



# Innovative Communication Technologies and Entrepreneurship (ICTE)

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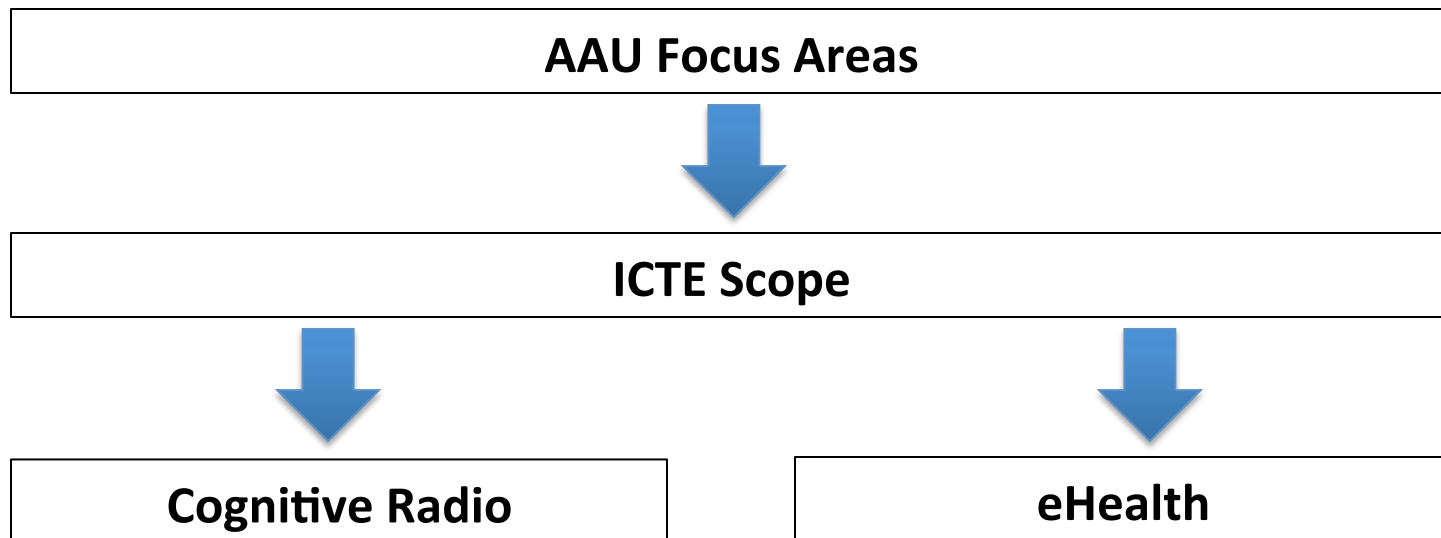
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ITU Standards Education Webinar

April 30, 2012

## AAU Focus Areas and ICTE Scope

- *Wireless Communications and related areas* are major research areas at Aalborg University
- Other significant areas are: Health science and green energy



## Problem-Based Learning

- Aalborg University and CTiF are world known for their approach to teaching and education:  
Problem-based learning (PBL)
  - In PBL the student learns the curriculum through working with complex, real-world problems
  - Often in groups or teams of up to six members
  - The supervisor or lecturer guides the students as a facilitator triggering discussion and innovation
- The PBL education is highly relevant to industry and Aalborg University graduates are very attractive to them

## The Master Programme

- CTIF has initiated a 2 years MSc in Engineering education (launched 2009)
  - Innovative Communication Technologies and Entrepreneurship
- An application-oriented MSc program
  - Combines technical knowledge of communication technologies and converging media with innovation, creativity, market, and user perspectives

## Master Programme

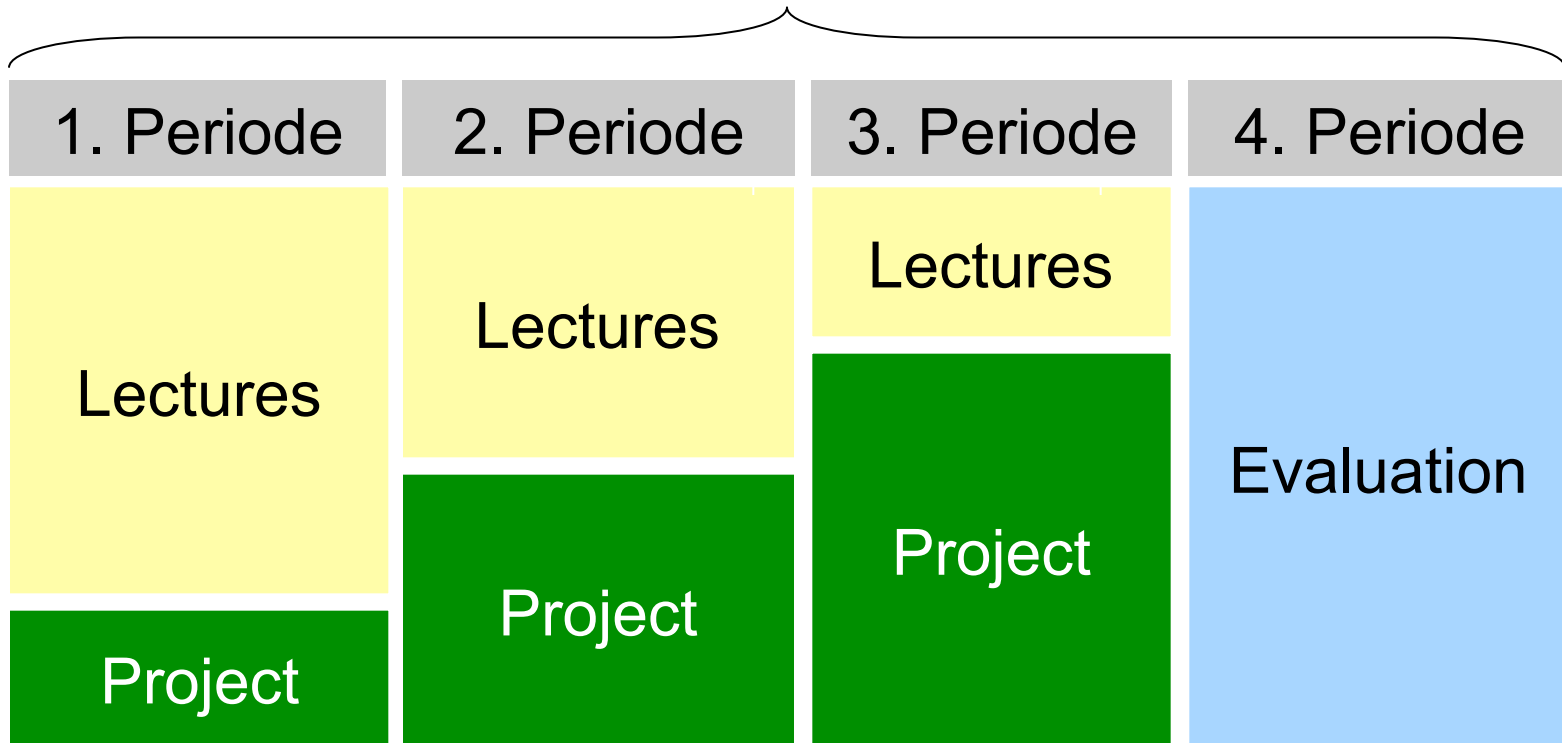
- The aim is to educate engineers with a thorough technical background combined with strong business competencies
  - Basic courses on wireless communications and network fundamentals and management
  - Advanced courses on wireless communications including cognitive radio, WSN, IoT and eHealth
- Courses include topics of entrepreneurship, **standardization**, IPRs

## Master Programme

- The training is multidisciplinary and is offered in English.
- The cross-disciplinary profile addresses the growing need for engineers who can combine knowledge from different areas:
  - Internet, Communication and Broadcast Technologies and Converging Media
  - Services and Platforms
  - Development of User-friendly Applications, Solutions and Services
  - Business Development and Business Models
  - Security, Trust, Privacy; Legal and Ethical Aspects
  - Use of IT and Communication Technology within Enterprises and Organizations
  - Cognitive Radio, an important technology for the future innovative telecom infrastructure
  - Telemedicine, a specific application domain with high requirements on security and resilience

## Semester Structure

One semester = 5 months = 30 ECTS = 900 hours



## Semesters

- 1<sup>st</sup> semester
  - Courses
    - Entrepreneurship, Innovation and Business Models (5 ECTS)
    - Communication Networks and Ambient Intelligence (5 ECTS)
    - PHY and MAC Fundamentals (5 ECTS)
  - Project
    - Services and Platforms (15 ECTS)
- 2<sup>nd</sup> semester
  - Courses
    - Advanced Telecommunication and its Applications (5 ECTS)
    - Standardization, IPR, Patenting and Technology Transfer (5 ECTS)
    - Distributed Network Management and Security (5 ECTS)
  - Project
    - Development of ICT-based Applications (15 ECTS)



## Semesters

- 3<sup>rd</sup> semester
  - Courses
    - Techniques and aspects for cooperative and cognitive radio (5 ECTS) – mandatory/elective depending on specialization
    - Techniques and aspects for eHealth (5 ECTS) – mandatory/elective depending on specialization
    - Machine learning (5 ECTS) – elective
  - Project (depends on specialization)
    - eHealth systems design (15-20 ECTS)
    - Cognitive radio systems design (15-20 ECTS)
- 4<sup>th</sup> semester
  - 30 ECTS dedicated to conducting the master projects and writing the master thesis
    - Often done in collaboration with industry
- Possible to combine 3<sup>rd</sup> and 4<sup>th</sup> semester for a 60 ECTS master project

## Example of Curriculum for Course

- PHY and MAC Fundamentals
  - The student...

...must have know the following (**knowledge**):

Wireless channel

Radio propagation elements

Channel modelling

Imperfect channel, impact of noise

Basic channel access

Fundamental single carrier access schemes

Modulation

Coding

Transceiver operation

Transceiver structures and synchronization

Channel estimation

Equalization

Link adaption

Capacity and advanced antenna systems

Channel capacity – multiple users

Multi-antennas systems

Diversity

Space multiplexing

Advanced Access

Multi-carrier access

Spread spectrum

Resource allocation

..must be able to (**skills**):

Establish a link budget

Illustrate the information flow on a block level

Perform basic simulations of parts of the communication chain

.. and must be able to (**competencies**):

Set up a basic model and/or simulation of the relevant parts of the communication chain and identify important parameters

## Example of Curriculum for Course

- Standardization, IPR, Patenting and Technology Transfer  
– The student...

...must have know the following (**knowledge**):

IPRs, the application process and the importance

Different standards, strategies and organizations for such

Understand the importance of IPRs .. and standards from different business perspectives

Technology transfer, different processes and the advantages from an academic and industrial point-of-view

such for a given invention

Must be able to evaluate the organizational as well as competitive aspects of IPRs and standards

.. and must be able to (**competencies**):

Assess strategies for applying standards and IPRs in a commercial perspective

Assess the feasibility, impact and complications of IPRs and standards

Assess technology transfer processes and the impact on different market players

..must be able to (**skills**):

Must be able to survey IPRs and assess the feasibility of applying

## Projects

- Carried out in groups. On the master programme, the groups typically consist of 2-5 students.
- The projects are written together, but the evaluation and exam is individual, with an individual assessment (either pass/fail or with grades).
- Groups are formed by the students, based on personal preferences and interests. The precise content of the project is decided between the students and their supervisor.
- Projects are often done in cooperation with industry and/or ongoing research projects.

## Project Examples

- RFID for Localization in Telemedicine Scenarios
  - Related to M2M standardization
- Security in IMS Networks
  - Related to unsolicited communication standardization
- Business Strategies in Cognitive Radio Networks
  - Related to 802.22 standardization

## Conclusions

- CTIF has initiated the Innovative Communication Technology and Entrepreneurship master programme
  - Currently being implement in Bulgaria and Romania
    - Worldwide interest
- The master programme encompasses many untraditional engineering courses relevant to e.g. project managers and entrepreneurs
  - Entrepreneurship, business models, standardization, IPR and technology transfer



ICTE

# CONNECTING TO THE FUTURE

# Thank you!

## Innovative Communication Technologies and Entrepreneurship — CTiF Master Programme

<http://www.ctif.aau.dk/Master+Program/>