COURSE OUTLINE

Instructor: Vishal Saxena
Email: vsaxena AT uidaho DOT edu
Time: Tue and Thu, 9:30-10:45 AM
Course dates: Jan 12, 2017 – May 4, 2017
Location: JEB 26 (Please note the change of place)
Office Hours: Tue & Thu 11:15 AM-12:15 PM (or by appointment), BEL 318
Holidays: Spring Break
Final Exam time: Friday, May 12, 7:30-9:30 AM
Course Site: http://lumerink.com/courses/ece517/s17/ECE517.htm
Piazza Site: https://piazza.com/uidaho/spring2017/ece517/home
COURSE TOPICS

• Data Conversion and spectral estimation fundamentals
• Review of Switched Capacitor Circuits, Sample-and-hold, Comparators
• Nyquist rate ADCs: Flash, SAR, Pipelined, Time-interleaved ADCs.
• High-speed Link design issues: Driver Circuits, Equalizers, PAM signaling, ADCs for high-speed links.

• **Note:** *This is an advanced elective course. It is important that the students have a good understanding of Analog and Digital Circuit fundamentals.*
PREREQUISITES

Analog IC Design Basics (ECE 410: Advanced Electronics)

- MOS amplifier design, including operation amplifiers, biasing, and stability analysis; advanced use of HSPICE
- Knowledge of material in ECE 4/515 is recommended

Undergrad-level Signals and Systems

- Fourier, DTFT, Laplace, z-transforms, poles and zeros. Matlab scripting.

Transistor-level circuit details are covered in ECE 4/515 Analog IC Course

Can review material online on the course sites:

- CMOS Analog IC Design: http://lumerink.com/courses/ece5411/s11/Lectures.htm
Lecture notes and handouts will be used. Following references are useful to supplement the course material:

- CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters by Rudy J. van de Plassche, Springer.
COURSE PEDAGOGY AND GRADING

Combination of lecture notes, slides and simulation

- Lecture notes will be posted online (may have 1 or 2 days delay)
- Additional slides, Matlab code, Homeworks, etc. will also be posted.

Workload (Grading)

- 25% Homeworks
- 25% Midterm Exam
- 25% Project 1
- 25% Project 2 or Final Exam
COURSE POLICIES

Policies

- No late work (rare exceptions allowed). Penalty details on course site.
  - Submission will not be accepted if the solutions are distributed by any means.
  - No net surfing in class. Avoid distracting other students.
- Neither the final exam nor final project will be returned at the end of the semester.
- Academic Honesty
  - No plagiarism is allowes
  - Do you own work: can discuss but not replicate work of others
  - See Article II of the University if Idaho’s Student Code of Conduct [http://www.webs.uidaho.edu/fsh/2300.html]
Real world: Continuous-time, continuous-amplitude signals.

Digital world: Discrete-time, discrete-amplitude signal representation.

Interface circuits: ADC and DACs.

- Varying speed and precision requirements.
DATA CONVERSION SCENARIOS

Any application using a sensor and/or an actuator

- Wireless: RF Rx and Tx chain
- Twisted pair: ADSL modem
- Coaxial: Cable modem
- Serial/Optical links: 10G+ ADC for modulation and equalization
- Audio Recording: 24-bit stereo ADCs
- Audio players: stored data to speaker (audio DAC)
- HDD read channel: Magnetic disk to microprocessor
- Biomedical applications (e.g. sensing blood glucose level and actuating the insulin pump),

Speed and resolution requirements vary with the application.
DATA CONVERTERS

ANALOG-TO-DIGITAL CONVERTER (ADC)

$x(t)$ → ADC → $v[n]$

Sampler → $y[n]$ → Quantizer → $v[n]$

S/H or T/H

Continuous-time
Continuous amplitude

Discrete-time
Continuous amplitude

Discrete-time
Discrete amplitude
SAMPLING PROCESS

• Refer to lecture notes.