Semester Description of Study Programme at Aalborg University

Semester description for 1st semester, Master in Biomedical Engineering and Informatics, Autumn 2015

<table>
<thead>
<tr>
<th>Semester details</th>
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</thead>
<tbody>
<tr>
<td>School of Medicine and Health</td>
</tr>
<tr>
<td>Study board for Health, Technology and Sports Science</td>
</tr>
<tr>
<td>Curriculum for the Master’s program in Biomedical Engineering and Informatics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester framework theme</th>
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</thead>
<tbody>
<tr>
<td>This should include an elaborated description in a prose form of the focus of the semester, activities implemented to fulfil the competence objectives and the thematic(s) of the semester. In other words, the semester description includes the “framework theme” that the students will be exposed to during the semester. The role of the semester and its contribution to students' academic progression should also be described.</td>
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</tbody>
</table>

The 1st semester on the master education is a progression of the bachelor education. The semester (and master education) will train the student in scientific and structured problem analysis and solving. The semester focuses on biomedical signals and information.

<table>
<thead>
<tr>
<th>Semester organisation and time schedule</th>
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</thead>
<tbody>
<tr>
<td>This must be a short description of the different activities of the semester, their mutual connections and the way in which they support each other and also support students in reaching their goals; such activities may be study trips, internship periods, project modules course modules, including laboratory activities, cooperation with external stakeholders, possible cross-disciplinary cooperation relations, any guest lectures and other events.</td>
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</table>

The semester activity is one 15 ECTS project and three 5 ECTS courses. The course on “Scientific methods and communication” supports the project directly in training the student in producing the deliverables of the project: a poster, an oral presentation and an abstract. These are used for a simulated scientific conference. “Scientific methods and communication” further enables the students to produce a scientific paper and work sheets for project evaluation. Please see the description of the course for further information.

<table>
<thead>
<tr>
<th>Semester coordinator and secretariat assistance</th>
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</thead>
<tbody>
<tr>
<td>Names of anchorperson (teaching staff), course coordinator, semester coordinator (or similar title) and secretariat assistance provider(s).</td>
</tr>
</tbody>
</table>

Semester coordinator: Carsten Dahl Mørch, cdahl@hst.aau.dk, Department of Health, Science and Technology
Semester secretary: Melanie Rosendahl, rosendahl@hst.aau.dk, School of Medicine and Health
Student representative: Please check semester details on Moodle.
Module description (description of each module)

Module title, ECTS credits (and possibly STADS code)
Medicotekniske signaler og information / Biomedical signals and information
15 ECTS project module

Location
Master, Biomedical Engineering and Informatics, 1st semester
Study board for Health, Technology and Sports Science

Module coordinator
The academic staff member responsible for the organisation and execution of the module. The module leader may be the same person as the semester coordinator. If a person responsible for exam is pointed out, please state name and e-mail address here.

Carsten Dahl Mørch, cdahl@hst.aau.dk, Department of Health, Science and Technology.

Type and language
Module type (e.g. study subject module, course module, project module etc.)
Language of instruction.

All communication in this semester is in English.

Objectives
Description of the content and objectives of the course as regards learning objectives of the students in the module. This comprises a transcript of the knowledge, skills and competences described in the study regulations and curriculum. Reference can be made to elaborations on semester Moodle site.

This module consists of a group project in an area of Biomedical signals and information, hereafter 'the project'. The objective of the project is to train the student in the scientific approach of problem solving, communication of this solution, and aligning it with present knowledge from relevant literature.

From Curriculum:
To learn to use scientific methods to carry out a project related to acquisition, processing, analysis or modelling and interpretation of physiologic / clinical information or signals.

Students who complete this project module:

Knowledge
- have knowledge of at least one of the areas: Signal processing, Pattern recognition and decision support, Clinical information systems, Sensory-motor control
- understand the biological source of the relevant signal or information
- know methods to acquire and to analyse or model the relevant signal or information
- understand the scientific communication processes related to conference presentations and related to publishing in peer-reviewed scientific journals
- know how to organise a scientific publication

Skills
- are able to apply scientific methods in the chosen area of knowledge
- are able to reflect on those methods
- are able to interpret signals and information in terms of clinical relevance
- are able to plan and to carry out a (minor) research study
- can explain the process of and criteria for peer reviewed scientific communications
- can write an abstract for a scientific meeting
- can prepare an oral presentation for a scientific meeting

Competences
- can set up a plan for getting an overview of existing knowledge within a scientific/technical topic
- are able to judge and prioritize the validity of various sources of scientific information
### Academic content and conjunction with other modules/semesters

A brief and general description of the academic content of the module as well as the basis and motivation for the module; i.e. a brief review of the content and foundation of the module. The intention is to provide students with an overview of each module and to create understanding of the module in relation to the semester and the entire programme.

The project is made in close relation to the "Scientific methods and communication" course. The course provides scientific and stringent approach to the methods applied in the project.

### Scope and expected performance

The expected scope of the module in terms of ECTS load. This comprises number of teaching hours, exercises, preparation time, etc.

The project is 15 ECTs, thus with an expected workload of 450 hours.

### Participants

Indication of the participants in the module, particularly if they include several year groups, programmes or another type of co-teaching.

The project is mandatory for 1st semester of the master in BME&I.

### Prerequisites for participation

Description of the prerequisites for students' participation in the course, i.e. previous modules/courses in other semesters etc. The overall intention is to emphasise the coherence of the programme. This may be a transcript of the text in the study regulations and curriculum.

The participants must follow the course "Scientific methods and communication" in parallel with the project.

### Module activities (course sessions etc.)

A catalogue of project proposals is provided at semester start. The students select a project from the catalogue and form groups of approximately 4 students. The staff member proposing the selected project will act as supervisor for the project.

The project requires the group to schedule activities to meet the requirements of the project. This includes but not limited to: supervisor meetings, literature review, study design, method selection, possibly data collection, data analysis, presentation, and perspectivation.

### Examination

We refer to [webpage concerning examination on smh.aau.dk](http://www.smh.aau.dk).
<table>
<thead>
<tr>
<th>Module description (description of each module)</th>
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<table>
<thead>
<tr>
<th>Module title, ECTS credits (and possibly STADS code)</th>
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</thead>
<tbody>
<tr>
<td>Videnskabelige metoder og kommunikation / Scientific methods and communication (SMAC)</td>
</tr>
<tr>
<td>5 ECTS course module</td>
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<table>
<thead>
<tr>
<th>Location</th>
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<tbody>
<tr>
<td>Master, Biomedical Engineering and Informatics, 1st semester</td>
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<td>Study board for Health, Technology and Sports Science</td>
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<td>The academic staff member responsible for the organisation and execution of the module. The module leader may be the same person as the semester coordinator. If a person responsible for exam is pointed out, please state name and e-mail address here.</td>
</tr>
<tr>
<td>Ole Kæseler Andersen, <a href="mailto:oka@hst.aau.dk">oka@hst.aau.dk</a>, Department of Health, Science and Technology</td>
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<tr>
<th>Type and language</th>
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<tbody>
<tr>
<td>Module type (e.g. study subject module, course module, project module etc.)</td>
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<tr>
<td>Language of instruction.</td>
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<tr>
<td>Course module. All lectures are in English</td>
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<tr>
<th>Objectives</th>
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<tbody>
<tr>
<td>Description of the content and objectives of the course as regards learning objectives of the students in the module. This comprises a transcript of the knowledge, skills and competences described in the study regulations and curriculum.</td>
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**From Curriculum:**

Students who complete this module:

<table>
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<tr>
<th>Knowledge</th>
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<tr>
<td>• understand the scientific communication processes related to conference presentations and related to publishing in peer-reviewed scientific journals</td>
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<td>• are able to organize a scientific publication</td>
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<td>• have knowledge of qualitative and quantitative research methods</td>
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<td>• have knowledge of experimental designs</td>
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<td>• have knowledge of validity and reliability of outcome measures</td>
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<td>• understand bias and statistical power in experimental designs</td>
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<td>• understand principles of epidemiological research designs</td>
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<td>• understand evidence-based medicine</td>
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<td>• understand and can reflect on proper conduct in scientific projects</td>
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<tr>
<td>• understand and can reflect on ethical concerns in biomedical and sports sciences</td>
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<tr>
<th>Skills</th>
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<tr>
<td>• can explain the principles of hypothesis-driven research and descriptive research</td>
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<td>• can critically read and judge experimental protocols in scientific articles</td>
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<tr>
<td>• can design an experimental protocol in relation to a scientific project</td>
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<tr>
<td>• can discuss principles for creating new and validated knowledge</td>
</tr>
<tr>
<td>• can explain the process of and criteria for peer reviewed scientific communications</td>
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<tr>
<td>• can discuss the importance of research ethics</td>
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<td>• can write an abstract for a scientific meeting and can respond to blind peer-review criticism</td>
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<td>• can prepare a poster and an oral presentation for a scientific meeting</td>
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<tr>
<td>• can apply biostatistics and have practical experience in statistical software</td>
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<table>
<thead>
<tr>
<th>Competences</th>
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<tr>
<td>• can set up a plan for getting an overview of existing knowledge within a scientific/technical topic</td>
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<tr>
<td>• can prioritize the validity of various sources of scientific information</td>
</tr>
<tr>
<td>• can evaluate scientific presentations from a communicative view point</td>
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</table>
• can judge the validity of scientific literature

The students get practical experience with design and analysis of the semester project in accordance with a timely and modern scientific approach. The project findings are presented in an open semester conference for all course participants. Here the findings are presented via a poster and a short oral presentation alike a free conference contribution.

Academic content and conjunction with other modules/semesters
A brief and general description of the academic content of the module as well as the basis and motivation for the module; i.e. a brief review of the content and foundation of the module. The intention is to provide students with an overview of each module and to create understanding of the module in relation to the semester and the entire programme.

The intention of the course is to give the students insight in the scientific way of thinking and communicating. A very important competence in science is to be able to defend and communicate your work in a clear and convincing way both in writing and orally. For reaching that point the scientific process already starts when preparing the study. The whole scientific process from critically reading scientific literature, setting up hypotheses, study design, written and oral dissemination will be taught. Moreover scientific misconduct and ethics will be touched on.

The finishing of the course will be a one-day semester conference (SEMCON) where also sport science students and biomedical engineering students must participate. Here the students will give a short oral and a poster presentation of their project. Participating in the SEMCON is obligatory. A price for the best scientific presentation at the conference is awarded.

Scope and expected performance
The expected scope of the module in terms of ECTS load. This comprises number of teaching hours, exercises, preparation time, travel activity (if applicable) etc.

The course is taught via 8 lectures, a study circle and a scientific conference.

Participants
Indication of the participants in the module, particularly if they include several year groups, programmes or another type of co-teaching.

The participants of the full course will be 3. Semester master Sports Technology students, 3. Semester master Sports Science students, 1. Semester master biomedical engineering students. Moreover some of the lectures (lecture 8, the study circle, and SEMCON) will also be followed by 1. Semester master Sports Technology students and 1. Semester master Sports Science students.

Prerequisites for participation
Description of the prerequisites for students’ participation in the course, i.e. previous modules/courses in other semesters etc. The overall intention is to emphasise the coherence of the programme. This may be a transcript of the text in the study regulations and curriculum.

A prerequisite for this course is that students have a bachelor in Sports Science or Biomedical Engineering.

Module activities (course sessions etc.)

<table>
<thead>
<tr>
<th>Activity - type and title</th>
<th>Planned instructor*</th>
<th>Learning goals from curriculum</th>
<th>Learning goal for activity</th>
<th>Time consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture 1</td>
<td>OKA</td>
<td>Principles of hypothesis-driven research and descriptive research</td>
<td></td>
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</tr>
<tr>
<td>Lecture 2</td>
<td>OKA/LPH</td>
<td>Quantitative and qualitative research methods</td>
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<tr>
<td>Lecture 3</td>
<td>MDZ</td>
<td>Experimental designs</td>
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<tr>
<td>Lecture 4</td>
<td>UL</td>
<td>Epidemiological research</td>
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</tbody>
</table>

Level 2 (from Spring 2016)
<table>
<thead>
<tr>
<th>Lecture 5</th>
<th>OKA</th>
<th>Proper scientific conduct and biomedical ethics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture 6</td>
<td>MDZ</td>
<td>Data reliability and validity</td>
</tr>
<tr>
<td>Lecture 7</td>
<td>MDZ</td>
<td>Biostatistics (bias, sample size, power etc.)</td>
</tr>
<tr>
<td>Lecture 8</td>
<td>OKA</td>
<td>Scientific communication</td>
</tr>
<tr>
<td>Study circle</td>
<td>OKA &amp; MDZ</td>
<td>Journal club: Evaluate scientific literature and techniques for presenting scientific findings</td>
</tr>
<tr>
<td>SEMCON</td>
<td>OKA &amp; MDZ</td>
<td>Different means for presenting scientific findings</td>
</tr>
</tbody>
</table>

OKA Ole Kæseler Andersen  
MDZ Mark de Zee  
LPH Louise Bilenberg Pape-Haugaard  
UL Uffe Læssøe  

*All rights reserved for changes during the semester due to e.g. illness, cancellations etc.*

**Examination**

We refer to [webpage concerning examination on smh.aau.dk](#).
## Module description (description of each module)

### Module title, ECTS credits (and possibly STADS code)

Stokastiske signaler og processer / Stochastic signals and processes (elective 1.a)
5 ECTS course module

### Location

Master, Biomedical Engineering and Informatics, 1st semester
Study board for Health, Technology and Sports Science

### Module coordinator

The academic staff member responsible for the organisation and execution of the module. The module leader may be the same person as the semester coordinator. If a person responsible for exam is pointed out, please state name and e-mail address here.

Ernest Nlandu Kamavuako, enk@hst.aau.dk, Department of Health Science and Technology.

### Type and language

Module type (e.g. study subject module, course module, project module etc.)
Language of instruction.

This is a course module and the language of the course is English.

### Objectives

Description of the content and objectives of the course as regards learning objectives of the students in the module. This comprises a transcript of the knowledge, skills and competences described in the study regulations and curriculum. Reference can be made to elaborations on semester Moodle site.

**From Curriculum:**

Students who complete this module:

#### Knowledge

- have knowledge of stochastic processes in general
- can describe stochastic processes and their application as models for real signals
- can explain the defining properties of various stochastic process models
- can identify the analytical tools for studying random phenomena in engineering systems
- demonstrate understanding of the concepts, theories and techniques for estimating parameters of discrete stochastic processes
- have knowledge about cross- and auto-correlation of stochastic processes
- have knowledge about power spectral analysis of stationary stochastic processes and can estimate the power spectral density of discrete stochastic processes and understand the limitations in this estimation

#### Skills

- can apply the theory of stochastic processes to model real phenomena
- can analyse and characterize appropriate stochastic process models for a given problem
- can apply methods for power spectral analysis and filtering to biomedical signals that can be modelled as realizations of stochastic processes
- can estimate and analyse the power spectrum of biomedical signals that can be modelled as realizations of stochastic processes
- can solve problems in applied sciences based on the theory for stochastic processes

#### Competences

- are prepared for a wide range of courses in communication, signal processing, control and other areas in which randomness has an important role
**Academic content and conjunction with other modules/semesters**

A brief and general description of the academic content of the module as well as the basis and motivation for the module; i.e. a brief review of the content and foundation of the module. The intention is to provide students with an overview of each module and to create understanding of the module in relation to the semester and the entire programme.

This course is intended to provide students a very strong theoretical understanding of the principles behind different techniques applied in signal processing, especially for stationary signals. Further it links to the course in Advanced Signal processing (2. master semester), where students learns how to deal with non-stationary signals.

**Scope and expected performance**

The expected scope of the module in terms of ECTS load. This comprises number of teaching hours, exercises, preparation time, travel activity (if applicable) etc.

This course comprises 20-24 classroom confrontation hours, plus 20-24 activities with assistance of the lecturers.

**Participants**

Indication of the participants in the module, particularly if they include several year groups, programmes or another type of co-teaching.

This is an elective course for 1st semester master program in Biomedical engineering and informatics. The number of participants varies from time to time.

**Prerequisites for participation**

Description of the prerequisites for students' participation in the course, i.e. previous modules/courses in other semesters etc. The overall intention is to emphasise the coherence of the programme. This may be a transcript of the text in the study regulations and curriculum.

A prerequisite is basic knowledge in probability theory; however, the first module is intended to refresh this knowledge.

**Module activities (course sessions etc.)**

<table>
<thead>
<tr>
<th><strong>Level 1</strong></th>
<th><strong>Level 2 (from Spring 2016)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity - type and title</strong></td>
<td><strong>Planned instructor</strong></td>
</tr>
</tbody>
</table>
| Classroom lecture and exercises: Introduction to probability and random variables | Ernest N. Kamavuako | • have knowledge of stochastic processes in general  
• can describe stochastic processes and their application as models for real signals | | |
| Classroom lecture and exercises: Moments and multi-dimensional random variables | Ernest N. Kamavuako | • can apply the theory of stochastic processes to model real phenomena  
• have knowledge about cross- and auto-correlation of stochastic processes | | |
| Classroom lecture and exercises: Introduction to random processes and stationarity | Ernest N. Kamavuako | • can explain the defining properties of various stochastic process models | | |
| Classroom lecture and exercises: Two random variables | Ernest N. Kamavuako | • can solve problems in applied sciences based on the theory for stochastic processes | | |
| Classroom lecture and exercises: | Ernest N. Kamavuako | • can identify the analytical tools for studying random phenomena in engineering systems  
• demonstrate understanding of the concepts, theories and techniques for estimating parameters of discrete stochastic processes |
| Classroom lecture and exercises: | Samuel Schmidt | • can analyse and characterize appropriate stochastic process models for a given problem |
| Classroom lecture and exercises: | Samuel Schmidt | • have knowledge about power spectral analysis of stationary stochastic processes and can estimate the power spectral density of discrete stochastic processes and understand the limitations in this estimation |
| Classroom lecture and exercises: | Samuel Schmidt | • can apply methods for power spectral analysis and filtering to biomedical signals that can be modelled as realizations of stochastic processes |
| Classroom lecture and exercises: | Samuel Schmidt | • can analyse and evaluate the appropriate models for stochastic processes  
• can solve problems in applied sciences based on the theory for stochastic processes |
| Classroom lecture and exercises: | Samuel Schmidt | • demonstrate understanding of the concepts, theories and techniques for estimating parameters of discrete stochastic processes |

*All rights reserved for changes during the semester due to e.g. illness, cancellations etc.*

**Examination**

We refer to [webpage concerning examination on smh.aau.dk](http://smh.aau.dk).
**Module description (description of each module)**

<table>
<thead>
<tr>
<th><strong>Module title, ECTS credits (and possibly STADS code)</strong></th>
<th>Mønstergenkendelse og beslutningsstøtte / Pattern recognition and decision support (elective 1.b) 5 ECTS course module</th>
</tr>
</thead>
</table>

**Location**  
Master, Biomedical Engineering and Informatics, 1st semester  
Study board for Health, Technology and Sports Science

**Module coordinator**  
The academic staff member responsible for the organisation and execution of the module. The module leader may be the same person as the semester coordinator. If a person responsible for exam is pointed out, please state name and e-mail address here.

Lasse Riis Østergaard, lasse@hst.aau.dk, Department of Health Science and Technology

**Type and language**  
*Module type (e.g. study subject module, course module, project module etc.)*  
*Language of instruction.*  
Course module in English.

**Objectives**  
*Description of the content and objectives of the course as regards learning objectives of the students in the module. This comprises a transcript of the knowledge, skills and competences described in the study regulations and curriculum. Reference can be made to elaborations on semester Moodle site.*

**From Curriculum:**

Students who complete this module:

**Knowledge**  
- have knowledge of statistical pattern recognition in general  
- have knowledge of methods such as neural networks, Bayesian nets and rule-based systems  
- are able to describe the components of a pattern recognition system  
- are able to understand how patterns can be described from characteristic features extracted from one- or multi-dimensional data  
- have knowledge of supervised and unsupervised learning

**Skills**  
- are able to design and test a pattern recognition system  
- are able to apply parametric and non-parametric classification techniques to univariate and multivariate data  
- are able to analyse and describe the underlying density function of a data set  
- are able to apply methods to reduce the dimensionality of the data  
- are able to design and test a decision support system

**Competences**  
- are able to demonstrate understanding of concepts, theories and techniques in the area of statistical pattern recognition and decision support  
- are able to apply feature analysis and classification techniques to specific multi-dimensional pattern recognition problems

**Academic content and conjunction with other modules/semesters**  
*A brief and general description of the academic content of the module as well as the basis and motivation for the module; i.e. a brief review of the content and foundation of the module. The intention is to provide students with an overview of each module and to create understanding of the module in relation to the semester and the entire programme.*

The course has a clear statistical foundation and extends the univariate statistical analysis from Biostatistics.
at 5th semester to multivariate analysis of patterns. In decision support, probabilistic networks define the
cause and effect related to clinical decision making. MATLAB experience from projects and courses during
the bachelor will be expanded during exercises. The course provides many general useful tools for project
work during the master education.

Scope and expected performance
The expected scope of the module in terms of ECTS load. This comprises number of teaching hours,
exercises, preparation time, travel activity (if applicable) etc.

The course is 5 ECTS which approx. equals a student work load of 150 hours. The course will contain 12
lectures (2 x 45min) followed by exercises (2 hours). It is expected that the student will use approx. 50 hours
on preparation for the lectures and exercises and approx. 24 hours for exam preparation.

Participants
Indication of the participants in the module, particularly if they include several year groups, programmes or
another type of co-teaching.

1st semester students from MSc in Biomedical Engineering and Informatics.

Prerequisites for participation
Description of the prerequisites for students’ participation in the course, i.e. previous modules/courses in
other semesters etc. The overall intention is to emphasise the coherence of the programme. This may be a
transcript of the text in the study regulations and curriculum.

Participation in Biostatistics on 5th semester BSc in Biomedical Engineering and Informatics. General data
acquisition and signal processing knowledge precedes the course.

Module activities (course sessions etc.)

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Activity - type and title</th>
<th>Planned instructor*</th>
<th>Learning goals from curriculum</th>
<th>Level 2 (from Spring 2016)</th>
<th>Learning goal for activity</th>
<th>Time consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture and exercises:</td>
<td>Introduction to statistical pattern recognition</td>
<td>Lasse Riis Østergaard</td>
<td>• have knowledge of statistical pattern recognition in general • are able to describe the components of a pattern recognition system • are able to understand how patterns can be described from characteristic features extracted from one- or multi-dimensional data • have knowledge of supervised and unsupervised learning</td>
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<tr>
<td>Lectures and exercises:</td>
<td>• Bayesian decision theory • Parameter estimation: ML, Bayes • Non-parametric techniques: Parzen, kNN • Linear discriminant functions / SVM • Unsupervised learning and clustering • Feature evaluation • String matching / Test of pattern recognition system</td>
<td>Lasse Riis Østergaard</td>
<td>• are able to apply parametric and non-parametric classification techniques to univariate and multivariate data • are able to analyse and describe the underlying density function of a data set • are able to apply methods to reduce the dimensionality of the data • are able to demonstrate understanding of concepts, theories and techniques in the area of statistical pattern recognition and decision support • are able to apply feature analysis and classification techniques to specific multi-dimensional pattern</td>
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<tr>
<td>Lectures and exercises:</td>
<td>Ole K. Hejlesen</td>
<td>Recognition problem</td>
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<tr>
<td>- Introduction to DSS + Rule based systems</td>
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<tr>
<td>- Bayesian networks</td>
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- have knowledge of methods such as neural networks, Bayesian nets and rule-based systems
- are able to design and test a decision support system

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**Examination**

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Module description (description of each module)

<table>
<thead>
<tr>
<th>Module title, ECTS credits (and possibly STADS code)</th>
<th>Kliniske informationssystemers semantik / The semantics of clinical information systems (elective 1.c)</th>
<th>5 ECTS course module</th>
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<thead>
<tr>
<th>Location</th>
<th>Master, Biomedical Engineering and Informatics, 1st semester</th>
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<tbody>
<tr>
<td>Study board for Health, Technology and Sports Science</td>
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<tr>
<th>Module coordinator</th>
<th>The academic staff member responsible for the organisation and execution of the module. The module leader may be the same person as the semester coordinator. If a person responsible for exam is pointed out, please state name and e-mail address here.</th>
</tr>
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<tbody>
<tr>
<td>Pia Elberg, <a href="mailto:pbe@hst.aau.dk">pbe@hst.aau.dk</a>, Department of Health, Science and Technology, and Kirstine R. Gøeg, <a href="mailto:kirse@hst.aau.dk">kirse@hst.aau.dk</a>, Department of Health, Science and Technology.</td>
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<tr>
<th>Type and language</th>
<th>Module type (e.g. study subject module, course module, project module etc.)</th>
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<tbody>
<tr>
<td>Language of instruction.</td>
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<tr>
<td>Elective course module in English.</td>
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<tr>
<th>Objectives</th>
<th>Description of the content and objectives of the course as regards learning objectives of the students in the module. This comprises a transcript of the knowledge, skills and competences described in the study regulations and curriculum. Reference can be made to elaborations on semester Moodle site.</th>
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From Curriculum:

Students who complete this module:

**Knowledge**
- have knowledge of standards on information and communication models in health care
- understand classifications and terminology models in health care
- have knowledge on terminology and semantics in clinical information systems from interface to database level
- understand use of clinical information for primary and secondary purposes
- have knowledge on different research approaches related to terminology and models in clinical information systems

**Skills**
- can analyse the need for terminology and classifications in a given clinical information system
- can choose appropriate standards for a given clinical information system
- can discuss issues associated with primary and secondary use of clinical information
- can design protocols for studies in clinical information systems

**Competences**
- are able to evaluate terminology and models in clinical information systems

<table>
<thead>
<tr>
<th>Intended learning outcomes: Readings and lectures</th>
<th>Intended learning outcome: Workshops</th>
</tr>
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<tbody>
<tr>
<td>describe different types of CIS and their usages</td>
<td>explain different approaches to CIS research</td>
</tr>
<tr>
<td>explain the importance of context in clinical documentation</td>
<td>describe design of protocols for studies in clinical information systems</td>
</tr>
<tr>
<td>explain characteristics and usages of national clinical registries</td>
<td></td>
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Side 13 af 20
- explain the differences between research protocols and templates for quality assurance registries
- explain what quality requirements clinical data must fulfill in order to be useful for primary and secondary purposes
- explain differences between a classification and a terminology
- explain usages of terminologies and classifications
- explain what SNOMED CT is
- explain potentials of SNOMED CT
- explain what characterizes semantic challenges in CIS
- explain how SNOMED CT can support presentation of clinical information
- explain what semantic interoperability is
- explain what characterizes system interoperability
- explain the benefits and shortcomings of standardized terminology from a clinical and a management perspective
- explain what types of standards are used in CIS
- explain what an information model is
- explain the differences between information and communication models
- design input user interfaces that balances primary and secondary needs
- map clinical terms to SNOMED CT
- discuss issues associated with primary and secondary use of clinical information
- design output interfaces for both primary and secondary purposes
- utilize SNOMED CT for retrieval tasks and similarity analysis
- analyze the need for terminology and classifications in a given clinical information system
- evaluate the use of terminology in a specific system design
- design openEHR archetypes for simple domains
- explain the purpose of different types of standardization
- choose appropriate standards for a given clinical information system
- discuss the appropriateness of terminology and models used in clinical information systems

**Academic content and conjunction with other modules/semesters**
A brief and general description of the academic content of the module as well as the basis and motivation for the module; i.e. a brief review of the content and foundation of the module.

The intention is to provide students with an overview of each module and to create understanding of the module in relation to the semester and the entire programme.

This course is designed to make the participants ready for the challenges of designing information systems in health care. In health care a huge variety of information systems – IT-based as well as paper-based - are used to inform primarily caregivers, administrators, researchers and politicians at different levels of detail in order to make them able to perform their various tasks. Designers of future information systems must thus understand the often contradictory requirements to be able to suggest solutions. Well defined semantics makes clinical information systems understandable beyond those who develop and use the system locally. A shared understanding of information may be obtained by standards, information models and terminology. Examples are presented and discussed based on journal papers.

**Scope and expected performance**
The expected scope of the module in terms of ECTS load. This comprises number of teaching hours, exercises, preparation time, travel activity (if applicable) etc.

The course load is 5 ECTS equivalent to approx. 150 working-hours. For each of the first 14 course-activities each student is supposed to spend approx. 4 hours for preparation (reading) and attend the 4 hours of
scheduled course-activity. Estimated time for the first assignment is 8 hours. The time needed for preparation for the exam including the last course-activity is expected to be approx. 25 hours.

Participants

*Indication of the participants in the module, particularly if they include several year groups, programmes or another type of co-teaching.*

The course is elective and may be chosen by master-students in Biomedical engineering and informatics, but also by second-year master-students in Clinical Science and Technology.

Prerequisites for participation

*Description of the prerequisites for students’ participation in the course, i.e. previous modules/courses in other semesters etc. The overall intention is to emphasise the coherence of the programme. This may be a transcript of the text in the study regulations and curriculum.*

Knowledge and skills equivalent to the content of the course module “Informationssystemer” in the curriculum for the bachelor program in Biomedical engineering and informatics. Completion of this elective course qualifies the students for project modules with a strong focus on informatics. Further qualifications may be obtained in the course module Methods and models in clinical information systems in the second semester in the master in Biomedical engineering and informatics curriculum.

Module activities (course sessions etc.)

<table>
<thead>
<tr>
<th><strong>Activity type and title</strong></th>
<th><strong>Planned instructor</strong></th>
<th><strong>Learning goals from curriculum</strong></th>
<th><strong>Level 2 (from spring 2016)</strong></th>
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</table>
| Lecture and discussions: CIS research and development | | • Why semantics of Clinical Information Systems is important in health care.  
• The contextual nature of clinical information. | |
| Workshop and discussions: CIS research and development | | • Research approaches in studying electronic health records | |
| Lecture and student presentations: CIS research and development | | • Research based on clinical registries in health care | |
| Lecture and workshop: Semantic challenges in CIS development and use | | • Use of classification and/or terminology systems in health care and design of user interfaces for Vascular surgery supporting primary and secondary use of data  
• The terminology system SNOMED CT and how to use it  
• Addressing semantic challenges in primary and secondary use of clinical information | |
| Lecture and Workshop: Analysis and design of clinical information | | • Methods for registration of clinical information and design improvements  
• Methods for designing clinical output interfaces and statistics interfaces using the power of SNOMED CT | |
| Lecture and Workshop: Standards and standards development | • Semantic inter-operability  
• Challenges in system design/ System inter-operability |
| Lecture and discussions: Standards and standards development | • Standardisation – objectives, organisations and processes  
• Views on appropriate levels of semantic standardisation in clinical information systems |
| Workshop: Standards and standards development | • Development and deployment of standards in clinical information systems |
| Problem-solving and discussions: Overview | • Designing by standards and archetypes for Vascular surgery supporting design differences |
| | • Course review and reflection |

*All rights reserved for changes during the semester due to e.g. illness, cancellations etc.*

**Examination**

We refer to [webpage concerning examination on smh.aau.dk](http://smh.aau.dk).
Module description (description of each module)

Module title, ECTS credits (and possibly STADS code)
Sensoriske systemer og sensorisk-motorisk kontrol / Sensory systems and sensory-motor control (1.d)
5 ECTS course module

Location
Master, Biomedical Engineering and Informatics, 1st semester
Study board for Health, Technology and Sports Science

Module coordinator
The academic staff member responsible for the organisation and execution of the module.
The module leader may be the same person as the semester coordinator. If a person responsible for exam is pointed out, please state name and e-mail address here.

Shellie A. Boudreau, sboudreau@hst.aau.dk, Department of Health Science and Technology.

Type and language
Module type (e.g. study subject module, course module, project module etc.)
Language of instruction.

Course module in English.

Objectives
Description of the content and objectives of the course as regards learning objectives of the students in the module. This comprises a transcript of the knowledge, skills and competences described in the study regulations and curriculum. Reference can be made to elaborations on semester Moodle site.

From Curriculum:

Students who complete this module:

Knowledge
• understand human sensory and motor control mechanisms
• understand neuroanatomical and physiological aspects of human sensory and motor control mechanisms
• have knowledge about methodologies to assess the normal and pathological sensory function
• have knowledge about methodologies to assess the normal and pathological motor control function
• have knowledge of quantitative and qualitative methodologies used to analyse neurophysiological data in relation to normal or pathological sensory and motor control mechanisms
• understand plasticity in sensory and motor pathways in normal and pathological conditions

Skills
• are able to interpret neurophysiological data in relation to the normal sensory or motor pathways and underlying disease
• are able to explain relevant sensory anatomy (e.g. vision, hearing, pain, balance, taste and olfaction, somatosensory cases) and coding of sensory information (e.g. mechanoreception, thermoreception, proprioception, nociception)
• are able to explain relevant motor neuroanatomy, including neural pathways related to control of movement and peripheral/spinal/subcortical/supra-spinal control of movement
• are able to explain relevant movement control mechanisms including postural control, motor reflexes, and sensory-motor integration of afferent and efferent information at spinal, sub-cortical and cortical level
• are able to identify and select appropriate methodologies to assess sensory and motor control mechanisms
• are able to identify sensory/motor pathways in selected neurological diseases

Competences
• are able to select and motivate appropriate methodologies to assess sensory and motor control mechanisms
• are able to judge neurophysiological data in scientific literature
Academic content and conjunction with other modules/semesters
A brief and general description of the academic content of the module as well as the basis and motivation for the module; i.e. a brief review of the content and foundation of the module. The intention is to provide students with an overview of each module and to create understanding of the module in relation to the semester and the entire programme.

The course module provides insight into the physiology and underlying neurophysiology of the human body in terms of innate design and associated functions of the sensory and motor control systems. The course provides a foundation for understanding the complex interplay between sensory and motor control which, to date, has many parallel engineering design solutions and applications. Moreover the course addresses how subtle changes in either of these two cooperative and feedback systems can alter function and performance. The course introduces students to methods and tools of biological measure in order to assess, quantify, and identify altered sensory or motor function. A thorough introduction to the sensory and motor systems provides a platform to understand our own biological design, inspire new concepts of measure or assessments, and make clear some of the current challenges facing biomedical engineering and health informatics. Exposure to the concepts associated with the sensory and motor control systems also provides an opportunity for students to develop an interdisciplinary vocabulary for communicating with professionals from healthcare and medical industry.

Scope and expected performance
The expected scope of the module in terms of ECTS load. This comprises number of teaching hours, exercises, preparation time, travel activity (if applicable) etc.

Based on a 5 ECTS course load:

- 16 Theory lectures and 16 exercise sessions (122 hrs.)
- 2 Self-study assignment preparation and feedback (8 hrs.)
- 4 lectures of case study exercises and feedback (20 hrs.)
- 2 case presentations (4 hrs.)
- Exam (approx. 30 min per student) + Exam preparation

154 hours + exam preparation + exam.

Participants
Indication of the participants in the module, particularly if they include several year groups, programmes or another type of co-teaching.

1st semester BME&I students.

Prerequisites for participation
Description of the prerequisites for students’ participation in the course, i.e. previous modules/courses in other semesters etc. The overall intention is to emphasise the coherence of the programme. This may be a transcript of the text in the study regulations and curriculum.

No pre-requisites are required for students enrolled in the Master, Biomedical Engineering and Informatics, 1st semester.

Module activities (course sessions etc.)

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2 (from Spring 2016)</th>
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<tbody>
<tr>
<td>Activity - type and title</td>
<td>Planned instructor*</td>
</tr>
<tr>
<td>Theory Lectures and exercises I-IV: The Sensory System</td>
<td>Shellie A. Boudreau</td>
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<tr>
<td>Module</td>
<td>Instructor</td>
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| Self-study
Sensory System | Shellie A. Boudreau | • In depth pre-assigned or agreed upon self-study assignment on a focus topic that is not covered in detail during the semester but has an interest to the student |
| Case Exercises
Sensory System | Shellie A. Boudreau | • Encourage critical thinking, integration of knowledge, and content filtering (knowing what is relevant)
• Student’s current knowledge is challenged is applied in practical cases where sensory-motor function abnormalities or losses are present. The development of a critical thinking |
| Case Presentations
Sensory System | Shellie A. Boudreau | • To gain an opportunity to verbally articulate the subject matter in a meaningful way within a peer-review environment
• To gain experience conveying complex topics to others which may or may not have a similar amount of background on the case study topic (e.g. disease, diagnosis and/or symptoms) |
| Theory Lectures and exercises I-IV: The Motor System | Cristian Sevcencu | • understand human motor control mechanisms, neuroanatomical and physiological aspects
• methodologies to assess the normal and pathological motor control function
• have knowledge of quantitative and qualitative methodologies used to analyse neurophysiological data in relation to normal or pathological motor mechanisms
• understand plasticity in motor pathways in normal and pathological conditions |
| Self-study
Motor Aspects | Cristian Sevcencu | • In depth pre-assigned or agreed upon self-study assignment on a focus topic that is not covered in detail during the semester but has an interest to the student |
| Case Exercises
Motor systems | Cristian Sevcencu | • Encourage critical thinking, integration of knowledge, and content filtering (knowing what is relevant)
• Student’s current knowledge is challenged is applied in practical cases where sensory-motor function abnormalities or losses are present. The development of a critical thinking |
| Case Presentations | Cristian Sevcencu | • To gain an opportunity to verbally articulate the subject matter in a meaningful way within a peer-review environment  
• To gain experience conveying complex topics to others which may or may not have a similar amount of background on the case study topic (e.g. disease, diagnosis and/or symptoms) |

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