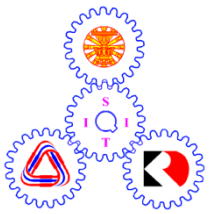

Sirindhorn International Institute of Technology
Thammasat University

School of Information, Computer and Communication Technology

ECS452: Course Syllabus

Semester/Year: 2/2016

Course Title: Digital Communication Systems
Instructor: Asst. Prof. Dr.Prapun Suksompong (prapun@siit.tu.ac.th)
***Course Website*:** http://www2.siit.tu.ac.th/prapun/ecs452/

Please check the course web site regularly for updated information about this course.

Lectures

- Tuesday 10:40-12:00 BKD 3511
- Thursday 10:40-12:00 BKD 3511

You are STRONGLY encouraged to attend lectures. (See the grading policy below.)

Course Information

Prerequisite: ECS 332 or consent of Head of School

Course Description: The subject of digital communications involves the transmission of information in digital form from a source that generates the information to one or more destinations. This course extends the knowledge gained from ECS332 (Principles of Communications) and ECS315 (Probability and Random Processes). Basic principles that underlie the analysis and design of digital communication systems are covered.

Grading Policy: Coursework will be weighted as follows:

Assignments (HWs)	5%
In-Class Exercises	5%
Class Discussion/Participation	10%
Midterm Examination	40%
Final Examination (comprehensive)	40%

- Late assignments will be heavily penalized or rejected.
- The lowest in-class exercise score will be dropped.
  Similarly, the lowest assignment score will be dropped.
- Cheating will not be tolerated

Textbook: John Proakis and Masoud Salehi, Digital Communications, 5th Edition, McGraw-Hill, 2007.

Additional References:

1. Robert G. Gallagher, Principles of Digital Communications, Cambridge University Press, 2008.
2. Bernard Sklar, Digital communications: fundamentals and applications, Prentice Hall, 2001
3. Ha H. Nguyen and Ed Shwedyk, A first course in digital communications, Cambridge University Press, 2009

Assignments: Homework will be assigned throughout the semester. Most assignments will be graded on completeness, not correctness: if an honest attempt was made on an assigned problem, it will be considered complete. Occasionally, part(s) of a selected problem will be graded. Of course, you do not know which problem of which assignment will be selected; so you should work on all of them. The complete solutions to all problems (not just answers) will be posted on the course web site.

In-Class Exercises: In-class exercises will focus on current or recently-discussed topics. An exercise may be given at any time during any class period. Students are expected to work in groups of at most three persons. In-class exercises will be given only to those students who are present. There will be no make-up exercise.

Exams: A handwritten A4 study sheet is allowed. One side for the midterm exam. Another side for the final exam.

Students should notify the instructor before missing any exam if at all possible and immediately thereafter when not possible. The instructor (and/or the fact-finding committee) will determine if the absence from an exam is legitimate. Simply not feeling well is not a reason to miss an exam. In the case of legitimate absence, an oral and/or written make-up exam could be arranged.

Expectations: You should expect to spend extra 5-8 hours per week studying outside of class. However, I do expect you to come to class and *participate actively* in class discussions. If you must miss a class, I expect you to find out and catch up with what happened in lecture, either from me or one of your classmates. You are responsible for all materials that are discussed in class.

Academic Integrity

The work you submit in this class is expected to be the result of your individual effort. You are free to discuss course material, approaches to problems with your colleagues or the instructor but you should never misrepresent someone else's work as your own.

It is your responsibility to protect your work from unauthorized access. For example, do not discard copies of your codes/assignments in public places.

Course Outline

The following is a tentative list of topics.

1. Course introduction,
   Elements of a Digital Communication System
2. **Source Coding**: General Concepts, Expected Length, Uniquely Decodable Codes, Prefix Codes, Huffman Coding
3. Extension Coding, Entropy, Convergence to Entropy
4. **Digital Communication Systems Over Discrete Memoryless Channel (DMC)**: DMC, Optimal Detection for DMC, Binary Symmetric Channel, Binary Asymmetric Channel, Symbol Error Probability
5. Maximum a Posteriori Probability (MAP) detector, Maximum Likelihood (ML), Block Encoding, Minimum-Distance Decoder, Hamming Distance
6. **Mutual Information and Channel Capacity**: Information-Theoretic Quantities, Conditional Entropy
7. **MIDTERM: 24 Mar 2017 TIME 09:00 - 11:00**
8. Mutual Information, Operational Channel Capacity, Reliable Communication, Information Channel Capacity, Symmetric and Weakly Symmetric Channel
9. Blahut-Arimoto Algorithm, Shannon's (Noisy Channel) Coding theorem
10. **Channel Coding**: Linear Block Codes, Generator Matrix, Parity Check Matrix, Hamming Codes
11. Binary Convolutional Codes, State Diagram and Trellis Diagram, Viterbi Decoding
12. **Introduction to Digital Modulation**: *M*-ary Modulation, Symbol Rate, Average signal energy, Pulse Amplitude Modulation, ASK, Gray Coding, Vector Space and Inner Product Space, Orthonormal Basis, Gram-Schmidt Orthogonalization Procedure, Constellations
13. **The Waveform Channel**: Random Processes, Autocorrelation Function, Wide-Sense Stationary (WSS) Random Processes, Power Spectral Density, White Noise
14. Wiener-Khinchine theorem, White Noise, Equivalent Vector Channel
15. **Optimal Detection for Additive Noise Channels**, Correlation detector, Matched filter
16. **FINAL: 8 Jun 2017 TIME 09:00 - 12:00**

Additional Remarks

1) Calculator: Casio FX-991 is permitted in exams and for in-class exercises
2) MATLAB: Computer simulation will be used to enhance learning. MATLAB is available in SIIT computer labs.