KOÇ ÜNİVERSİTESİ

ELEC 514/414
Wireless Communications
Lecture 0 – Introduction to ELEC 514/414

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Spring 2019

Course Information

- Instructor

  Associate Professor (Doç. Dr.)
  Ertuğrul Başar
  ebasar@ku.edu.tr – ENG 168 - https://corelab.ku.edu.tr/
- Meeting Information:
  CASE Z24 – Mo We 10:00-11:15 (two 75-min lectures)
- Lecture notes will be available weekly on the course website. Please download and bring them with you to take further notes.
- Course website: Blackboard
- Office Hours: Mo 11:30-13:00

What You Need to Know?

- Probability Theory & Random Variables
- Signals & Systems
- Analog Communications
- Digital Communications
- Basic Programming Skills (Matlab, Mathematica, …)

- However, we will briefly review all of these and you will memorize almost NOTHING in this course !

Resources:

- We will not directly follow a textbook.

- T. Rappaport, “Wireless Communications, Principles & Practice”, 2nd Ed., Prentice-Hall, 2002.
- Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
- Andreas F. Molish, “Wireless Communications”, 2nd Ed., John&Wiley, 2011.
- S. Haykin, M. Moher, “Modern Wireless Communications”, Prentice-Hall, 2005.
- G. Stuber, “Principles of Mobile Communication”, 4th Ed., Springer, 2017.
- C. Beard, W. Stallings, “Wireless Communication Networks and Systems”, Pearson, 2017.
- Lecture Notes (E. Başar), Introduction to Mobile Communications, İTÜ, 2017.

Evaluation Methodology

Item	%	DATE
Midterm Exam	30	Week 9 (Apr. 3rd)
HWs & Quizzes	15	
Term Project	15	Week 14
Final Exam	40	TBA

- Make-up Exam Policy: Students with an university-approved excuse for the Midterm Exam or the Final Exam will be allowed to take the Make-up Exam at the end of the semester (after final exams).
- Make-up Exam will cover all semester topics!
- Conditions for the entrance to the Final Exam:
  - Entrance to the Midterm Exam and obtaining a minimum score of 30
  - Giving a proposal for the term project.

Asking questions is the key to learning !!!

Academic Dishonesty

- Academic dishonesty is a serious violation of the trust upon which an academic community depends.
- The students must submit their own work in all exams, quizzes, and homeworks. In exams and quizzes, all forms of information exchange and talking between students is forbidden.
- KU Statement on Academic Dishonesty https://vpaa.ku.edu.tr/sites/vpaa.ku.edu.tr/files/Misc_Documents/Statement_on_Academic_Honesty.pdf

Information about Term Project

- This course will combine in-class lectures with in-depth research projects of the students' own choosing.

- Project objective:
  - To understand an up-to-date research topic and duplicate research findings
- Topics:
  - Selected from active research frontiers in wireless communications
  - Topics are distributed on the first come first serve basis
    - The group that informs us about the topic will be assigned to that topic
    - Other goups will be asked to change the subject
  - We will be using http://turnitin.com/tr/ against plagiarism
- Sources:
  - http://ieeexplore.ieee.org/Xplore/dynhome.jsp
  - http://scholar.google.com.tr/

TEST AND SIMULATIONS WILL BE GRADED EXTRA POINTS

Project Proposal

- Up to **2** students are allowed to work together on a term project.
  - Send an email upon selection of your topic
  - The list is available online, please check it before your selection:
  - https://docs.google.com/document/d/12ZOByurCPomLxnMdENgfEDMceHHZY2vmzbg3ZRcWLjs/edit?usp=sharing
  - TO KEEP PROJECT LIST UPDATED
- A one page proposal is due on Feb. 22 at midnight (a few hours of work is required)
- The project proposal should include a fairly detailed description of
  - Your motivation
  - What you plan to do
    - (i.e. a clear description of the specific problem you plan to investigate)
  - How you plan to do it
    - (i.e. a description of your approach and the expected results).
- Your proposal should also list **2-3 relevant references**.
  - Make sure that you use correct citing format!
- USE THE TEMPLATE FILE

Project Report

- FINAL REPORT **(DUE MAY 15)**
  - The final report should follow one of the formatting styles in IEEE Transactions/Journal/Magazine/Letters.
  - The report should demonstrate in-depth understanding of the topic addressed and present key technical considerations in the issues involved.
  - 15-20 hours of work after the proposal is typical for a Project.
  - It must include
    - An abstract describing your main work
    - An introduction describing the problem being addressed;
    - In-depth technical descriptions including
      - problem modeling and solutions,
      - literature survey
      - systems design considerations and trade offs,
      - application range and current implementation status
      - future work;
    - Final summary
    - **Generated code/test set-up**

Potential Topics for the Research Project

- Massive MIMO Systems
- Millimeter-wave and Terahertz Communications
- Visible Light Communications
- Molecular Communications
- Beyond 5G Wireless Networks
- Cognitive Radio Networks
- Alternative Waveforms
- Reconfigurable Antennas and New Antenna Technologies
- Physical-Layer Security
- Energy Harvesting & Simultenous Wireless Information and Power Transfer
- Standards (LTE Release 15, IEEE 802.11x)
- Non-Terrestrial Networks
- Vehicular Networks
- Non-Orthogonal Multiple Access (NOMA) Systems
- …

	Course Outline (Tentative)	Date
1	Overview of Wireless Communications	4/2-6/2
2	Large-Scale Propogation Effects	11/2-13/2
3	Large-Scale Propogation Effects (con't) & Small-Scale Fading and Multipath	20/2
4	Small-Scale Fading and Multipath	25/2-27/2
5	Cellular Systems and Multiple Access, Antenna Basics	4/3-6/3
6	Digital Modulation and Detection for Wireless Communication	11/3-13/3
7	Error Performance over Fading Channels	18/3-20/3
8	Channel Coding & Information Theory	25/3-27/3
9	Problem Solving Session & Midterm Exam	1/4-3/4
	SPRING BREAK	8/4-12/4
10	Diversity Techniques	15/4-17/4
11	MIMO Systems	22/4-24/4
12	Spread Spectrum and CDMA	29/4
13	Multi-Carrier Communications and OFDM	6/5-8/5
14	Advanced Topics (5G, Massive MIMO, mmWaves, Optical Wireless Comm.)	13/5-15/5