

Principles of Communications

ECS 332

Asst. Prof. Dr. Prapun Suksompong

(ผศ.ดร.ประพันธ์ สุขสมปอง)

prapun@siit.tu.ac.th

Introduction



Office Hours:

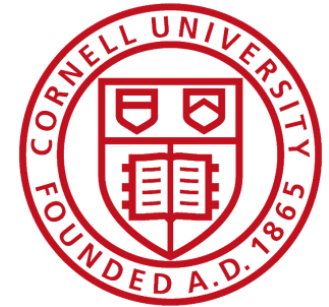
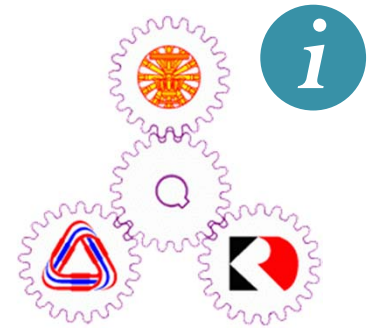
BKD, 6th floor of Sirindhralai building

Wednesday 13:45-15:15

Friday 13:45-15:15

Me?

- Ph.D. from **Cornell** University, USA
- In Electrical and Computer Engineering
- Minor: Mathematics (Probability Theory)
- Ph.D. Research: Neuro-Information Theory
- Current Research:
Wireless Communications
- 2009 and 2013 SIIT Best Teaching Awards
- 2011 SIIT Research Award
- 2013 TU Outstanding Young Researcher Award



prapun.com



Course Syllabus



Sirindhorn International Institute of Technology
Thammasat University

School of Information, Computer and Communication Technology

ECS332: Course Syllabus

Semester/Year: 1/2017

Course Title: Principles of Communications
Instructor: Asst. Prof. Dr.Prapun Sukksompong (prapun@siit.tu.ac.th)
Course Website: <http://www2.siiit.tu.ac.th/prapun/ecs332/>

Please check the course website regularly for updated information about this course.

Lectures

- Wednesday 10:40-12:00 BKD 2601
- Friday 10:40-12:00 BKD 2605
- Wednesday 09:00-10:20 BKD 2601 (Tutorial/Make-up; Shared with ECS332)

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

Office Hours

See Calendar on the course website.

Course Information

Prerequisite: ECS281 Signals and Systems

Corequisite: ECS315 (Probability and Random Processes)
or IES302 (Engineering Statistics)

Course Description: This course introduces the fundamental elements of analog and digital communication systems. The focus will be on the mathematical analysis of the signals in the frequency domain and basic building blocks of communication systems. Topics include AM, DSB, SSB, FM, NB/WBFM, PM, noises in analog communication; binary baseband modulation; Nyquist's sampling theory and quantization; pulse analog modulation. Performance of digital communication systems in the presence of noise will be discussed towards the end. The skills and knowledge gained from this class are essential for other advanced communication courses such as, digital communication systems and mobile communications.

Textbook: [C&C] A. Bruce Carlson and Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, McGraw-Hill, 2010, 5th International edition. Call No. TK5102.5 C3 2010. ISBN: 978-007-126332-0.

Additional References:

1. [Z&T] Rodger E. Ziemer and William H. Tranter, Principles of Communications, 6th International student edition, John Wiley & Sons Ltd, 2010. Call No. TK5105 Z54 2010.
2. [L&D] B.P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 4th Edition, Oxford: Oxford University Press, 2009. Call No. TK5101 L333 2009
3. J. G. Proakis and M. Salehi, Communication Systems Engineering, 2nd Edition, Prentice Hall, 2002. ISBN: 0-13-095007-6
4. S.S. Haykin, Communication Systems, 4th Edition, John Wiley & Sons, 2001. Call Number: TK5101 H38 2001.

Grading Policy: Coursework will be weighted as follows:

Assignments (HWs)	5%
In-Class Exercises	5%
Class Discussion/Participation	10%
Midterm Examination	35%
Final Examination (comprehensive)	45%

- 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

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 may 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.

Course Website

prapun.com

Teaching

- For 1/2017, he teaches
 - [ECS315 \(Probability and Random Processes\)](#)
 - [ECS332 \(Principles of Communications\)](#)
- For 3/2016, he taught
 - [ICT Elementary for Embedded Systems](#) (Fourier transform and principles of communications)
- For 2/2016, he taught
 - [ECS452 \(Digital Communication Systems\)](#)
 - [ECS455 \(Mobile Communications\)](#)
- For 1/2016, he taught
 - [ECS315 \(Probability and Random Processes\)](#)
 - [ECS332 \(Principles of Communications\)](#)

Current version



Last-year version



Asst. Prof. Dr. Prapun Suksompong (ผศ.ดร.ประพันธ์ สุขสมปอง) is currently the Chairperson of [Electronics and Communication Engineering \(EC\)](#) Curriculum at [Sirindhorn International Institute of Technology \(SIIT\)](#), Thammasat University, Thailand. In 1997, he received the [King's Scholarship](#) to study in the [School of Electrical and Computer Engineering \(ECE\)](#) at [Cornell university](#). He topped the [Cornell ECE class of 2002](#), with the highest GPA among all engineering students. He then received the Cornell's fellowship for his graduate study.

Prapun joined Prof. [Toby Berger](#)'s group in 2003 and got his Ph.D. in 2008.

Right after his graduation, he started his teaching career at SIIT. His research interest is in the areas of [communication theory](#), [information theory](#), [probability theory](#), and [theoretical neuroscience](#). In 2012, he (along with two other faculty members in the Wireless Communication Research Group) received the 2011 SIIT Research Award. In 2014, he received the 2013 Outstanding Young Researcher Award (รางวัลนักวิจัยรุ่นใหม่ดีเด่นระดับคณะประเททอาจารย์) from Thammasat University.

[Ajarn](#) Prapun always highly values the teaching aspect of his career and his life. Many of his notes are available on his personal websites. In 2006, he received the Teaching Assistant of the Year Award from members of the Cornell IEEE Student Branch "for exemplary teaching in ECE". In 2010 and in 2014, he also received the Best Teaching Awards from SIIT.

For more information, [here is his CV](#). (Download [pdf version](#).)

Teaching

- For 1/2017, he teaches
 - [ECS315 \(Probability and Random Processes\)](#)
 - [ECS332 \(Principles of Communications\)](#)
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- For 1/2016, he taught
 - [ECS315 \(Probability and Random Processes\)](#)
 - [ECS332 \(Principles of Communications\)](#)



Getting Info About This Course

Announcements

- The **syllabus** contains tentative information.
- I will announce **in class** and on the **web site** if there is any change.
- You are **responsible** for making sure that you obtain this information.
- Come to classes **on time** and listen carefully for **announcement(s)**.
- For those who want a preview of the class materials, old slides along with the notes and HW from earlier years are available on my web site (**prapun.com**).

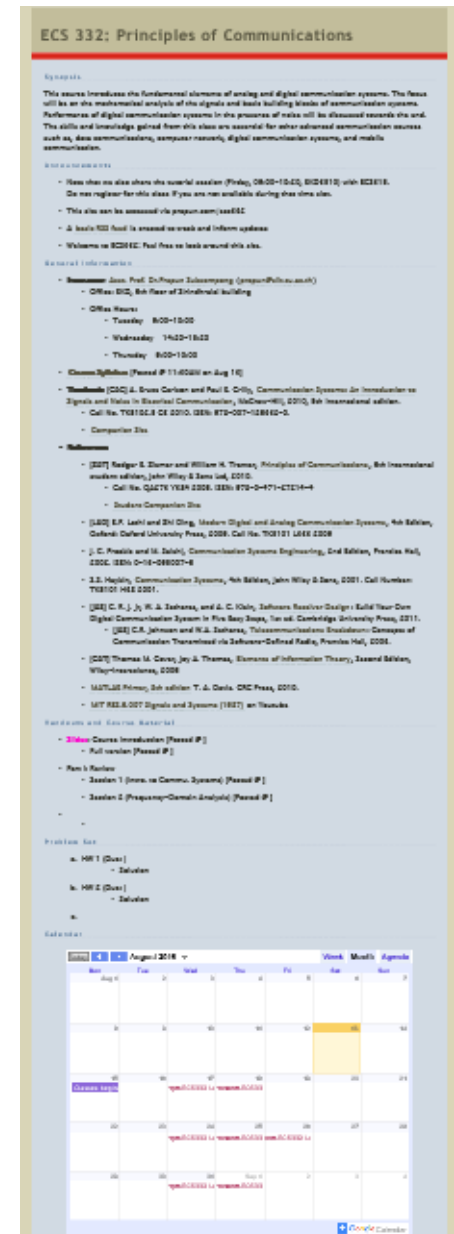


Course Web Site

- Announcements
- References
- Handouts (Posted before corresponding lectures; also available at the copy center)
- Annotated Notes/Slides (Posted after corresponding lectures)
- Calendar
 - Exams
 - HW due dates

Please check the course website regularly.

www2.siit.tu.ac.th/prapun/ecs332/



Course Website: Notes & Slides

- Some **PDF notes/slides** will be posted *before* the corresponding lectures.
 - Hard copies can also be purchased from the **copy center**.
- In lectures...
 - PDF notes/slides will be highlighted and annotated with examples / comments.
 - **Put all of your energy into understanding the material.**
 - The slides and annotated notes will be **posted after** the corresponding lectures.
- **Remind** (email) me the day after the lecture if the annotated notes/slides from the day before are still not posted on the web.

Course Organization

- **Course Website:**

<http://www2.siit.tu.ac.th/prapun/ecs332/>

- **Lectures:**

- **Wednesday 10:40-12:00 BKD 2601**

- **Friday 10:40-12:00 BKD 2605**

- **Tutorial/Exercise/Make-up sessions:**

- **Wednesday 09:00-10:20 BKD 2601 (Shared with ECS315)**

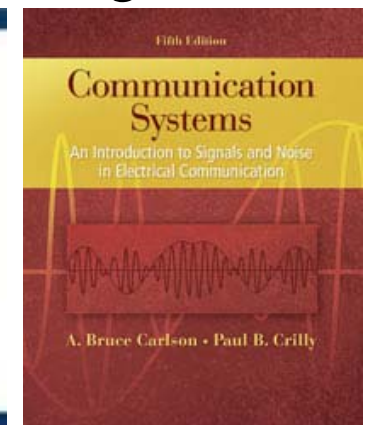
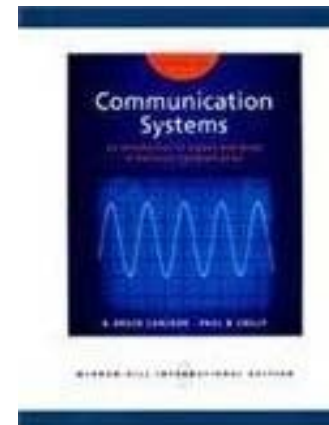
- **Textbook:** Communication Systems: An Introduction to Signals and Noise in Electrical Communication

- By A. Bruce Carlson and Paul B. Crilly

- 5th International edition

- Call No. TK5102.5 C3 2010

- ISBN: 978-007-126332-0



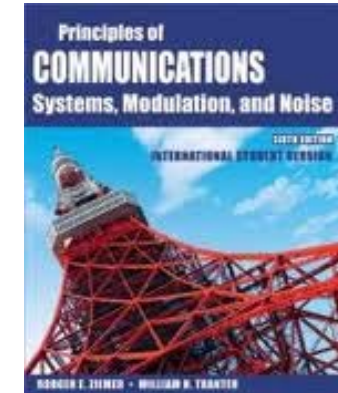
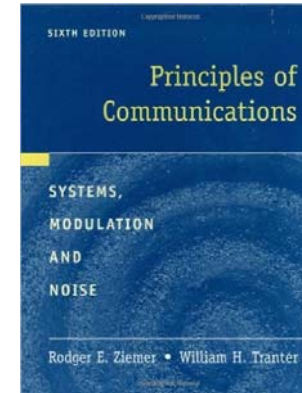
The Wednesday Sessions

- The first 4-5 sessions will be used for ECS315 **tutorial/review** classes.
- Later, we will start using them as tutorial sessions.
 - Will be conducted **in Thai** to help those who have problem with English.
 - Hopefully, you will ask more questions as well.
 - After the midterm, those whose scores are below the median will be required to attend.
- They can also be used for pre-announced in-class exercises as well.

More references

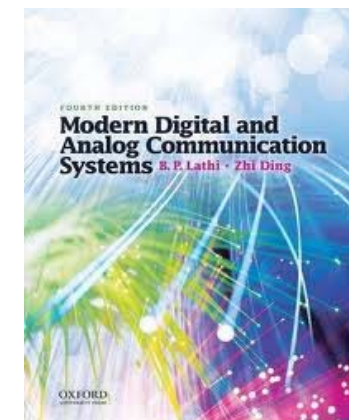
- Principles of Communications

- By Rodger E. **Ziemer** and William H. **Tranter**
- 6th International student edition
- ISBN 978-0-470-39878-4
- Library Call No. TK5105 Z54 2010
- Student Companion Site: <http://bit.ly/mN18kQ>



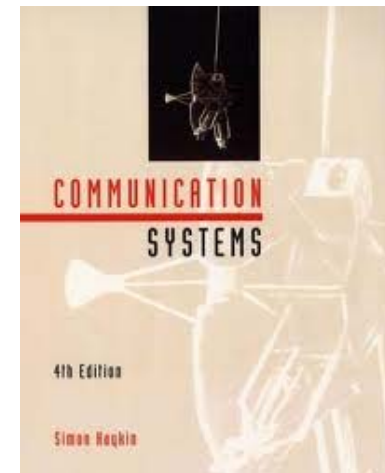
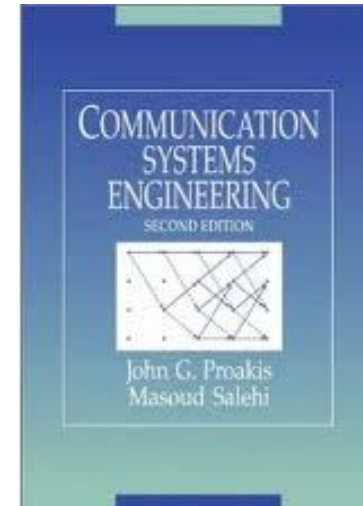
- Modern Digital and Analog Communication Systems

- By B.P. **Lathi** and Zhi **Ding**
- 4th Edition
- Library Call No. TK5101 L333 2009



More references

- J. G. **Proakis** and M. **Salehi**,
Communication Systems Engineering,
2nd Edition, Prentice Hall, 2002. ISBN:
0-13-095007-6
- S.S. **Haykin**, Communication Systems,
4th Edition, John Wiley & Sons, 2001.
Call Number: TK5101 H38 2001.



Another Reference (in Thai)



- รศ. ดร. ลัญจนกร วุฒิสีทธิกุลกิจ และคณะ, หลักการไฟฟ้าสื่อสาร, พิมพ์ครั้งที่ 2, สำนักพิมพ์แห่งจุฬาลงกรณ์ มหาวิทยาลัย, 2554. ISBN: 978-974-03-2770-7
- หนังสือ หลักการไฟฟ้าสื่อสาร เล่มนี้กล่าวถึง ทฤษฎีการแปลงฟูเรียร์ (Fourier transform) ระบบเชิงเส้น สหสัมพันธ์ (Correlation) ความหนาแน่นสเปกตรัม (Spectral density) การมอดูเลตเชิงแอมพลิจูด (amplitude modulation) การมอดูเลตเชิงมุม (angle modulation) กระบวนการสุ่ม (random process) สัญญาณรบกวน (noise) ทฤษฎีการซีกตัวอย่าง (sampling theory) การมอดูเลตโดยใช้พัลส์ (pulse modulation) การส่งผ่านพัลส์เบสแบนด์ (baseband pulse transmission) การมอดูเลตแบนด์พาส (digital passband transmission) และทฤษฎีข่าวสาร (information)
- หนังสือเล่มนี้เป็นผลจากความร่วมมือทางวิชาการของคณาจารย์จากหลายสถาบันการศึกษาที่มีชื่อเสียงของประเทศหลายแห่ง

ECS 332: Course Outline

1. Introduction to communication systems
2. Frequency domain analysis (Fourier transform and its property)
3. Frequency-shifting (translation), Bandwidth
4. Modulation, , multiplexing, DSB-SC
5. Channel characteristics, distortion, multipath Fading
6. Fourier series and its applications in analyzing modulator and demodulator
7. Energy and power, instantaneous frequency
8. **MIDTERM: 4 Oct 2017 TIME 12:00 - 14:00**
9. Classical DSB-SC Modulators, Amplitude Modulation (AM), envelope detector, Quadrature Amplitude Modulation (QAM)
10. Suppressed-Sideband Amplitude Modulation, Vestigial-Sideband Modulation (VSB)
11. Angle modulation: FM and PM
12. Sampling
13. Reconstruction
14. Analog pulse modulation, inter-symbol Interference, and pulse shaping
15. Pulse Code Modulation (PCM)
16. Digital communication in the presence of noise
17. **FINAL: 13 Dec 2017 TIME 09:00 - 12:00**



Calendar

Lectures, Tutorials / Make-up

M	T	W	R	F
14-Aug-17	15-Aug-17	16-Aug-17	17-Aug-17	18-Aug-17
21-Aug-17	22-Aug-17	23-Aug-17	24-Aug-17	25-Aug-17
28-Aug-17	29-Aug-17	30-Aug-17	31-Aug-17	1-Sep-17
4-Sep-17	5-Sep-17	6-Sep-17	7-Sep-17	8-Sep-17
11-Sep-17	12-Sep-17	13-Sep-17	14-Sep-17	15-Sep-17
18-Sep-17	19-Sep-17	20-Sep-17	21-Sep-17	22-Sep-17
25-Sep-17	26-Sep-17	27-Sep-17	28-Sep-17	29-Sep-17
2-Oct-17	3-Oct-17	4-Oct-17	5-Oct-17	6-Oct-17
9-Oct-17	10-Oct-17	11-Oct-17	12-Oct-17	13-Oct-17
16-Oct-17	17-Oct-17	18-Oct-17	19-Oct-17	20-Oct-17
23-Oct-17	24-Oct-17	25-Oct-17	26-Oct-17	27-Oct-17
30-Oct-17	31-Oct-17	1-Nov-17	2-Nov-17	3-Nov-17
6-Nov-17	7-Nov-17	8-Nov-17	9-Nov-17	10-Nov-17
13-Nov-17	14-Nov-17	15-Nov-17	16-Nov-17	17-Nov-17
20-Nov-17	21-Nov-17	22-Nov-17	23-Nov-17	24-Nov-17
27-Nov-17	28-Nov-17	29-Nov-17	30-Nov-17	1-Dec-17
4-Dec-17	5-Dec-17	6-Dec-17	7-Dec-17	8-Dec-17
11-Dec-17	12-Dec-17	13-Dec-17	14-Dec-17	15-Dec-17

Lectures

Exams

Please Double-Check Exam Dates!



Calendar (Google)

Available on the course web site.

The screenshot shows a Google Calendar interface for August 2017. The calendar is viewed in a weekly grid. The days of the week are labeled at the top: Mon, Tue, Wed, Thu, Fri, Sat, Sun. The dates are listed in the first row: 31, Aug 1, 2, 3, 4, 5, 6. The second row shows dates 7, 8, 9, 10, 11, 12, 13. The third row shows dates 14, 15, 16, 17, 18, 19, 20. The fourth row shows dates 21, 22, 23, 24, 25, 26, 27. The fifth row shows dates 28, 29, 30, 31, Sep 1, 2, 3. The calendar contains several events for ECS332, including 'National Moth' on 14th, 'Classes begin' on 15th, and 'Last day for a' on 28th. There are also regular lecture and office hours listed for ECS332.

The screenshot shows the course page for ECS 332: Principles of Communications. The page includes a description of the course, a list of topics, and a list of resources. The course description states: "This course introduces the fundamental elements of analog and digital communication systems. The focus will be on the mathematical analysis of the signals and basic building blocks of communication systems. Performance of digital communication systems in the presence of noise will be discussed towards the end. The skills and knowledge gained from this course are essential for other advanced communication courses such as, data communications, computer networks, digital communication systems, and mobile communications." The list of resources includes textbooks and other materials.



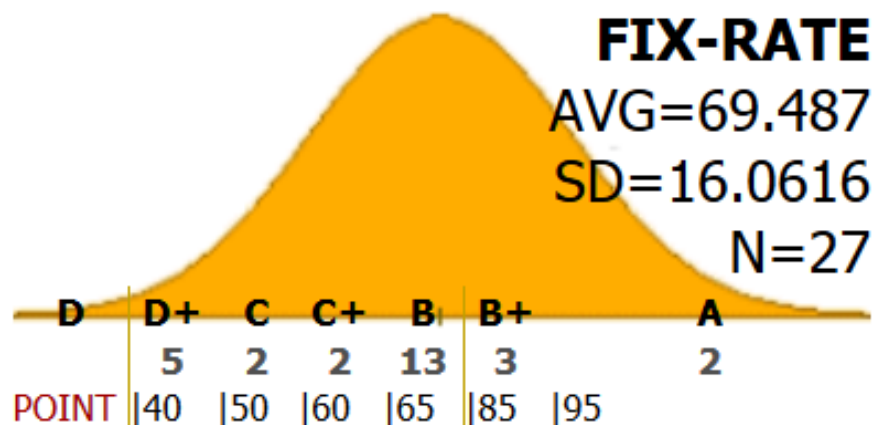
Grading System

- Coursework will be weighted as follows:

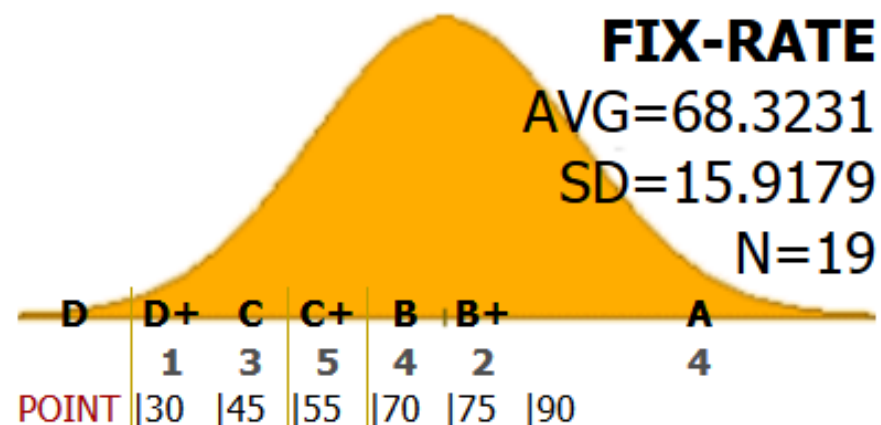
Assignments	5%
In-Class Exercises	5%
Class Discussion/Participation	10%
Midterm Examination	35%
Final Examination (comprehensive)	45%

- Mark your calendars now!
- Late HW submission will be rejected.

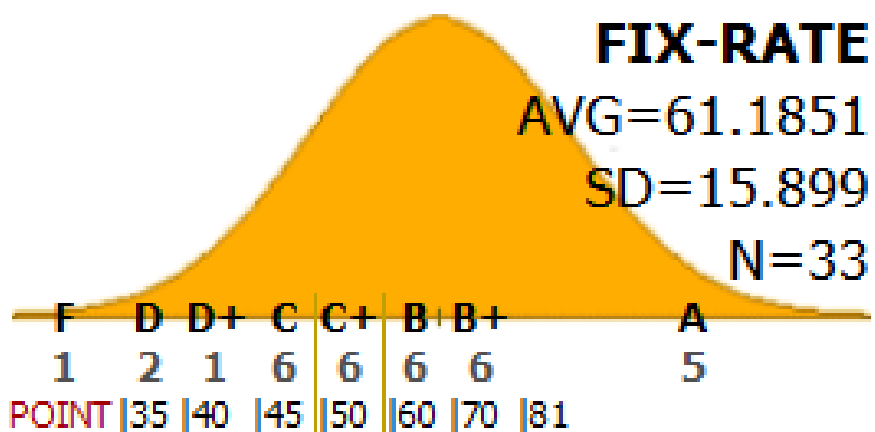
Grading System



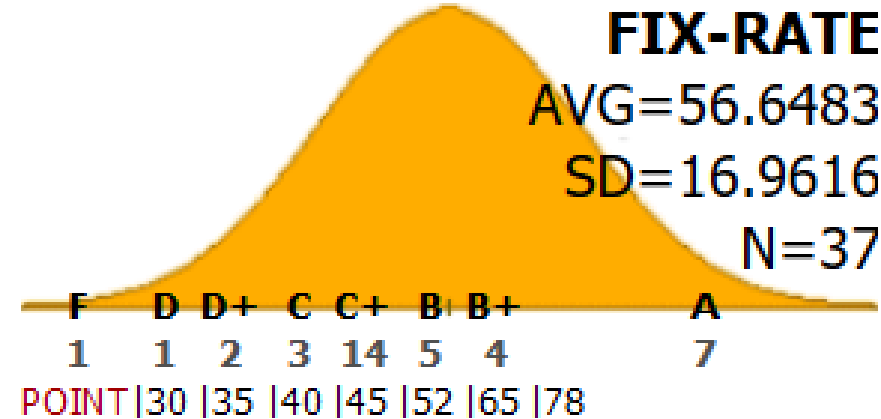
2011: CLASS GPA: 2.74



2012: CLASS GPA: 2.89



2015: CLASS GPA: 2.71



2016: CLASS GPA: 2.76

In-Class Exercises

- Most in-class exercises will occur **without** prior warning or announcement.
 - Focus on the current topic under discussion.
- Done **in group** to **reduce pressure** and provide **opportunity**
 - for those who think they understand the course material to **explain** to their friends and see whether they really know the material under consideration
 - and
 - for those who are falling behind to get an **alternative explanation** from their peers
- Note that you **can't be in exactly the same group every time**.
 - Have to change your group members every time.
 - If you are with a friend before, then next time, form a group with someone else.

Class Participation

- NOT the same as class attendance!
- If you come only to **receive**, you will fall **asleep**.
 - Do not simply sit quietly in the class.
- Need **interaction** between lecturer and students.
- **Ask question** when there is something that you don't understand.
 - Don't be shy!
 - It is very likely that your friends don't understand it as well.
- If you already understand what I'm presenting, **SHOW ME!**
 - Point out the errors/typos.
 - I will raise many issues/questions in class. Try to comment on them.



Class Participation (2)

- Record what you have done.
 - To be submitted right after the midterm and right after the final.

ECS 332: Self-Evaluation 2017

1. The class participation score for this class is judged by how much you actively participate in the class discussion both inside and outside of the classroom.
2. Please honestly answer the following questions. Please provide as much information as possible. Do not include the activities that you have already stated in the first self-evaluation form.

Name

Student ID

How many times have you been absent from the class? Are there any specific reason(s)? Please explain.

How many times have you been late (> 30s) for the class? Are there any specific reason(s)? Please explain.

How many times have you participated (provided comments, asked questions, answered questions, etc) in the lectures? Be specific. Provide some short description for each event. Number alone does not count.


How many times have you correctly informed the instructors the typo or mistake on the whiteboard/slides/hw/etc? Please provide some short description about each of the issues.

How many times have you discussed with the instructor outside of class? (Ask questions, express concerns, etc.) Be specific.

Based on the clock on my computer. (This should be approx. the same as your phone's and computer's clocks if they are synchronized properly.)



Policy

- We will start the class **on time** and will finish **on time**.
 - I recommend arriving at least 3 minutes before the start time.
 - Raise your hand and tell me immediately if I go over the time limit.
 - Does NOT mean that I will leave the room immediately after lecture.
 - I will stay and answer questions.
- Mobile phones *must* be turned off or set in silent mode. 
- Attendance will be taken/given irregularly and randomly.
- Cheating will not be tolerated.
- Feel free to stop me when I talk too fast or too slow.

Policy (con't)

- I will surely make some **mistakes** in lectures / HW / exams.
 - Some amount of class participation scores will be reserved to reward the **first** student who informs me about each of these mistakes.
 - Grammatical errors are best informed/corrected after class.
- Unless instructed otherwise, points on exercises and exams are based on your entire solution, not your final answer.
 - You may get full credit even when you have the wrong final answer.
 - You may get **zero** even when you write down a right answer without justification.

Policy (con't)

- Please stop me if I go over the time limit.
- Please stop me if I talk too fast.
- Please stop me if you have any question.





Help and Office Hours

- Get some help!
 - Do not wait until the final exam time or after the grade is out.
 - Right after lecture is always a good time to ask question.
- Office Hours
 - Tentative Time: W,F 13:45-15:15
 - Check Google Calendar on the course website.
 - Appointment can be made.
 - Feel free to come to my office and chat!
 - Don't be shy.

Asst.Prof.Dr.Prapun Suksompong - 1/2017					
	9.00-10.20	10.40-12.00	13.00-14.20	14.40-16.00	16.00-17:00
MON		Office Hour	JAE	MEETING	
TUE		ECS315 BKD 2601		Office Hour	
WED	ECS315/332 BKD 2601	ECS332 BKD 2601		Office Hour	
THU			ECS315 BKD 2401	Office Hour	
	Office Hour	ECS332 BKD 2605		Office Hour	

Office Hours:

BKD, 6th floor of Sirindhralai building

Wednesday 13:45-15:15

Friday 13:45-15:15

Warning

- This class is **difficult**.
 - Keep up with the lectures.
 - Make sure that you understand the concepts presented in the lecture before you go home.
- I will **evaluate** your understanding of the course **regularly** through
 - In-class exercises/activities
 - Exams



Remarks

- Get as much **legitimate** help as you can
- **Participate actively in class** and outside of class
 - Record what you have done.
- If you feel that the class is very easy, you might overlook something.
- If you feel that the class is very difficult, you are probably not the only one who feel that way.
 - Don't give up. Chat with me.
- My notation can be different from the textbook.
 - Every notation has some advantages and disadvantages.