

# Principles of Communications

## ECS 332

**Dr. Prapun Suksompong**

[prapun@siit.tu.ac.th](mailto:prapun@siit.tu.ac.th)

**Introduction**



**Office Hours:**

**BKD 3601-7**

**Monday 14:40-16:00**

**Friday 14:00-16:00**

# Course Organization

- **Course Website:**

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

- **Lectures:**

- **Wednesday 09:00-10:20 BKD 3206**

- **Friday 10:40-12:00 BKD 3206**

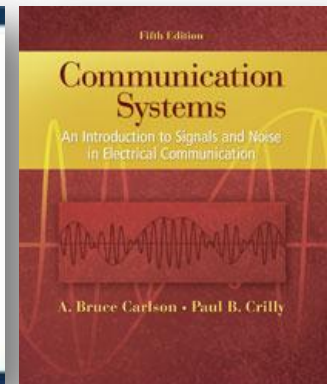
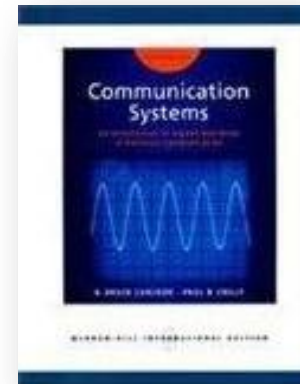
- **Textbook:** Communication Systems: An Introduction to Signals and Noise in Electrical Communication

- By A. Bruce Carlson and Paul B. Crilly

- 5th International edition

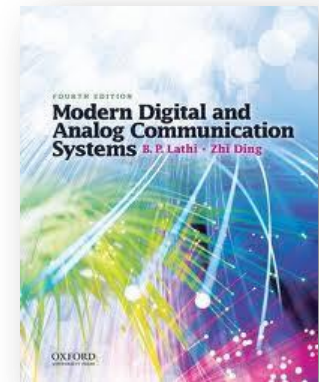
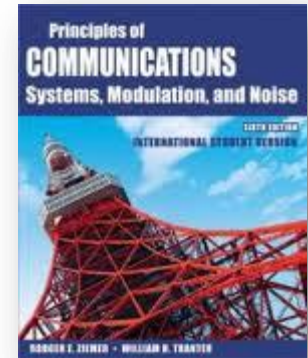
- Call No. TK5102.5 C3 2010

- ISBN: 978-007-126332-0



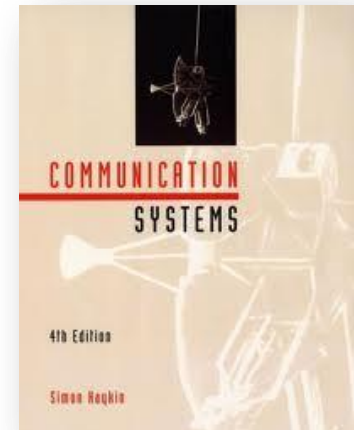
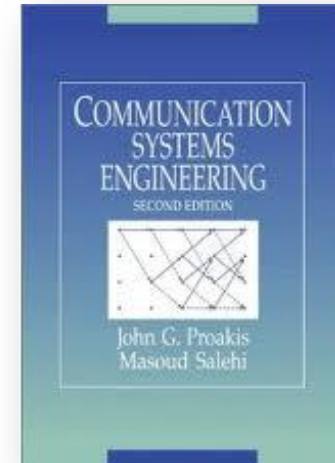
# More references

- 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**
  - 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.



# Course Web Site

- Please check the course web site regularly.
- Announcement
- References
- Handouts/Slides
- Calendar
  - Exams
  - HW due dates

[www2.siiit.tu.ac.th/prapun/ecs332/](http://www2.siiit.tu.ac.th/prapun/ecs332/)

## 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

- This site can be accessed via [prapun.com/ecs332](http://prapun.com/ecs332)
- A basic [RSS feed](#) is created to track and inform updates
- Welcome to ECS332! Feel free to look around this site.

### General Information

- **Instructor:** Dr. Prapun Suksompong ([prapun@siit.tu.ac.th](mailto:prapun@siit.tu.ac.th))
  - Office: BKD3601-7
  - Office Hour: Monday 14:40-16:00, Friday 14:00-16:00
- **Course Syllabus** [Posted @ 11PM on June 25]
- **Class information**
- **Textbook** [C&C] A. Bruce Carlson and Paul B. Crilly, *Communication Systems: An Introduction to Signals and Noise in Electrical Communication*, McGraw-Hill, 2010, 3th International edition.
  - Call No. TK5102.5 C3 2010. ISBN: 978-007-126332-0.
  - [Companion Site](#)

### References

- [Z&T] Rodger E. Ziemer and William H. Tranter, *Principles of Communications*, 6th International student edition, John Wiley & Sons Ltd, 2010.
  - Call No. QA273 Y384 2005. ISBN: 978-0-471-27214-4
  - [Student Companion Site](#)
- [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
- 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.
- [D&S] C. R. J. Jr, W. A. Sethares, and A. G. Klein, *Software Receiver Design: Build Your Own Digital Communication System in Five Easy Steps*, 1st ed. Cambridge University Press, 2011.
  - [D&S] C.R. Johnson and W.A. Sethares, *Telecommunications Breakdown: Concepts of Communication Transmitted via Software-Defined Radio*, Prentice Hall, 2003.
- [C&T] Thomas M. Cover, Joy A. Thomas, *Elements of Information Theory*, Second Edition, Wiley-Interscience, 2006
- *MATLAB Primer*, 8th edition T. A. Davis. CRC Press, 2010.

### Handouts and Course Material

- Part I: Section 1 (Intro. to Commu. Systems) and Section 2 (Frequency-Domain Analysis)
  - [Audio](#): Fourier's Song

### Problem Set

- HW 1 (Due.)
- 

### Calendar

สัปดาห์	อ.	จ.	พ.	พฤ.	ศ.	ส. 1	ส. 2	ส. 3
28	29	30	31	1 ส.ค.	2	3		
4	5	6	7	8	9	10		
11	12	13	14	15	16	17		
18	19	20	21	22	23	24		
25	26	27	28	29	30	1 ส.ค.		
	09:00 u. ECS33: Celebration Day		10:40 u. ECS33					

### Reading Assignment

- 

### Misc. Links

- **Paper:** B.L. Burrows and D.J. Colwell, *The Fourier transform of the unit step function*, International Journal of Mathematical Education in Science and Technology, Vol. 21, Iss. 4, 2006

# RSS Feed



<http://page2rss.com/page?url=www2.siit.tu.ac.th/prapun/ecs332/index.html>

**26 Jun ' 04:33**

- This site can be accessed via [prapun.com/ecs332](http://prapun.com/ecs332)
  - Part I: [Section 1 \(Intro. to Commu. Systems\)](#) and [Section 2 \(Frequency-Domain Analysis\)](#)
- 1.

[Permalink](#) | [View Entire Page](#)

**25 Jun ' 11:47**

- [Posted @ 11PM on June 25]

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**20 Jun ' 03:20**

- This site can be access via [prapun.com/ecs332](http://prapun.com/ecs332)
- is created to track and inform updates
- Welcome to ECS332! Feel free to look around this site.
- : [C&C] A. Bruce Carlson and Paul B. Crilly, [Communication Systems: An Introduction to Signals and Noise in Electrical Commu](#)
  - Call No. TK5102.5 C3 2010. ISBN: 978-007-126332-0.
  - [Companion Site](#)
  - [Z&T] Rodger E. Ziemer and William H. Tranter,
  - [L&D] B.P. Lathi and Zhi Ding,
  - [J&S] C. R. J. Jr, W. A. Sethares, and A. G. Klein, [Software Receiver Design](#): Build Your Own Digital Communication Syst
- 
- 
- 1. HW 1 (Due: )
- 2.
  - Article[IEEE 802.11ac—Wi-Fi for the Mobile and Video Generation](#)
  - Article.
  - ArticleJim Giles, [Traffic jam: the coming cellphone crunch](#), New Scientist, November, 2010

[Permalink](#) | [View Entire Page](#)

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**page<sup>2</sup>rss**

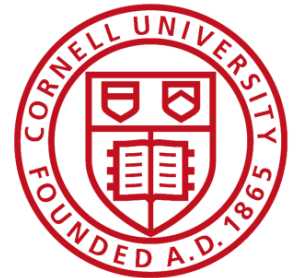
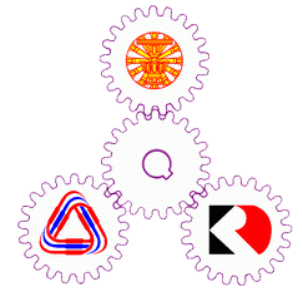
# Course Website: Notes & Slides

- **PDF Notes** will be posted *before* the corresponding lectures.
  - Hard copies can also be purchased from the **copy center**.
- In lectures...
  - PDF Notes will be highlighted and updated with examples / comments.
  - Some lectures may use slides.
- The slides and updated notes will be **posted after** the corresponding lectures.
- I also frequently use Microsoft **OneNote** on my tablet instead of the whiteboard. The files will be exported as pdf and posted *after* the corresponding lectures.
- **Remind** me the day after the lecture if the notes/slides from the day before are still not posted on the web.

# Me?

- Ph.D. from **Cornell** University, USA
- In Electrical and Computer Engineering
- Minor: Mathematics (Probability Theory)
- Ph.D. Research: Neuro-Information Theory
  - Modeling and analyzing neurons in human brain from communication engineering perspective.
- Current Research: Wireless Communication
  - Mobile Communications, WiFi (802.11)
- 2009 SIIT Best Teaching Award
- 2011 SIIT Research Award

[prapun.com](http://prapun.com)





# ECS 332: Course Outline

1. Introduction and Review of Fourier Transform
2. Modulation and DSB-SC
3. QAM and AM
4. Angle modulation
5. Sampling Theorem
6. **MIDTERM: 16 Aug 2012 TIME 13:30 - 16:30**
7. Analog Pulse Modulation
8. DTFT, DFT, FFT
9. Pulse Shaping, Digitization
10. Review of theory of probability and random processes
11. Source Coding and Entropy
12. Introduction to digital data transmission: binary symmetric channel, detectors, channel coding
13. Advanced topic: Multi-carrier and OFDM systems
14. **FINAL: 15 Oct 2012 TIME 09:00 - 12:00**

# Grading System

- Coursework will be weighted as follows:

Assignments	5%
Class Participation and Quizzes	15%
Midterm Examination •16 Aug 2012 TIME 13:30 - 16:30	40%
Final Examination (comprehensive) •15 Oct 2012 TIME 09:00 - 12:00	40%

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

# Calendar (Google)

Available on the course web site.

The screenshot shows a Google Calendar interface for July 2012. The calendar is displayed in a weekly grid view. 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 of the grid. The events are as follows:

Day	Event
July 26 (Tue)	9am ECS332
July 27 (Wed)	9am ECS332
July 28 (Thu)	Celebration of
July 29 (Fri)	10:40am ECS33
July 30 (Sat)	
July 31 (Sun)	
Aug 1 (Mon)	9am ECS332
Aug 2 (Tue)	Asarnha Buch
Aug 3 (Wed)	Buddhist Lent

The calendar also features navigation buttons for 'Today', 'Previous', and 'Next', and view options for 'Week', 'Month', and 'Agenda'. The Google Calendar logo is visible in the bottom right corner.

# Calendar

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

Buddhist Lent Day

Exam

Lecture

# 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**.
- **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.
- Don't be shy!

# Class Participation (2)

- Record what you have done.
- Submitted before the midterm and before the final.

Name \_\_\_\_\_ ID \_\_\_\_\_

ECS 332: Self-Evaluation (1)

## Instructions

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. If you feel that you can't answer the questions on the last page honestly because you name can be identified, you may submit page 3 separately and you are not required to write your name on that page.

## Questions

1. How many times have you been absent from the class? Are there any specific reason(s)? Please explain.
2. How many times have you been late (> 3 mins) for the class? Are there any specific reason(s)? Please explain.
3. How many times have you left the class early (> 3 mins)? Are there any specific reason(s)? Please explain.
4. 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. (You may answer this question on an extra sheet of paper.)

17/06/2010 : I asked question for the example of current source [Op-amp].

24/06/2010 : I answered for the Example 2.2.7. that's  $1 \parallel 2 \Omega$  and series with  $5 \Omega$ .  
But it's wrong. The correct answer is "There's no series in that circuit".

01/07/2010 : I asked question "Is participate include with ask question after class".  
Answer: Yes


08/07/2010 : I asked about Linear equation "Why  $f(x) = 3x+1$  is not a linear equation eventually it is  $y = mx+c$ "  
Answer: Because it's not satisfy  $s(x)+k(x)$  and  $s(x_1+x_2) = s(x_1)+s(x_2)$

15/07/2010 : I asked teacher to give an example of supermesh.  
Answer: "We can use only supernode to solve the problems in this class.  
You can find more in the textbook for supermesh".

29/07/2010 : I told teacher that we don't have class in static today so we can move this class instead.  
I asked: "Is the integrator and differentiator op-amp circuit is the same as in the calculator function" "No for the op-amp it's analog and for calculator is digital".

19/08/2010 : I answered  $\frac{d}{dt} \sin \theta = \cos \theta$  ,  $\frac{d}{dt} \cos \theta = -\sin \theta$   
I corrected  $\frac{d}{dt}$  the unit of voltage from A  $\rightarrow$  V.

# Policy

- We will start the class **on time** and will finish **on 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. 
- We may have some **pop quizzes** (without prior warning or announcement) and in-class activities.
- Attendance and pop quizzes will be taken/given irregularly and randomly.
- Cheating will not be tolerated.

# Policy (con't)

- Feel free to stop me when I talk too fast or too slow.
- I will surely make some **mistakes** in lectures / HWs / exams.
  - Some amount of class participation scores will be reserved to reward the **first** student who inform me about each of these mistakes.
    - Grammatical errors are best informed/corrected after class.
- Points on quizzes/ exercises/ exams are generally based on your entire solution, not your final answer.
  - You can 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.



# 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 (BKD-3601)
  - Time: Monday 14:40-16:00, Friday 14:00-16:00
  - Appointment can be made.
  - Tutorial session can be arranged.
  - Feel free to come to my office and chat!
  - Don't be shy.

# Warning

- This class can be **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 problems/ activities
  - Quizzes
  - Exams



# Remarks

- Get as much legitimate help as you can
- No need to take detailed lecture notes (if you don't want to).
  - Put all of your energy into understanding the material.
  - Of course, there is always someone (in the class) who will take good notes anyway and you can (potentially) borrow or make a copy of the notes from them.
- **Participate actively in class** and outside of class
  - Record what you have done.
- My notation can be different from the textbook.
  - Every notation has some advantages and disadvantages.