

# ECEN 720: High-Speed Links Circuits & Systems

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Spring 2023

Lecture: TR 9:35AM-10:50AM, ZACH 361

Distance Learning: Lecture video will be posted online TR at ~5:00PM

Lab (All Sections): M 12:40PM-3:30PM

Course Website (without videos): <https://people.engr.tamu.edu/spalermo/ecen720.html>

**Instructor:** Sam Palermo

**Office:** 315-E WEB

**Office Hours:** M 8:30AM-10:00AM & R 4:00PM-5:30PM, In-person and via Zoom

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**Prerequisite:** ECEN 474/704 or Approval of Instructor

**Textbook:** Class Notes and Technical Papers

## References:

1. *Digital Systems Engineering*, W. Dally and J. Poulton, Cambridge University Press, 1998.
2. *Advanced Signal Integrity for High-Speed Digital Designs*, S. H. Hall and H. L. Heck, John Wiley & Sons, 2009.
3. *Design of Integrated Circuits for Optical Communications*, B. Razavi, McGraw-Hill, 2003.
4. *High-Speed Digital Design: A Handbook of Black Magic*, H. Johnson and M. Graham, Prentice Hall, 1993.

## Class Notes:

- Posted on the web and will hand out hard copies in class

**Objectives:** At the end of this course, students be able to

1. Understand high-speed electrical and optical channel properties, modeling, measurements, and communications techniques
2. Understand the design specifications and implementation details of high-speed serial link circuits such as drivers, receivers, equalizers, and synchronization systems.
3. Understand link system design utilizing statistical bit-error-rate analysis and modeling tools.
4. Understand the challenges and some of the link architectures proposed to realize electrical and optical serial link standards.

## Grading:

- **Exams** **50%**
  - Two Midterm Exams (25% each)
- **Lab/Homework** **25%**
  - Labs (Prelab + Report) and homework assignments are weighted equally
  - You are encouraged to work together with your colleagues on the homework and labs. However, each student must turn in an independent write-up.
  - No late assignments will be graded
- **Final Project** **25%**

## Grading Policy:

Letter Grade	x = Your Average
A	$x \geq 90.00$
B	$89.99 \geq x \geq 80.00$
C	$79.99 \geq x \geq 70.00$
D	$69.99 \geq x \geq 60.00$
F	$59.99 \geq x$

## Outline & Preliminary Schedule

Topic	Week
I. Channels	Week 1-7
II. Communication Techniques	
III. Equalizers	
IV. Transmitter/Receiver Circuits	
<b>First Exam</b>	<b>March 7</b>
V. Equalizer Circuits	Week 8-14
VI. Clocking Circuits	
VII. Clocking Systems	
VIII. Link Modeling	
IX. Link Examples	
<b>Second Exam</b>	<b>April 25</b>
<b>Project Report Due</b>	<b>May 2</b>
<b>Project Presentations</b>	<b>May 4 (12:30PM – 2:30PM)</b>

\*Exam dates are approximate and subject to change with reasonable notice.

### Academic Integrity Statement and Policy

“An Aggie does not lie, cheat or steal, or tolerate those who do.”

“Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one’s work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case” ([Section 20.1.2.3, Student Rule 20](#)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at [aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

### Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845-1637 or visit [disability.tamu.edu](http://disability.tamu.edu). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

### Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and

must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, you will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University’s goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with [Counseling and Psychological Services](#) (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University’s [Title IX webpage](#).

### **Statement on Mental Health and Wellness**

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student’s academic success and overall wellbeing. Students are encouraged to engage in proper self-care by utilizing the resources and services available from Counseling & Psychological Services (CAPS). Students who need someone to talk to can call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the National Suicide Prevention Hotline (800-273-8255) or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

## **Build the Hell Outta High-Speed Links!**

