ELEC-E7211
Digital Wireless Communication   D

Course Plan, fall 2024

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General

- Course in M.Sc. Program in Communications Engineering
- Acceptable for post-graduate studies
- Prerequisites: Working understanding of
  - Linear algebra
  - Digital communication in AWGN channels
  - Matlab & some mathematica
- Teachers
  - Prof. Olav Tirkkonen, responsible teacher, lecturer.
  - Dr. Mahdi Bayanifar, tutorials, homework.

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F2F Teaching

❑ Lectures 2.9.-26.11, typically **Tue 12-14 in AS4**
- Exceptions:
    - First lecture **Mon 2.9**. at 12 in AS4
    - Lectures Tue 8.10 and 26.11 at 12 in **AS3**
- Some lectures may be distributed remotely in Zoom

❑ Tutorials: **Wed 12-14 in AS6**
- Eight analytic and four matlab tutorials
- Please bring your own laptop with matlab installed (Aalto student license)

- Homework assignments:
    - 5 assignments with deadlines over periods 1 & 2

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Schedule II

Week starting	Week number	Lecture (AS4) Tue 12-14	Tutorials (AS6) Wed 12-14
2.9.	36	Lecture 1 (Monday)	Tutorial 1
9.9.	37	Lecture 2	Tutorial 2
16.9.	38	Lecture 3	Tutorial 3
23.9.	39	Lecture 4	Matlab tut 1
30.9.	40	Lecture 5	Tutorial 4
7.10.	41	Lecture 6 (AS3)	Matlab tut 2
14.10.		---	---
21.10.	43	Lecture 7	Tutorial 5
28.10.	44	Lecture 8	Matlab tut 3
4.11.	45	Lecture 9	Tutorial 6
11.11.	46	Lecture 10	Matlab tut 4
18.11.	47	Lecture 11	Tutorial 7
25.11.	48	Lecture 12 (AS3)	Tutorial 8

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Teaching Material

❑ Slides & tutorial solutions distributed in MyCourses.
❑ Textbook A. Goldsmith: "Wireless Communication"
  ❑ e-copy at https://primo.aalto.fi/
    1. Log in with your aalto-credentials
    2. Search for "Goldsmith", select "Wireless Communication"
    3. Select the e-book and go for it
❑ Other recommended books:
  ❑ Madhow, "Introduction to Communication Systems",
  ❑ Tse-Viswanath, "Fundamentals of Wireless Communications"
  ❑ Haykin-Moher, "Modern Wireless Communications"
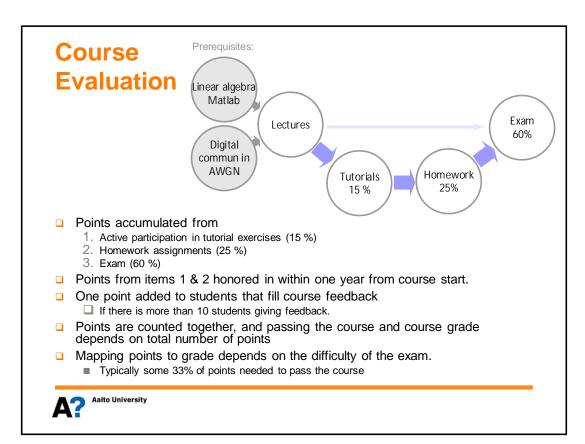 ❑ Proakis, "Digital Communications",

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Learning Objectives

❑ After the course the student
  ■ Is prepared to start working on a contemporary physical layer wireless communication engineering problem
  ■ Understands the functionalities of the physical layer in a modern communication system in multipath multiantenna fading channels
  ■ Understands principles of OFDM, multiantenna and multiuser communication
  ■ Can operate a link simulator

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Course Evaluation

Prerequisites:

- ❑ Points accumulated from
  1. Active participation in tutorial exercises (15 %)
  2. Homework assignments (25 %)
  3. Exam (60 %)
- ❑ Points from items 1 & 2 honored in within one year from course start.
- ❑ One point added to students that fill course feedback
  - ❑ If there is more than 10 students giving feedback.
- ❑ Points are counted together, and passing the course and course grade depends on total number of points
- ❑ Mapping points to grade depends on the difficulty of the exam.
  - ■ Typically some 33% of points needed to pass the course

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Exam

- ❑ Exams in December 2024 and January 2025
  - ■ Tentatively 5.12.2004 and 27.1.2025 at 16:30-19:30
  - ■ See SISU for final date, time & place.
- ❑ Exams will have 5 questions
  - ■ 1-2 questions based on explaining theoretical concepts, of the type discussed in the lectures
  - ■ 3-4 analytic calculations of the kind discussed in the tutorials
- ❑ The exams are **open book**
  - ■ Students may take any material printed or written on paper to the exam, including books, printouts and hand written notes.
  - ■ No electronic equipment is allowed except a scientific calculator
    - ❑ Thus phones, tablets, computers and programmable calculators may not be used in the exam.

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Assumed Starting Level & Equalization

❑ B.Sc. course level knowledge on principles of digital communications in AWGN channels
  ■ As exemplified by course by O. Tirkkonen
  ■ The material of this course will be disseminated in MyCourses
    ❑ Lectures 2-11 of the course
    ❑ The material has references to the textbook B.P. Lathi & Z. Ding: Modern Digital and Analog Communication Systems, International 4th ed, Oxford University Press 2010.

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Level of Digital AWGN Knowledge?

❑ QPSK
❑ QAM
❑ AWGN
❑ SNR
❑ BER
❑ SER
❑ Matched Filter
❑ Capacity
❑ Spectral Efficiency
➜ Patching up AWGN knowledge:
  ➜ Take course ELEC-C7231 in spring
  ■ Course is in Finnish, but all material exists in English, and it is possible to do the course in English
  ■ Can be used as a elective course in the major, if not earlier taken

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Questions, comments?

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