Before we start …

- Grab the free handouts
  - Course syllabus

  - Slides

- Please join the ECS332 **Line group**

- Make sure that you have the lecture notes either via
  - buying the hardcopy from the copy center or
  - downloading a pdf copy from the course website

Principles of Communications
ECS 332

Asst. Prof. Dr. Prapun Suksompong

(ผศ.ดร.ประพันธ์ สุขสมปอง)

prapun@siit.tu.ac.th

Introduction
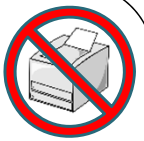
Office Hours:

Check Google Calendar on the course website.

Dr.Prapun's Office:

6th floor of Sirindhralai building, BKD

2

Asst.Prof.Dr.Prapun Suksompong

- Chairperson of **Electrical Engineering Program** (and Chairperson of **Electronics and Communication Engineering** Curriculum and Electrical Engineering Curriculum)
  at **Sirindhorn International Institute of Technology (SIIT)**

- Ph.D. from **Cornell** University, USA
  - In Electrical and Computer Engineering
  - Minor: Mathematics (Probability Theory)
  - Research: Neuro-Information Theory (Communications in Human Brain)

- Current Research: Wireless Communications, Localization, Game Theory

- 2009, 2013, and 2017 SIIT Best Teaching Awards

- 2011 SIIT Research Award

- 2013 TU Outstanding Young Researcher Award

- 2017 SIIT Distinguished Teacher Award

- 2018 TU Outstanding Teacher in Science and Technology

prapun.com

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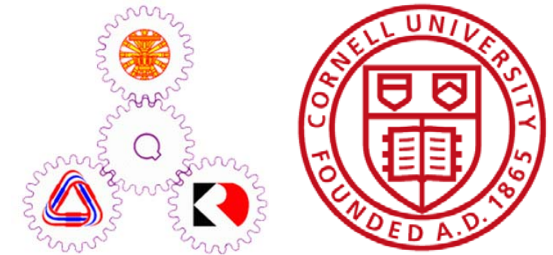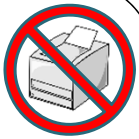
Course Syllabus

Sirindhorn International Institute of Technology

Thammasat University

School of Information, Computer and Communication Technology

ECS332: Course Syllabus

Semester/Year: 1/2019

Course Title: Principles of Communications
Instructor: Asst. Prof. Dr.Prapun Suksompong
(prapun@siit.tu.ac.th)
Course Website: http://www2.siit.tu.ac.th/prapun/ecs332/
Line Group: http://line.me/ti/g/YwoSVmhahT

Lectures

- Wednesday 10:40-12:00 BKD 2602
- Friday 10:40-12:00 BKD 3511
- Friday 13:00-14:20 BKD 3511
  (Tutorial/Make-up; Shared with ECS315)

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)

Grading Policy: Coursework will be weighted as follows:

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

- Late assignments will be heavily penalized or rejected.
- Cheating will not be tolerated

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.

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

Academic Integrity

The work submitted 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. 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 2019 TIME 09:00 - 11:00
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: 11 Dec 2019 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.

Last updated: 8/8/2019 3:15 PM

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.

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.

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 lowest assignment score will be dropped. The complete solutions to all problems (not just answers) will be posted on the course web site.

Class Discussion: The score for this part is judged by the amount of active participation in the class discussion (with the instructor) either inside or outside of the classroom. There will be (self-evaluation) forms for collecting information about this twice (one right after the midterm exam and another one right after the final exam).

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.

Two lowest in-class exercise scores will be dropped. Additionally, one who has legitimate excuse (such as participating in competition, or university-approved curricular and extracurricular activity, career-related interview, broken bone(s), being admitted to the hospital) may request that the corresponding missing score will not be counted. For such request, supporting document should be submitted to the instructor and the student must explicitly provide the missing exercise number and date in the (self-evaluation) forms.

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.

Course Website

prapun.com

Asst. Prof. Dr.Prapun Suksompong
Sirindhorn International Institute o
university. He topped the Cornell e

Right after his graduation, he starte
other faculty members in the Wirel
ประเภทอาจารย์) from Thammasat

Ajarn Prapun always highly values the teaching a
Student Branch "for exemplary teaching in Electr
"Distinguished Teacher" award from SIIT and the

For more information, here is his CV. (Download

Teaching

- For 1/2019, he teaches
  - ECS315 (Probability and Random Processes)
  - ECS332 (Principles of Communications)   ← **Current version**
- For 3/2018, he taught
  - ICT Elementary for Embedded Systems (Fourier transform and principles
- For 2/2018, he taught
  - ECS452 (Digital Communication Systems)
- For 1/2018, he taught
  - ECS315 (Probability and Random Processes)
  - ECS332 (Principles of Communications)   ← **Earlier version**

ECS 332: Principles of Communications

Synopsis

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 class are essential for other advanced communication courses such as, data communications, computer network, digital communication systems, and mobile communication.

Announcements

- Note that we also share the tutorial/make-up session with ECS315. See Google calendar below.
- This site can be accessed via prapun.com/ecs332
- Welcome to ECS332! Feel free to look around this site.

General Information

- **Instructor**: Asst. Prof. Dr.Prapun Suksompong (prapun@siit.tu.ac.th)
  - Office: BKD, 6th floor of Sirindhralai building
  - Office Hours: See Google calendar below.
- **Lectures**: See Google calendar below.
- **Course Syllabus**
- **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.
  - Companion Site
- **References**
  - Draft of the lecture notes

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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 Web Site

- The **syllabus** contains tentative information.

- I will announce **in class** and on the **website** 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**).

Teaching

- For 1/2018, he teacl
    - ECS315 (Prol
    - ECS332 (Prin
- For 3/2018, he taugl
    - ICT Elementa
- For 2/2018, he taugl
    - ECS452 (Dig
- For 1/2018, he taugl
    - ECS315 (Prol
    - ECS332 (Prin
- For 3/2017, he taugl
    - ICT Elementa
- For 2/2017, he taugl
    - ECS452 (Dig
- For 1/2017, he taugl
    - ECS315 (Prol
    - ECS332 (Prin

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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 2602**
  - **Friday   10:40–12:00   BKD 3511**

- Tutorial/Exercise/Make-up sessions:
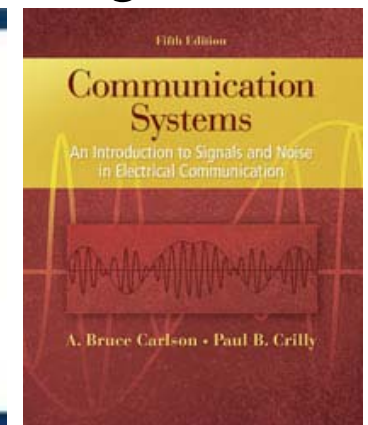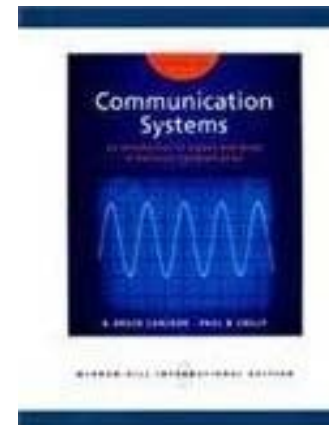 - **Friday   13:00–14:20   BKD 3511 (Shared with ECS315)**

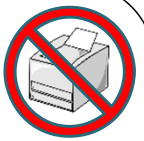- **Textbook:** Communication Systems: An Introduction to Signals and Noise in Electrical Communication
  - By A. Bruce Carlson and Paul B. Crilly
  - 5th International edition
  - Call No. TK5102.5 C3 2010
  - ISBN: 978-007-126332-0

A. Bruce Carlson

- Was a professor and curriculum chairman of the electrical, computer and systems engineering department at Rensselaer Polytechnic Institute (RPI).

- Retired in 2002.

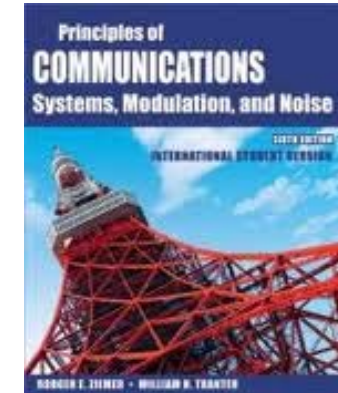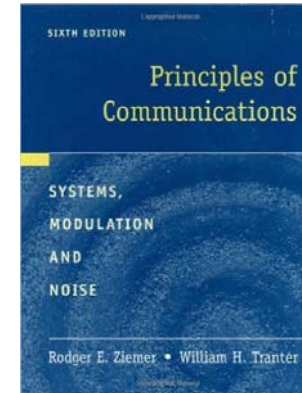Bruce A. Carlson

Phillip J. "Phil" Coulson

The Friday Sessions

- Shared with ECS315.

- The first 4-5 sessions will be used for ECS315 **tutorial/review** classes.
  - Start from **this** Friday.

- Later, we will start using them as tutorial sessions.

- They can also be used for pre-announced make-up classes and in-class exercises as well.
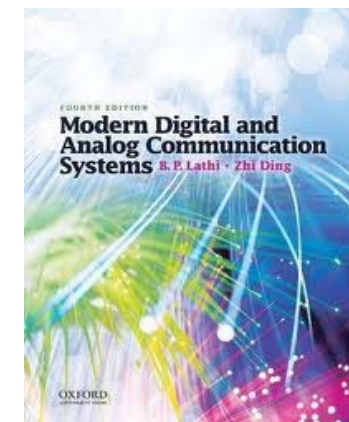
More references

- 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
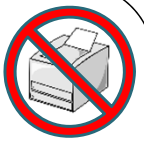
More references

- 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.
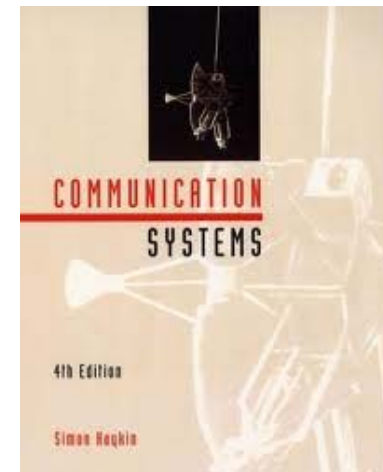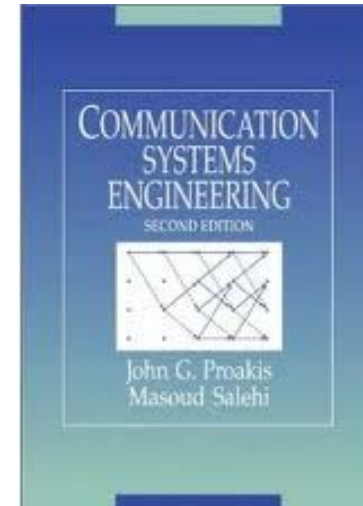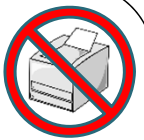
Another Reference (in Thai)

- สุวิทย์ นาคพีระยุทธ และคณะ

- หลักการไฟฟ้าสื่อสาร

- พิมพ์ครั้งที่ 3, 2558

- ISBN: 9789740333890

- หนังสือ หลักการไฟฟ้าสื่อสาร เล่มนี้กล่าวถึง ทฤษฎีการแปลงฟูเรียร์ (Fourier transform) ระบบเชิงเส้น สหสัมพันธ์ (Correlation) ความหนาแน่นสเปกตรัม (Spectral density) การมอดูเลตเชิงแอมพลิจูด (amplitude modulation) การมอดูเลตเชิงมุม (angle modulation) กระบวนการกลุ่ม (random process) สัญญาณรบกวน (noise) ทฤษฎีการชักตัวอย่าง (sampling theory) การมอดูเลตโดยใช้พัลส์ (pulse modulation) การส่งผ่านพัลส์เบสแบนด์ (basenand pulse transmission) การมอดูเลตแบนด์พาส (digital passband transmission) และทฤษฎีข่าวสาร (information)

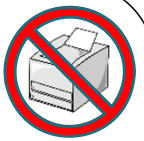- เป็นผลจากความร่วมมือทางวิชาการของคณาจารย์จากหลายสถาบันการศึกษาที่มีชื่อเสียงของประเทศหลายแห่ง

[http://www.chulabook.com/description.asp?barcode=9789740333890]

Another Reference (in Thai)

[http://www.chulabook.com/description.asp?barcode=9789740333890]

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 2019 TIME 09:00 - 11:00**
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
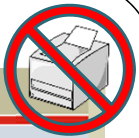17. **FINAL: 11 Dec 2019 TIME 09:00 - 12:00**

Calendar

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

Lectures

Exams

Please Double-Check Exam Dates!

Calendar (Google)

Available on the course web site.

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: T,F 14:30-15:30
  - Check Google Calendar on the course website.
  - Appointment can be made.
  - Feel free to come to my office and chat!
  - Don't be shy.
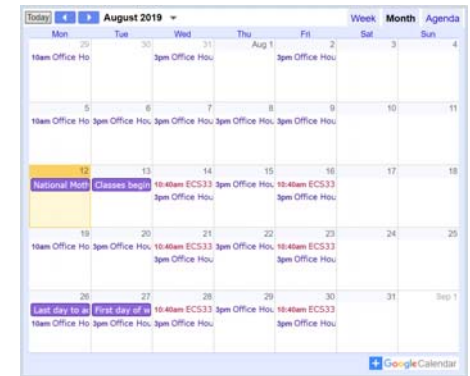
	9.00-10.20	10.40-12.00	13.00-14.20	14.40-16.00	16:00-17:00
		Asst.Prof.Dr.Prapun Suksompong – 1/2019			
MON	OH		JAE	MEETING	
TUE		ECS315 BKD 3510		ECS315/332 Office Hour	
WED		ECS332 BKD 2602		OH	
THU		ECS315 BKD 3506		OH	
FRI		ECS332 BKD 3511	ECS315/332 BKD 3511	ECS315/332 Office Hour	

Office Hours:
BKD, 6th floor of Sirindhralai building
Tuesday 14:30–15:30
Friday 14:30–15:30

Grading System

- Coursework will be weighted as follows:

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

- Late HW submission will be rejected.
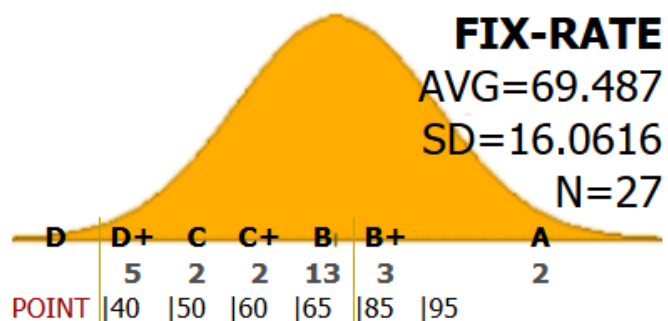
Please Double-Check Exam Dates!

Grading System: History

FIX-RATE
AVG=69.487
SD=16.0616
N=27

D	D+	C	C+	B	B+		A
	5	2	2	13	3		2
POINT	40	50	60	65	85	95	

2011: CLASS GPA: 2.74

FIX-RATE
AVG=68.3231
SD=15.9179
N=19

D	D+	C	C+	B	B+		A
	1	3	5	4	2		4
POINT	30	45	55	70	75	90	

2012: CLASS GPA: 2.89

FIX-RATE
AVG=61.1851
SD=15.899
N=33

F	D	D+	C	C+	B	B+		A
1	2	1	6	6	6	6		5
POINT	35	40	45	50	60	70	81	

2015: CLASS GPA: 2.71

FIX-RATE
AVG=56.6483
SD=16.9616
N=37

F	D	D+	C	C+	B	B+		A
1	1	2	3	14	5	4		7
POINT	30	35	40	45	52	65	78	

2016: CLASS GPA: 2.76

FIX-RATE
AVG=58.4639
SD=15.6194
N=48

F	D	D+	C	C+	B	B+		A
1	2	1	5	13	12	6		8
POINT	31	36	41	48	55	68	77	

2017: CLASS GPA: 2.81

FIX-RATE
AVG=56.8575
SD=13.1355
N=45

F	D	D+	C	C+	B	B+		A
	2	4	6	7	11	9		6
POINT	28	36	42	49	55	60	70	
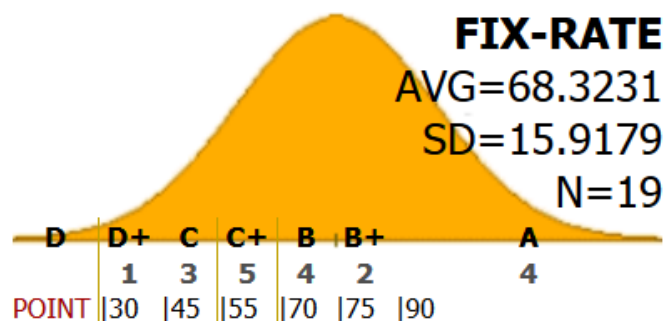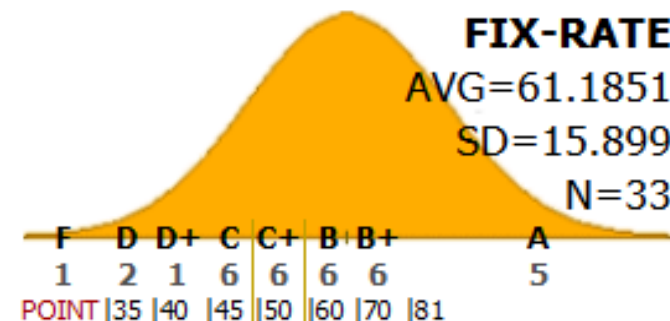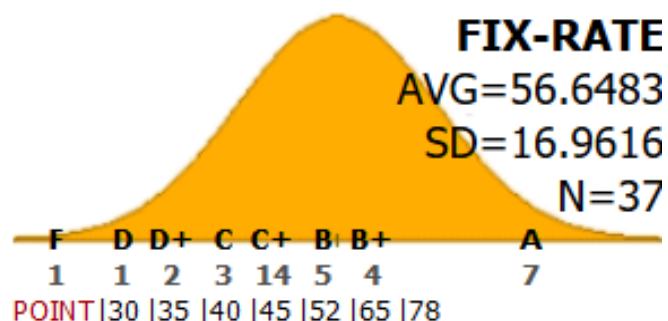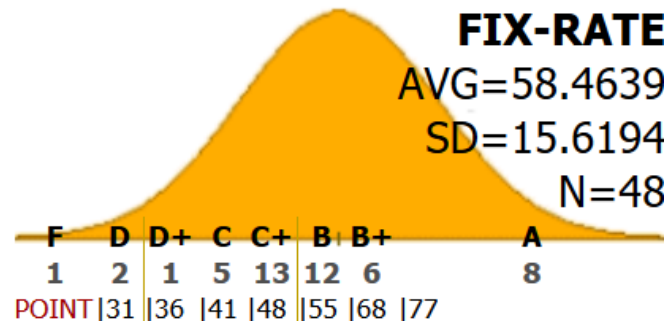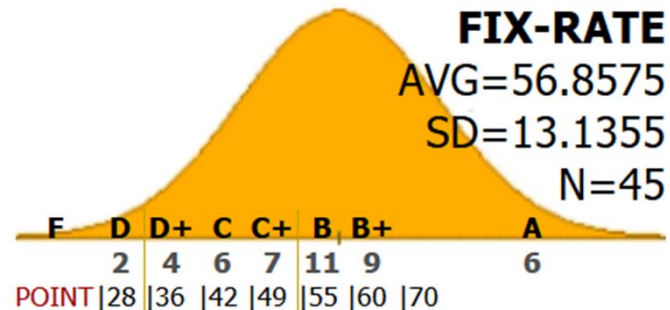
2018: CLASS GPA: 2.80
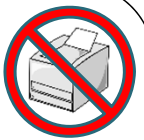
In-Class Exercises

- 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 Discussion

- 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.
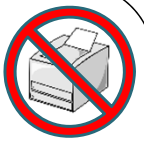
Self-Evaluation Form

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

ECS332: Self Evaluation 2019 (1)

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.
3. A link is provided after submission so that you can come back and edit your own response later.
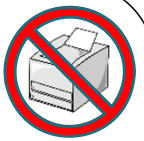
Name

Student ID

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

Note that the lowest scores among your own in-class exercise wil be dropped. However, if you have valid reason for missing class on the day that we have in-class exercise(s), please indicate the date, exercise number, and the reason here. (No credit for incomplete information.) Make sure that you also submit/email supporting document/evidence to Dr.Prapun (if you haven't done so).

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? Provide short description for each of the issues.

How many times have you discussed with the instructor outside of class? (Ask questions, express concerns, etc.) Be specific. Number alone does not count.

Self-Evaluation Form:

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.

Example:

Three times.

On Aug 14, I played the Monty Hall game in class.

I choose to "switch" but did not get the car.

On Aug 21, I remind Dr.Prapun that the class time was already over.

On Sep 13, Dr.Prapun worked on an example about intersection of sets. I raised my hand and answered "{3,4}" which was the correct answer.
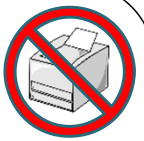
How many times have you correctly informed the instructors the typo or mistake on the whiteboard/slides/hw/etc? Provide short description for each of the issues.

Example:

Twice.

On Aug 16, I sent an email to Dr.Prapun about a typo in the lecture note. On page 15, the note said $1+1 = 3$. It should be $1+1=2$.

On Sep 14, In class, while we were working on page 24 of the lecture note, Dr.Prapun mistakenly wrote $5×5=30$. It should be $5×6=30$. I corrected him in class.

Self-Evaluation Form (Con't)

- If you have legitimate reason for missing class on the day that we have exercise, please indicate the date, exercise number, and the reason in the self-evaluation form.

- Make sure that you also submit/email supporting document/evidence to Dr.Prapun.

Note that the lowest scores among your own in-class exercise wil be dropped. However, if you have valid reason for missing class on the day that we have in-class exercise(s), please indicate the date, exercise number, and the reason here. (No credit for incomplete information.) Make sure that you also submit/email supporting document/evidence to Dr.Prapun (if you haven't done so).

Example:

On Oct 18, we had Exercise 5 but I have to miss the class because I broke my leg and was hospitalized for two days. I have scanned the doctor's certificate and email it to Aj.Prapun on Oct 30.
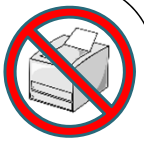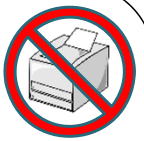
Policy
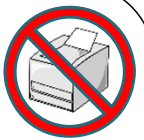
- We will start the class on time and will finish on time.
  - I recommend arriving at least 3 minutes before the start time.
  - Raise your hand and tell me immediately if I go over the time limit.
    - Does NOT mean that I will leave the room immediately after lecture.
    - I will stay and answer 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.

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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.

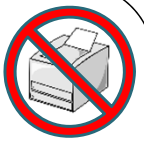- Please stop me if you have any question.
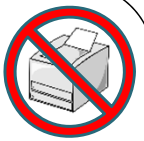
Warning

- This class can be **difficult**.
  - Keep up with the lectures.
  - Make sure that you understand the concepts presented in the lecture <u>before</u> 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.