Course Introdiction: Information Transmissions

OVE EDFORS

DEPT. OF EIT, LUND UNIVERSITY

Administrative information

Course homepage

`http://www.eit.lth.se/course/EITA30/`

- Schedule and updates (check regularly)
- Lecture slides
- Table of formulas (bring it to the exam)
- Problems and solutions

LUND
UNIVERSITY

People

- **Lectures**
  Ove Edfors
  Office E:2359
  `mailto:Ove.Edfors@eit.lth.se`

- **Exercise classes**
  Sara Gunnarsson
  Office E:2368
 `mailto:Sara.Gunnarsson@eit.lth.se`

LUND
UNIVERSITY

Course Literature

Book

Anderson, J.B. and Johannesson, R.:
Understanding Information Transmission,
IEEE Press/Wiley Interscience, 2005, ISBN
0-471-67910-0.

In 2005 it was chosen by the American Library
Association's Choice Editors as "Outstanding
Academic Title - The Best of the Best in
Published Scholarship".

Chapters 1–6 and appendices A, B, and C are
all included in the course requirement, but not
Section 2.5 and Chapter 7

Understanding
Information
Transmission

JOHN B. ANDERSON
ROLF JOHANNESSON
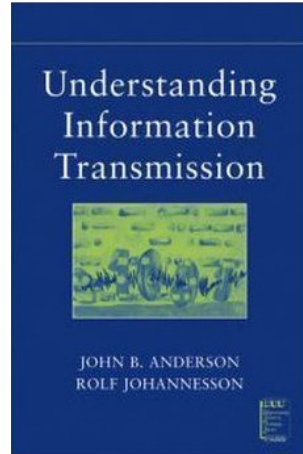
LADOK

- All students must be registered in LADOK. During the first two weeks of the course a list of names will be sent round during the lectures. Put an **x** next to your name, or, if your name is missing, add it to the list.

- If you will not be present during the first two weeks but would like to be registered, you send an e-mail to Anne Andersson with your name, "personnummer", and course code (EITA30) ... or visit her on the third floor (EIT Kursexpedition). (`mailto:Anne.Andersson@eit.lth.se`)

LUND
UNIVERSITY

Schedule

Day	Date	Time	Activity	Room	Contents	Slides
Mon	Mar 19	13:15	Lecture	E:2311	General information. Chapter 1: Introduction	OH_1_1
Thu	Mar 22	13:15	Lecture	E:2517	Chapter 3:Text and speech sources	OH_3_1
Fri	Mar 23	10:15	Lecture	E:2517	Chapter 3: Image & video sources	OH_3_2
Mon	Mar 26	13:15	Exercise	E:2311	Problems 3.1, 3.2, 3.3, 3.4, 3.5, 3.6	Solutions
Tue	Mar 27	13:15	Lecture	E:2517	Chapter 2: Section 2.1	OH_2_1
Wed	Mar 28	10:15	Lecture	E:2517	Chapter 2: Section 2.2-2.3	OH_2_2
Fri	Mar 29	13:15	Exercise	E:2517	Problems 2.2, 2.3, 2.16	Solutions
Tue	Apr 10	08:00	Retake exam	E:2517	For last year's students. Registration required!	
Mon	Apr 16	13:15	Lecture	E:2311	Chapter 2: Appendix	OH_B_1
Tue	Apr 17	13:15	Lecture	E:2517	Guest Lecture – Liesbet vd Perre B	
Wed	Apr 18	10:15	Exercise	E:2517	Problems B.1, B.2, B.3, B.4.	Solutions
Thu	Apr 19	13:15	Lecture	E:2517	Chapter 2: Section 2.4.	OH_2_3
Fri	Apr 20	10:15	Lecture	E:2517	Chapter 4: Channels	OH_4_1
Mon	Apr 23	13:15	Exercise	E:2311	Problems 2.17, and 2.18.	Solutions
Tue	Apr 24	13:15	Lecture	E:2517	Chapter 4: Channels, Analog modulation	OH_4_2
Wed	Apr 25	10:15	Lecture	E:2517	Chapter 4: Digital Modulation	OH_4_3
Thu	Apr 26	13:15	Lecture	E:2517	Chapter 4: Digital Modulation	
Fri	Apr 27	10:15	Exercise	E:2517	Problem 2.5, Problem 2.13(a).	Solutions
Wed	May 02	10:15	Lecture	E:2517	Chapter 2: Repetition	OH_2_rep
Thu	May 03	13:15	Exercise	E:2517	Problems 4.1, 4.4, 4.5, 4.7, and 4.8.	Solutions
Fri	May 04	10:15	Lecture	E:2517	Chapter 5: Probability theory and about Shannon, until Sec 5.1.2	OH_5_1

LUND
UNIVERSITY

Schedule

Day	Date	Time	Activity	Room	Contents	Slides
Mon	May 07	10:15	Lecture	E:2311	Subsections 5.1.2 and 5.1.3	OH_5_2
Tue	May 08	13:15	Exercise	E:2517	Exam May 31, 2002, Problem 3. Exam August 28, 2002, Problem 1.	Solutions
Wed	May 09	10:15	Lecture	E:2517	Chapter 5: Subsection 5.1.4 and Section 5.2	OH_5_3
Mon	May 14	13:15	Lecture	E:2311	Chapter 5: Section 5.3	OH_5_4
Tue	May 15	13:15	Lecture	E:2517	Chapter 5: Section 5.4	OH_5_5
Wed	May 16	10:15	Lecture	E:2517	Chapter 6: Sections 6.1 and 6.2	OH_6_1
Thu	May 17	13:15	Exercise	E:2517	Problems 5.1 and 5.2, 5.8(d), i.e. Exam June 1, 2004, Problem 4	Solutions
Mon	May 21	13:15	Exercise	E:2311	Problems 5.3 and 5.4.: Problem 5.8(a)=Exam June 3, 2003, Problem 4	Solutions
Tue	May 22	13:15	Lecture	E:2311	Chapter 6: Sections 6.3, 6.4, 6.5 and 6.6. Section 6.7 to 6.7.1	OH_6_2
Wed	May 23	10:15	Exercise	E:2517	Problems 5.9 5.12 and 6.1	Solutions
Thu	May 24	13:15	Lecture	E:2311	Section 6.7, Exam June 1, 2010, Problem 1	
Fri	May 25	10:15	Exercise	E:2517	Open problems	
Mon	May 28	08:00	Examination	Sparta C		
Fri	Aug 31	08:00	Retake exam	E:2517	Registration required!	

LUND
UNIVERSITY

Learning

Course Aim

- This course introduces the students to the entire field of information technology. It is given for anyone who wants to know more about this field that affects almost every aspect of our contemporary life.
- The aim of this course is to answer some fundamental questions:
    - Which kinds of information need to be transferred?
    - How do we measure information?
    - How do we transfer or store information?
    - What is the advantage of digital communication?
    - Which laws govern information transmission?

Knowledge and Understanding

For a passing grade the student must:

- be able to identify and formulate, on his or her own, problems within the areas of information transmission and communication

- be able to classify, on his or her own, how difficult a problem is in relation to his or her level of knowledge

- be able to analyze and describe, on his or her own, systems for information transmission and digital communication having low and medium complexity

Skills and Abilities, Values and Attitudes

For a passing grade the student must:

- show ability to handle, on his or her own, methods and results that are new to the student
- make, on his or her own, well-founded decisions among offered elective courses

Examination

Written exam

NOTE: On re-exams you have to register no later than 7 days before.

Grading: Each one of five problem yields maximum 10 points, giving a total maximum of 50 points.

- 40–50 points → Grade FIVE
- 30–39 points → Grade FOUR
- 20–29 points → Grade THREE

eLearning Problems

- eLearning problems are *optional*, but if all are submitted on time and correct you will get **3 bonus points** on the exams on May 28 and August 31, 2018.
- There is one batch of problems per book chapter.
- Submission of each batch closes one week after the final lecture on the corresponding chapter.
- eLearning address `http://elearning.eit.lth.se`

Overview of course content

Content in popular terms

- **Introduction**
  How do we broadcast music? Why digital communication? History
- **Why sinusoids?**
  How do we describe a communication system mathematically?
- **The importance of being sinusoidal**
  What is bandwidth?

Content in popular terms

What is out there that needs to be sent?

- What came after smoke signals?
- What is text?
- What is speech?
- What is music?
- What is a picture?
- What is video?

How is it sent?

- Sending information from here to there and from now to then.
- Is FM better than AM?
- How do we send 0s and 1s?

Content in popular terms

What did Shannon promise?

- Can we transmit information as fast as we want or is there a fundamental upper limit? (Cf. speed of light.)
- Can we correct errors that occur during transmission or storage?
- Can we compress data as much as we want or is there a fundamental lower limit?

Content in popular terms

FUBSWRORJB?? (Cryptology)

- How do we achieve secrecy and authenticity?
- Do provably secure cryptosystems exist?
- Can we prove that a message is authentic?

Relations to other courses

- Acquired knowledge from math courses will be applied here
- Those students that wish to learn more on the various subjects covered in this course are referred to the elective courses in the information and telecommunication areas

LUND
UNIVERSITY

Courses in related areas (examples)

- Modern Wireless Systems - LTE and Beyond
- Digital Communications, Advanced Course
- Internet Protocol
- Cryptography
- Internet Inside
- Wireless Communication Channels
- Information Theory
- Wireless System Design Principles
- Simulation
- Channel Coding for Reliable Communication
- Multiple Antenna Systems