without aids. The course grade is based on the written exam (100%). Passing the mandatory weekly assignments is required to qualify for the exam.

RE- EXAMINATION

The re-examination is the same as ordinary. The weekly assignments must be passed before the re-exam. Re-examination will be converted to oral examination in case of less than five students: 30 min. oral exam, no aids, no preparation time.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Bionanomaterials

5 ECTS

Course responsible: Baoquan Ding, dingbq@nanoctr.cn

CONTENT

The aim of this course is to provide the students with background knowledge on bionanomaterials based on the assembly of nucleic acid, peptide, and protein. To introduce the latest achievements in basic research and potential applications.

This course will go through themes such as: Self-assembly of biological molecules. Design and assembly principle of DNA and RNA nanostructures: build 3D nanostructures with controlled size and geometry. DNA based organic synthesis. Modification of nucleic acids nanostructures with various functional elements. Nucleic acids-based imaging probes and drug delivery system. Artificial molecular devices. Construction of peptide assembly nanostructures. Protein assembly nanostructures. Peptide assembly-based nanomaterials. Biomedical application of peptide-based nanomaterials. Disease associated peptide and protein assembly.

LEARNING OBJECTIVES

Knowledge: Molecular structures of natural and artificial nucleic acids and peptides; strategies to assemble these molecules into nanomaterials with different functions.

Skills: Designing of nanostructures using biomolecules

Competencies: The students will learn the principal of biomolecular assembly and the latest progress in the field of biomaterials, drug delivery, etc. They will gain higher innovation consciousness on biomedical studies and be ready for their own research.

At the end of the course, the students should be able to:

- describe the basic concept of DNA and RNA nanotechnology; explain and compare different strategies to assemble DNA nanostructure; design DNA nanostructures with provided software relate models of designed nanostructures to fabrication of nucleic acids nanomaterials; explain the strategies to assemble metal nanoparticle for plasmonic study and encapsulate drug molecules for therapeutic purpose.
- read and give a short presentation of a scientific paper within the subject area, understand the basic concept of peptide and protein assembly.
- understand the interaction mechanism between peptides in peptide and protein assembly; describe the possible aggregation pathways in peptide assembly; explain the strategies to design peptide assembly nanostructures for biomedical applications.
- expose the above goals in a scientifically correct language.

EXAMINATION

A three-day take-home assignment in the form of an essay. The Essay must include your analysis of the provided reference and your answers for the provided questions and the scope should be 5-8 pages. All aid allowed. All students will be evaluated based on their class attendance (25%) and the essay (75%). There will be one final grade base on the two grades.

RE-EXAMINATION

The re-examination will be graded based on a 3-day take home assignment in the form of an essay. The Essay must include your analysis of the provided reference and your answers for the provided questions and the scope should be 8-10 pages.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales. Internal censorship.

Business Innovation and Entrepreneurship

5 ECTS

Course responsible: Yimei Hu, yimei@business.aau.dk

CONTENT

Taking into consideration that more natural sciences graduates will work in companies in real business contexts or start new business ventures as their career choices, this course will introduce main concepts and theories related to innovation, entrepreneurship, and business management.

How to organise and manage technological activities is an important part of a high-velocity global market. To keep competitive advantage in such a dynamic global market, companies and organisations are required to change and develop continuously, i.e., work with innovation. On the other hand, to take advantage of the new global and technological opportunities, new value creation opportunities can be captured and realized through entrepreneurial initiatives such as venture creation. For business and innovation managers, the ability to analyse the market, and ensure value creation and appropriation are hereby core to business sustainability and global competence.

The main subjects covered are:

- Concepts and theories of innovation and entrepreneurship.
- Market structure, business strategies, and strategic management for competitive advantages.

The course comprises lectures, cases, discussions, guest lecturers, and students' active involvement.

LEARNING OBJECTIVES

By the end of the course, the students are expected to relate knowledge learnt from the course and nanotechnology knowledge, and gain the following knowledge, skills, and competences.

Knowledge

- basic concepts and theories in innovation, entrepreneurship, and strategic management.
- explain basic characteristics of different market structure and competitive strategies.
- describe different types of organization structures.
- explain the role of nano technologies and nano research in innovation and value creation processes.

Skills

- identify different types of organization structures and their pros and cons.
- apply the principles and theories to analyse an industry or a market.
- apply the tools and frameworks to critically analyse a business model.

Competencies

- identify a business idea based on current engineering and scientific knowledge in nano technology.
- design a business model and organization structure suitable for a business idea.
- critical thinking and comprehensive reflection on business environment.

EXAMINATION

Essay 5-10 pages based on questions from the examiners. 1 week take home.

Format:

- Min 5 pages, max 10 pages (excluding references, tables, and figures)
- Standard page, font 12, double line space.

RE-EXAMINATION

The same as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Neuroscience and Neuroimaging

Magnetic Resonance Imaging (MRI)

5 ECTS

Course coordinators: Steffen Ringgaard (steffen@clin.au.dk) and ZUO Zhentao (zuozt@ibp.ac.cn)

CONTENT

Basic MRI covers the basic principles of magnetic resonance (MR) imaging and some research methods. This includes spin dynamics in a magnetic field, interaction of magnetization by radiofrequency pulses, principles of MR imaging using magnetic field gradients, relaxation of magnetization and contrast in images. The most important applications of MR will be introduced. These include angiography and blood flow measurement, perfusion and diffusion assessment and functional MRI. Besides, examples of the clinical use of MR imaging will be given.

LEARNING OBJECTIVES

The student should have knowledge of the basic principles of:

Knowledge

- magnetic dipole moments in a magnetic field.
- image formation.
- obtaining contrast in MR images.
- using MRI for various physiological measurements.
- clinical MRI.

Skills

- possess overall knowledge of fundamental MRI and the clinical use of MRI.
- understanding of which kind of research problems for which MR can be used.
- understanding of the limitations of MR.

Competences

- competence to be able to participate in research projects using MRI.
- competence to be able to participate in evaluation of MR scanners for equipment purchasing.

EXAMINATION

20 min oral examination without preparation, drawn from a pool of unknown topics. Examiners will be teachers from the course. 7-step grading scale/100 points. Internal censor.

RE-EXAMINATION

Will be in the same form as original exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Methods in Preclinical Neuroscience (MPN)

5 ECTS

Module coordinator team:

China: Principal Investigator Ninglong Xu, Center for Excellence in Brain Science and Intelligence Technology, Institute of Neuroscience, CAS Shanghai; (xunl@ion.ac.cn)

Associate Professor Zhaolin Hua, State Key Laboratory of Brain and Cognitive Science, Institute of Biophysics, CAS Beijing, (zlhua@moon.ibp.ac.cn)

Denmark: Associate Professor Anders Olsen, Department of Chemistry and Bioscience, AAU; (ao@bio.aau.dk)

AIM

A multitude of methods and models are used in modern neuroscience to study molecular interactions, network, functions, behaviour etc. The aim of this course is to introduce various methods and models for preclinical neuroscience research, including methods of behavioural measurement, optical imaging and cell- type specific manipulations of brain activity that are central for these studies. The students will be introduced to various animal models currently used in neuroscience research. The techniques for generating novel transgenic models using genetic manipulation of popular model organisms, such as C. elegans, Drosophila, and mice will be described. A particular focus will be placed on the different types of genetic models used to study neurological disease. The usages of these models in modern neuroimaging, the selection of an appropriate animal model, and experimental design will be discussed. Finally, the students will be introduced to ethical considerations in animal experiments (i.e. the 3R's: Replacement, Reduction, Refinement) and legislative aspects pertaining to animal experiments.

LEARNING OBJECTIVES

Knowledge

At the end of the course, the students will have gained knowledge and understanding of:

- common techniques of genome editing used to generate transgenic animals.
- techniques of how to record and manipulate brain activity using optical methods.
- the strengths and limitations of the different animal models based on their human physiological and pathophysiological relevance.
- the problems of defining and selecting the most appropriate animal model(s).
- knowledge of animal ethics and the 3R's and of legislative aspects of carrying out animal experiments (both independently and under supervision).

Skills

During the course the student will have obtained skills to:

- evaluate results derived from experiments performed in animals in neuroscience research.
- identify the relevant animal model or combinations of models to address a particular neuroscientific question.
- design animal experiments that can generate statistically sound and conclusive results required for publications.

Competencies

The student is expected to gain the following competencies through the course:

- evaluate animal models based on their human physiological and pathophysiological relevance.
- select the best animal models based on the above criteria, and independently design animal experiments as part of neuroscientific studies.
- participate in improving/modifying existing animal models and develop new and better animal models to solve neuroscientific problems.
- be able to advance experimental neuroscience research by the use of modern techniques of neuroimaging and optogenetics.

Student requirements

General knowledge of the nervous system at a level equivalent to the Basic Neuroscience Course (BNS).

ASSIGNMENT AND EXAM

80% of the grade will be given based on a written take-home assignment. The assignment should be submitted 5 days after being set. 5 pages long. All aids allowed.

Internal censor.

20% of the grade will be on the basis from group exercise during the course

RE-EXAM

The re-exam is a 5 day take home assignment. 5 pages long. All aids allowed.

Internal censor.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales

Machine Learning in Neuroscience (MLN)

5 ECTS

Module coordinator team

Denmark: Peter Mondrup Rasmussen, Associate Professor, CFIN, Department of Clinical Medicine, Aarhus University (pmr@cfin.au.dk)

China: Shihua Zhang, Professor, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, (zsh@amss.ac.cn)

Aim

The aim of this course is to introduce machine learning techniques and enable students to apply these to complex data sets as typically encountered in neuroscience. The course introduces topics in i) supervised learning such as basic and advanced models for predicting continuous and discrete outcomes (regression and classification), ii) unsupervised learning such as cluster analysis and dimension reduction techniques, and iii) techniques for model training, -selection, and -assessment. The machine learning techniques are put into neuroscientific context through examples form neuroimaging research (e.g. brain network analysis and disease prediction).

LEARNING OBJECTIVES

Knowledge

At the end of the course the students will have gained knowledge of:

- describe mathematical and statistical principles in supervised- and unsupervised machine learning.
- describe basic and advanced models for predicting continuous and discrete outcomes, models for clustering and dimension reduction, and strategies for model selection and model assessment.
- argue for or against different approaches based on their theoretical and practical strengths and weaknesses.
- describe how the machine learning techniques can be used within the fields of neuroscience and neuroimaging (disease prediction and brain network analysis).

Skills

During the course the student will have obtained skills to:

- identify relevant techniques to solve research-based problems within neuroscience.
- concisely account for solution strategy and analysis results, as necessary for publication in scientific journals or prototyping machine learning algorithms.
- apply unsupervised and supervised learning techniques particularly within neuroscience research.

Competencies

The student is expected to gain the following competencies through the course:

- independently develop analysis strategies and apply machine learning techniques to solve research-based problems within neuroscience.
- become proficient in novel techniques (not covered in lectures) by studying and critically reviewing research articles.

Student requirements

Knowledge and competence within mathematics equivalent to the mathematics course in the master's program. Basic knowledge in biostatistics (ANOVA, regression).

EXAM

Oral examination.

The exam is a 20-minute oral examination of the topics covered in the course curriculum (textbooks, lecture slides/notes, exercises). The student randomly draws a question/topic and has 20 minutes for preparation with access to all aids. One sheet of hand-written notes may be brought from the preparation to the exam. The exam duration is 20 min, beginning with the student presenting. Internal censor.

RE-EXAM

Will be in the same form as the original exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Neuroscience in a Clinical Perspective (NCP)

5 ECTS

Course Coordinators: Thomas Alrik Sørensen (alrik@ikp.aau.dk) og LI Yonghui (liyonghui@psych.ac.cn)

CONTENT

This course builds upon the knowledge obtained in BNS with a focus on clinical perspectives of neuroscience and the methods used (e.g. EEG & other neurophysiologic methods as well as PET, autoradiography and radiochemistry). Although we may be interested in very basic questions about neuronal behavior or the optimization of MR coils, then in the end much of the research in neuroscience have implications for patients at some point. Similarly, patients have through various injuries and diseases helped neuroscientists to gain a better understanding of how the brain works, whereby, knowledge about patients also may help researchers in basic research. The goal is a broad introduction to various clinical aspects and the students will be introduced to common psychiatric disorders (e.g. affective disorders - unipolar (depression) and bipolar (manic-depressive); schizophrenia; OCD; addiction, etc.). In addition, the course also touches neurodegenerative diseases (e.g. Parkinson's and Alzheimer's diseases) and developmental disorders (e.g. Autism). In addition, students are introduced to neuropsychological issues following brain injury and how patient assessment is done and what rehabilitation and treatment perspectives are available.

Recommended student requirements

Knowledge equivalent to Basic Neuroscience, Fundamental Biomedical Signal Processing and Medical Imaging Techniques.

LEARNING OBJECTIVES

Knowledge

The course will enable the student to understand and reflect on:

- central neuroscience topics related to both normal brain function and neuropsychiatric disorders.
- how neuroanatomy and transmission affect mental functions.
- basic features and applications of several important methodologies in clinical neuroscience such as assessment, symptoms, treatment, including general neuroscience methods.

Skills

During the course, the student will acquire skills in:

- basic insights into examination and assessment.
- the molecular basis of mental function in health and disease with particular focus on serotonergic, noradrenergic, and dopaminergic mechanisms.
- the behavioral disturbances affected by these neurotransmitters e.g. in neurodegenerative, psychiatric, and neuropsychological disorders from a biopsychosocial perspective.
- identifying treatment perspectives of the described disorders.

Competences

At the end of the course the student will be able to:

- select and certify the most suitable methodologies for studying neurological, psychiatric, and neuropsychological disorders.
- reflect on the cause of behavioural disturbances and propose research solutions.
- have a foundation to critically review scientific publications dealing with neurological, psychiatric, and neuropsychological diseases.
- combine molecular, anatomical and signalling knowledge to gain insight and suggest research approaches in the study of diseases of the brain.

EXAMINATION

The exam is a 2-hour written multiple-choice examination without aids. For each question, it will be indicated how it contributes to the grade. Internal censor.

RE-EXAMINATION

Will be in the same form as original exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Integrative Neuroimaging (INI)

5 ECTS

Course Coordinators: Kristoffer Hougaard Madsen (khma@dtu.dk) og WANG Fan (fanwang@ibp.ac.cn)

CONTENT

Neuroimaging techniques are capable of probing physiology and function at molecular, cellular and system levels, in animal models and humans. However, each imaging modality has its unique strength and inherent limitations. Moreover, most imaging modalities are correlative in nature, precluding causal inferences. The aim of the Integrative Neuroimaging Course is to give the students the possibility to gain experience in the rapidly advancing field of multimodal imaging. The students will learn about when, why, and how to combine different imaging modalities. The course will provide the students with a "multimodal imaging framework" which will help them to critically interpret literature within the field and to optimally plan scientific projects in the field of brain imaging.

During the course, the following topics will be covered in overview lectures or exercises:

- Introduction into the concepts behind integrative multimodal imaging
- Introduction to standard neuroimaging analysis tools
- General analysis techniques useful for integration of modalities
- Integration of electrophysiology (EEG/ERP/MEG) and functional MRI
- Introduction to transcranial brain stimulation (TMS, TDCS) and deep brain stimulation
- Combining EEG and TMS/TDCS
- Neurostimulation and neuroimaging: TMS & fMRI, offline and online
- Integration of MR-related techniques: structural MRI (sMRI) and diffusion weighted MRI (DWI)
- Combining sMRI and functional MRI (fMRI)
- Combining DWI & fMRI
- Integrating DWI and TMS
- Integration of MR-based techniques with positron emission tomography

Recommended student requirements

Basic knowledge of the major brain mapping techniques (structural and functional MRI, diffusion sensitive MRI, PET, EEG, MEG)

Basic experience with Matlab, MRI and EEG data analysis software

LEARNING OBJECTIVES

Knowledge

By the end of the course, the student will have:

- acquired in-depth knowledge about how the combined use of brain mapping modalities can help overcome modality-inherent weaknesses and to maximize the modality-specific scientific potential.
- knowledge on standard analysis tools including statistical parametric mapping, analysis of event related potentials and unsupervised decomposition with applications in multimodal neuroimaging.
- basic knowledge about how to model multimodal imaging data.
- knowledge on how to critically review own and published multimodal results.
- the ability to understand, reflect over and explain how to best integrate two imaging modalities.
- acquired knowledge to be able to identify neuroscientific questions that can best be studied with an integrative neuroimaging approach.

Skills

The student will be able to:

- design a multimodal neuroimaging study: Identify the most relevant neuroimaging techniques, choose the most appropriate analysis tools and discuss strengths and weaknesses of different approaches.
- explain how to incorporate interventional approaches (TMS, TDCS) in brain mapping studies.
- explain the technical and computational challenges of multimodal integration.
- use and understand standard tools for analysis of neuroimaging data.
- co-register multimodal imaging data and integrate data sets acquired in different imaging modalities for subsequent analysis.
- evaluate the choice of method for multimodal integration.
- evaluate and choose the most appropriate neurostimulation techniques and protocols.
- account for solution strategy and analysis of results, as necessary for publication in scientific journals.
- disseminate knowledge about integrative neuroimaging and discuss related professional and scientific topics with both peers and non-specialists.

Competences

This course provides the students with the capacity to:

- overview complex experimental situations that require the integration of two imaging modalities.
- plan and pursue interdisciplinary cooperation with researchers using complementary imaging modalities.
- develop new ideas on how to improve multimodal integration and implement novel applications for integrative neuroimaging.
- acquired knowledge to be able to identify neuroscientific questions that can best be studied with an integrative neuroimaging approach.

EXAMINATION

The exam is a 30-minute oral exam based upon an original research paper.

The student will receive their specific research paper at the conclusion of the course. For the oral defense, the student must prepare a presentation, including a short summary and a discussion/review of the paper. This presentation should last approximately 10 minutes. The students should attempt to integrate the knowledge obtained during the course in the evaluation of the research. During the exam additional questions regarding either the paper or course curriculum will be asked.

Evaluation will be based on internal censorship.

RE-EXAMINATION

Will be in the same form as original exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Advanced Magnetic Resonance Neuroimaging (AMRI) (elective)

5 ECTS

Course Coordinators: Fan Wang, Associate Professor, Institute of Biophysics, Chinese Academy of Sciences (fwang@bcslab.ibp.ac.cn), Rong Xue, Professor, Institute of Biophysics, Chinese Academy of Sciences (rxue@bcslab.ibp.ac.cn), Lars G. Hanson, Associate Professor, Technical University of Denmark – DTU (lghan@dtu.dk); Senior Researcher The Danish Research Centre for Magnetic Resonance (DRCMR), Copenhagen University Hospital Hvidovre.

AIM

The course aims at to give a comprehensive understanding of one of the most important imaging modalities for neuroscience, MRI. The emphasis will be on physical aspects including the relationship between design of key hardware components, signal processing and the quality of the final image data acquired. The course will provide the necessary skills for using spectroscopy, structural and functional MRI in neuroscience.

STUDENT REQUIREMENTS

Basic knowledge of calculus, physics, signal processing, programming and MRI. A basic understanding of medical imaging techniques. English language proficiency.

LEARNING OBJECTIVES

Knowledge

The student will gain knowledge about:

- theoretical description of spin dynamics, magnetization, and interaction between field and tissue.
- general design of magnet coil, gradient coil, RF coil, RF components in the RF transmission and receiving pathways.
- methods for spectroscopy, contrast selection, fast imaging, functional MRI (fMRI), ultra-high field MRI.

Skills

At the end of the course the student will be able to:

- reflect on the physical limitations and advantages of MRI.
- perform data analysis and processing of data from structural and functional MRI studies.
- design and optimize advanced MRI protocols for best data quality.

Competences

The course enables the student to:

- contribute with essential knowledge about MRI as a member of an inter-disciplinary research team.
- interpret data from MRI relative to a scientific question.
- give advice regarding assessment and selection of optimal MRI equipment suitable for various clinical and scientific purposes.

EXAMINATION

Obligatory reports following practical exercises (corrected, but not graded).

At least 50% presence during lectures/exercises is a requirement for attending the exam on which grading is based:

30 minutes oral examination without preparation time in two MRI topics drawn from a pool of at least 10 pre-announced topics relating to lectures and exercises.

RE-EXAMINATION

Same format as original exam

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Advanced Neuroscience (ANS) (elective)

5 ECTS

Course coordinator(s): Jens Midtgaard (jmidtgaard@sund.ku.dk) and HUA Zhaolin (zlhua@moon.ibp.ac.cn)

CONTENT

The objective of this course is to provide the student with a broad knowledge of current approaches for the study of neural function and behaviour.

The student should get an understanding of information processing in synapses, neurons and microcircuits; understand the experimental approaches used in analysing the neurophysiological basis of behaviour in intact animals and understand the use of animal models in the study of neurological disease. The course includes a wide variety of animal model systems used in neuroscience research, and techniques for genetic manipulation in both invertebrate (e.g. C. elegans, Drosophila) and vertebrate models. The students should be able to critically read and present the current literature and discuss the function and structure of neuronal circuits in relation to animal behaviour. This course provides an up-to-date knowledge of the neural basis for indirect measurements of global brain function such as PET and fMRI. As such, it provides insights useful when designing and interpreting experiments in human brain scanning studies. The course provides examples of genetics, signal processing, neural modelling and physiology used in the study of neural function in health and disease.

Recommended student requirements

Knowledge and understanding of basic neurobiology, physics, mathematics and signal processing, and electrophysiological and optical imaging methods, commensurate with a level at or above that which is the objective of the basic 1st. and 2nd.semester courses in neuroscience and neuroimaging. English language proficiency.

Module structure and teaching approach

Each subject will be covered by one original paper and possibly one review in double-lessons. One or two students (working as a team) will present the original paper (15 minutes), followed by a general discussion. In the second lesson a review may be presented by another student or by another pair of students (also 15 minutes presentations). Alternatively, only the original paper will be presented, and the review is expected to be read by the students in preparation. Both original papers and reviews will be used in the examination. Teachers will be from Chinese and Danish Universities affiliated with SDC. The teacher's role is primarily to guide the presentations in class, and to provide feedback.

All students are expected to actively participate in class. The course coordinators will (before the start of the course) allocate published papers/reviews for the students to present. It is a prerequisite for attending the oral exam that the student has presented two papers, one of these must be an individual presentation (to mimic the exam situation).

LEARNING OBJECTIVES

Knowledge

At the end of the course the student should be able to:

- demonstrate knowledge and understanding of molecular, genetic and physiological methods for measuring and manipulating brain function and behaviour.
- demonstrate an understanding of the strengths and limitations of the different animal models on the basis of their physiological and pathophysiological relevance and understand how to select the best animal model(s).

- demonstrate knowledge and understanding of the molecular, dendritic, cellular and circuit organization and physiology of the CNS in relation to the behavioural requirements and evolutionary adaptations of the organism.

Skills

During the course, the student will obtain the ability to:

- evaluate results derived from experiments performed in animals in neuroscience research.
- argue for the relative merits of the above methods and suggest new developments of methods and new physiological experiments.
- identify relevant animal models and experimental approaches to address a particular neuroscientific question.
- find, evaluate and present relevant current scientific literature.

Competences

By the end of the course the students have acquired the capacity to:

- critically understand modern molecular, cellular and behaviour-testing methods in relation to the analysis of neural information processing and brain function in health and disease.
- perform independent as well as in teamwork, trans-disciplinary scientific projects using a variety of physiological methods for the analysis of brain function.
- analytically evaluate his/her own and general knowledge and understanding of brain function and indicate avenues for further improvements.

EXAMINATION

Exam format: Oral examination based on the papers/reviews presented during the course.

Examiners: Teachers from the course.

The exam duration will be 35 minutes (followed by 5 minutes for evaluation). The first part (15 minutes) consists of a paper presentation by the student, followed by 20 minutes of discussion.

Each student will be assigned a paper for presentation 48 hours prior to the examination. During the 48 hours, the student is expected to produce an exam-PowerPoint presentation of the paper. The exam-paper will not be the same as the one(s) the student has presented in class during the course but will be one of the papers presented by other students during the course.

When evaluating the exam, it is important that the student has shown the ability to present the paper in a concise fashion, using effective presentation techniques. The main emphasis is on the ability to extract the important points of the paper, to argue why things have been included in the exam-presentation, to evaluate the paper in a critical fashion, and to put the findings and conclusions of the paper into a wider context, for instance based on the course literature and material found by the student.

RE-EXAMINATION

Will be in the same form as the original exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Cognitive Science (CS) (elective)

5 ECTS

Course Coordinators: Thomas Alrik Sørensen (alrik@ikp.aau.dk) og ZHOU Yuan (zhouyuan@psych.ac.cn)

CONTENT

The students will be introduced to cognitive science emphasising the functional aspects of the human brain that govern everyday behaviour, such as; attention, memory, problem solving, etc. The course is based on a number of lectures in combination with student participation in workshops and exercises. Here the students will conduct small behavioural experiments, typical relating to some of the classical studies in cognitive science (e.g. visual search (Treisman & Gelade, 1980), the serial positioning curve (Glazer and Cunitz, 1966) in free recall, etc.). The overall goal is to give the course participants a thorough introduction to cognitive science and behavioural methods.

Recommended student requirements

An understanding of the content covered in the courses BNS and NNPN. A basic knowledge of the major imaging techniques (structural and functional MRI, diffusion sensitive MRI, PET, EEG, MEG). English language proficiency.

Module structure and teaching approach

Combined lectures, with student activities. The student activities can take the form of small behavioural experiments that may provide the empirical data for one of the two final synopsis papers, classroom presentations, as well as group work.

LEARNING OBJECTIVES

Knowledge

During this course, the student will obtain:

- knowledge about the historical roots and foundation of cognitive science.
- knowledge about specific cognitive functions (e.g. memory, attention, emotions, etc.).
- knowledge of behavioural experiments that can provide the basis for further neuroscientific enquiries.

Skills

By the end of the course the student will be able to:

- disseminate theoretical knowledge about cognitive science and experimental results.
- conduct behavioural experiments investigating human cognition.
- devise, design, and set-up simple behavioural experiments within cognitive science.

Competences

The course provides the student with the ability to:

- critically review scientific publications dealing with topics relating to cognitive science, and cognitive neuroscience more broadly.
- select suitable methodologies for studying cognition.
- reflect behavioural test designs and propose research solutions.

EXAMINATION

The exam is an oral synopsis exam. Examiners will be teachers from the course.

By 9 am the day before the exam, the student must hand in two synopsis papers, one theoretical and one empirical, the maximum size of a synopsis is three pages each (times new roman, pt. 12, 1.5 line spacing). The topics should not be too overlapping and needs to be approved by the course coordinator before the final exam. A synopsis is a short academic text, based on the course literature, and may include supplementary literature chosen by the student.

The oral part of the exam is 30 min. The student will enter the examination room and choose one of the two synopsis papers at random, which will be the basis for the exam. Then the student will have 7 min to make a brief presentation, followed by an examination based on the chosen synopsis (approximately 7 min) and the broader course curriculum (approximately 7 min), leaving the remaining time for the examiner and censor to discuss the final grade and give feedback.

RE-EXAMINATION

Will be in the same form as the original exam.

This is a new oral synopsis exam, based on new topics that are not too overlapping with previous chosen topics (for specifics on format please cf. to the above section), and these need to be approved by the course organiser before a re-examination.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Public Management and Social Development

Business and Global Governance

7.5 ECTS

Course coordinator: Duncan Wigan (dw.dbp@cbs.dk)

CONTENT

This course provides students with an understanding of the global business context in which public and private actors operate and seek to realize goals. The course explores a range of theories within International Political Economy and introduces students to a range of the international political economic problems and processes. In doing, the course invites students to consider the roles of, and relations between, states, markets, firms, governments and international organisations in governing and conditioning the international political economy. Issue areas covered in the course include, not exhaustively, international finance, production, trade, law, taxation and the environment.

LEARNING OBJECTIVES

Following the successful completion of the course, participants should be able to:

- Formulate and respond persuasively to research questions about business and global governance, drawing on relevant theories.
- Demonstrate knowledge and understanding of central processes, institutions, and actors in the international political economy and how these processes, institutions and actors impact on the constitution and dynamics of the international political economy.

EXAMINATION

3-hour individual written exam followed by oral exam. All aids, except internet allowed. ChatGPT or similar is not allowed. Students provide three abstracts in response to a selection of questions in the written exam. The written exam, course content and curriculum form the basis of the oral exam and are assessed in aggregate.

RE- EXAMINATION

The re-examination is subject to the same regulations as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Comparative Policy Processes

7.5 ECTS

Course coordinator: Edward Ashbee (ea.egb@cbs.dk)

CONTENT

The aim of this course is to introduce and explore different theoretical frameworks that can be used in studying policymaking processes. These include institutionalist explanations of policymaking, multiple streams analysis, and the advocacy coalition framework. The course's coverage of these will also incorporate case-studies of policymaking processes in different settings, the concept of policy transfer, and studies of the ways in which actors are constrained by, but can also develop strategic in response to, particular forms of public policy. There will furthermore be an evaluation of some methodological challenges that arise when seeking to operationalise theories and concepts.

LEARNING OBJECTIVES

Following the successful completion of the course, participants should be able to:

- identify, analyse, and evaluate key concepts, models, and theories in the study of policymaking processes and the assumptions that underpin them
- relate core concepts, models, and theories to empirical evidence.
- identify and assess the key methodological issues that arise when particular approaches to policymaking processes are operationalised.
- identify and assess the major contemporary challenges facing policymakers in different countries, settings, and sectors
- consider the impact of particular policies and policy regimes upon firms and groupings within different settings
- provide analyses of policymaking processes based upon structured and coherent forms of argumentation and relevant forms of evidence.

EXAMINATION

There will be TWO individual written examinations (each of which has a 50% weighting in determining the overall grade). Both examinations – which will be held at least five days apart - will be two hours in length and are undertaken without aids.

RE- EXAMINATION

4-hour sit in exam with no aids.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Social Innovation and Entrepreneurship

7.5 ECTS

Course coordinator: Kai Hockerts (kho.msc@cbs.dk)

CONTENT

The course will help students understand processes underlying social innovation and entrepreneurship. The students will be introduced to the theory and practice of busine model development through knowledge collaboration in relation with Sustainable Development Goals (SDGs).

Students will work in teams to identify a real-world opportunity in different forms of innovation that will create charitable or societal benefits, either being developed in the public or private sector. They will then be required to "transfer" this knowledge into the real world. The students will also gain hands-on experience with the practice of social business modelling and the systematic management of knowledge in the development of these business models. They will use the digital technologies (e.g., the seizmic APP as a virtual open innovation platform) to identify and describe the business model, determining relevant market segments, income strategies, and financing models. The course will be completed with the students presenting their business models and opportunities.

The course will include lectures and case studies but will consist primarily of team-based work on your social enterprise business models.

The course will develop capabilities in social opportunity identification as well as the writing of business plans for social enterprises. The students will be introduced to the disciplines of business modelling and management of knowledge work. They will learn how to identify ideas for social innovation that will help create charitable or societal benefits and how to use collaboration and social networking to develop and leverage social innovation. In particular, the course will ask the students to set up their own social enterprise during the course, which will expose them to the practical challenges associated with launching social ventures.

One main element of the course is the development of a business plan. For this purpose, students work in groups together.

LEARNING OBJECTIVES

Following the successful completion of the course, participants should be able to:

- discuss the differences between different theories of social innovation.
- explain how these theories link to social performance.
- explain the opportunities and challenges in managing knowledge work for social innovation.
- reflect on how knowledge processes and strategies can be used to leverage social innovation.
- define which variables impact the social performance of social enterprises.
- apply classroom learning to a specific real-world problem for which a business plan must be prepared with the seizmic APP (https://app.seizmic.eu).

EXAMINATION

Individual 4 hours closed book exam. The exam will ask students to reflect critically on their group's seizmic business model applying readings from the class syllabus. The specific exam task will ask students to reflect both on the group's social enterprise's business model as well as the group processes in relation to digital collaboration and knowledge management.

RE- EXAMINATION

The re-exam is subject to the same regulations as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Comparing Social Policies: Welfare States in Theory and Practice

7.5 ECTS

Course coordinators: Jesper Willaing Zeuthen, (zeuthen@dps.aau.dk) and Christian Albrekt Larsen, (albrekt@dps.aau.dk).

AIMS

The aim of this course is to provide empirical and theoretical insights into how different states and societies solve welfare questions. Using this foundation, the course engages topical discussions on challenges to welfare states across different social systems and welfare regimes. By doing so, students will not only be exposed to theories about welfare states and empirical material about different welfare regimes, but also be introduced to different tools of policy analysis.

CONTENT AND PERSPECTIVE

This course introduces basic theoretical and empirical perspectives on welfare states and the different ways of meeting social needs in different social systems. The course includes theories and methods of policy analysis and their application to policy development and institution building in the welfare area. The course furthermore elaborates various challenges to welfare states all over the world with a particular focus on comparison between Scandinavia and China. Both mature and newer welfare states face similar challenges: ageing populations, migration, poverty, new social risks, changing family patterns, social cohesion, etc. The aim of the course is to compare these challenges across different social systems and welfare regimes. It examines the drivers of change as well as constraints to change in terms of path dependency and institutional complementarity. It addresses how possible solutions vary with the different combinations of social actors in the field: states, markets, families, voluntary associations, social partners etc.

LEARNING OBJECTIVES

Following the successful completion of the course, participants should be able to:

- Undertake an in-depth comparative analysis on a selected topic within social policy
- Conceptualize and analyze the effects of different welfare state arrangements on social equality, economic efficiency and political stability
- Conceptualize and analyze challenges to the welfare state emanating from social risks and different forms of social change in different settings
- Identify, discuss and evaluate solutions suggested to the kind of welfare challenges covered in the course

MODULE STRUCTURE AND TEACHING APPROACHES

The primary study form is seminar activity, i.e. teaching based on interaction between teacher and students. In the seminar sessions, the teacher will provide theoretical overviews and initiate discussions on the basis of the topic and literature provided for each seminar. Students will be asked to engage in discussions related to topics studied during

each lecture.

COURSE LITERATURE

See lecture plan. We both provide mandatory literature, which we expect student have read, and supplementary literature, which is voluntary.

EXAM

The examination is an individual oral exam. The examination is 20 minutes with 20 minutes preparation. During preparation all aids are allowed. Each student will be given a short, unknown text related to the course and asked to formulate a problem addressing the issue discussed in the text and applying relevant knowledge from the course. During the exam, students will also be examined in key discussions from the course.

RE-EXAM

The re-exam is subject to the same regulations as the ordinary exam.

GRADING

Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Master's thesis (4th Semester)

30 ECTS

Course coordinator: Edward Ashbee (ea.egb@cbs.dk)

CONTENT

The thesis addresses a student-developed challenge or puzzle which is relevant to the programme. It should demonstrate that the student is able to formulate and delimit a research problem, and that the student can design and carry out an inquiry suitable to the problem at hand by:

• being situated in, drawing upon and evaluating social science literature relevant to the problem.
• selecting, evaluating, and applying appropriate social science theories and methods.
• compiling and analysing appropriate forms of empirical data and evidence.

Students should be able to draw substantiated conclusions and discuss the quality of thesis findings.
The thesis can be written in collaboration with an organization, focusing on a topic of particular interest to that organisation. However, the thesis is evaluated solely on academic grounds. Students will be provided with guidance during the thesis and will have a Danish and Chinese supervisor.

LEARNING OBJECTIVES

Following the successful completion of the thesis, participants should be able to:

- formulate, delimit, and operationalise a research question in an area of relevance to the programme.
- select, apply, and critically evaluate relevant theories and scientific methods.
- collect, deploy, and critically evaluate relevant empirical material
- persuasively justify the analysis and assess the strengths and weaknesses of the thesis
- present the results of the analysis in a logically coherent, structured and linguistically sufficient way

EXAMINATION

The thesis is an individual written assignment. The length of the thesis is 60-80 standard pages. Students must include an abstract of the thesis in English.The examination (defence) is oral, based upon the thesis. It takes the form of a dialogue between the student and the examiners. The duration of the oral examination is 60 minutes including grading. The students have maximum of 12 minutes to present the thesis. The grade awarded by the examiners reflects an overall assessment of the written thesis and the oral defence.

RE-EXAMINATION

Re-examinations are subject to the same regulations as the ordinary exam.
A revised version of the thesis can be based on a new or revised subject.

GRADING

For the Danish / international students, grades are given according to the Danish 7-point grading scale and the Chinese thesis grading scales. For the Chinese students, grades are given according to the Danish 7-point grading scale only. The details of the thesis procedure are described in the SDC Thesis Regulations.

Water and Environment

Statistics, Modelling and Global Change (Module 3)

15 ECTS

Module responsible: Davide Cammarano davide.cammarano@agro.au.dk

CONTENT

The objective of this course is to provide students with knowledge and tools to:

- understand and apply frequently used data analysis and statistics, which are necessary for their future work and research.
- understand and apply GIS-based geospatial analysis for environmental mapping and analysis at small to large spatial scales.
- understand and - through simulation models - quantify the interactions between climate forcing, land use, water resources and surface water quality.
- understand and quantify the processes of carbon and nitrogen flows in ecosystems (soils, plant communities and animals) and the resulting effects on greenhouse gas emissions, climate change and feedbacks to ecosystems.
- The course comprises a combination of out-of-class and in-class activities, including lectures, theoretical exercises and computer exercises. Computer exercises will be based on topics and case-studies presented at lectures.

LEARNING OBJECTIVES
After completion of the course, the students should be able to:

Knowledge

- understand the logic underlying commonly used statistical procedures, including regression models and analysis of variance.
- describe and explain general methodological approaches and their problems in GIS-based geospatial data handling and modelling, as well as spatial statistical analysis.
- identify relevant tools and models that can quantify how climate forcing (e.g., CO_2, temperature, precipitation and irradiance) and land use influence water resource availability and surface water quality.
- describe and explain greenhouse gas emissions from ecosystems and the effects of climate variability and climate change on ecosystem functioning at different spatial scales (ranging from plant, ecosystem to global).

Skills

- apply frequently used data manipulation and statistical procedures, such as regression models, analysis of variance and graphical presentations.
- apply tools and statistical analysis for GIS-based geospatial data.
- apply and demonstrate the use of eco-hydrological models for river basin water resources management and scenario simulations.
- be able to quantify measures for reducing greenhouse gas emissions from agriculture and forestry with respect to efficiency, including the accounting of possible side effects on the environment and ecosystem services.

Competences

- assess and discuss the methodological approaches used in GIS-based geospatial data handling, modelling as well as spatial statistical analysis.
- collect, handle and analyse datasets at small to large spatial and temporal (time) scales, in relation to describing and understanding river basin dynamics, aquatic ecosystems and global changes.
- assess, discuss and propose how various management scenarios may influence water resources and water quality.
- describe and discuss measures for reducing greenhouse gases from managed ecosystems and adapting managed and natural ecosystems to climate change and describe the possible consequences of such measures.

EXAMINATION
The exam is a 3-hour written multiple choice exam with 40 questions of equal weight.
No aids. Only calculator is allowed at the exam.

RE-EXAMINATION
The re-exam is subject to the same regulations as the ordinary exam.

GRADING
Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.

Integrated Water Management and Legislation (Module 4)

15 ECTS

Module Responsible: Fulai Liu fl@plen.ku.dk

CONTENT

The objective of the module is to provide knowledge and understanding on:

- major flows of water and nutrients (mainly nitrogen and phosphorus) in freshwater and agroecosystems across different climates, their role in pollution and restoration.
- managing urban water flows and sustainable urban development, as well as legislation, policy and planning of water and nutrients (mainly nitrogen and phosphorus).
- analysis of qualitative and quantitative data and writing scientific report.

The module offers an in-depth and up-to-date knowledge in the following areas (sub-modules):

Freshwater ecosystem management

- Introduction to nutrient (nitrogen and phosphorus) loading to streams, lakes and reservoirs in different climate zones, effects of nutrient loads on primary producers, consumers and water quality
- Physico-chemical and biological methods for restoration of lake/reservoir, including reduction of nutrient loads and shift to a clear-water state (biomanipulation)
- Methods for restoration of streams, including effects of re-meandering that improve the physical variations in streams and reduce plant harvesting

Agricultural water and nutrients management

- Water dynamics in the soil-plant-atmosphere continuum, water balance and crop water productivity
- Turnover of nitrogen and phosphorus in the soil, effect on plant nutrient availability and deficiency diagnosis
- Methods to improve water- and nutrient use efficiency, balance crop production and environmental protection

Water legislation and policy

- Introduction to water legislation in China and the EU, with focus on policy for water quality and integrated water resource management
- Main water policy instruments, including economic, information/voluntary and command-and-control-regulation; environmental policies and challenges in fulfilling policy aims
- Water planning, including spatial planning principles, approaches and challenges in water management and cross-sectorial planning and policy integration

Urban water management

- Introduction of urban water systems, challenges and trends in water solutions, including water supply and treatment systems, urban drainage and conventional stormwater management
- Non-conventional stormwater management, ecosystem services, aquatic ecological restoration in inland urban lakes
- Introduction to urban development and management towards sustainable development

The teachings of all sub-modules comprise lectures, theoretical exercises and project work in combination with visits/tours to ongoing projects on urban, fresh- and agricultural water and nutrients management in China. The topics of the theoretical exercises correspond to the topics presented in the lectures. Each project is typically conducted in groups of students and presented as a report and an oral presentation.

LEARNING OBJECTIVES

Following the successful completion of the course, the students will be able to:

- describe the main flows of water and nutrients (mainly nitrogen and phosphorus) in freshwater, agroecosystem and urban systems, their management and policy framework.
- conduct field work, integrate qualitative and quantitative data with scientific materials for problem-solving.
- write scientific report.

Sub-module: Water legislation and policy

- identify relevant legal, policy and planning mechanisms in water management.
- critically evaluate main legal principles governing water management in jurisdictions in China and the EU.

Sub-module: Urban water management

- critically evaluate urban water systems.
- suggest environment friendly solutions for urban water issues.

Sub-module: Freshwater ecosystem management

- compare methods for reducing nutrient loading to surface- and ground waters.
- critically evaluate freshwater restoration and management case studies.

Sub-module: Nutrients management in agroecosystems

- quantify water- and nitrogen relations in soil-plant-atmosphere continuum and generalize crop production.
- critically evaluate water- and nitrogen-saving strategies for agroecosystem and apply numerical modelling.

EXAMINATION

The exam comprises of:

- three assignments, each accounting for 15%, i.e., 45% of the total grade.
- written 4-hour examination, accounting for 55% of the total grade. No aids, besides calculator, are allowed.

The three assignments are conducted in groups and are accompanied by individual oral presentation and questions. Each group consists of 3-4 members, and the topics are fixed. The length of the assignments is 2-4 standard pages. The assignments are focused on the main learning objectives of the sub-modules.
The written examination is a 4-hour examination with physical presence and based on short questions related to the learning objectives, requiring short text answers and/or calculations. The questions cover the full module. No aid, other than calculator, is allowed.

RE-EXAMINATION

The re-exam is a 4-hour examination with physical presence based on short questions related to the learning objectives, requiring short text answers and/or calculations. The questions cover the full module. No aid, other than calculator, is allowed.

GRADING
Grades are given according to the Danish 7-point grading scale and the Chinese 100 points grading scales.