



CAMOSUN COLLEGE - ELECTRONICS DEPARTMENT

ELEN 186 – DIGITAL SIGNAL PROCESSING

Course Outline – Summer 2019

IN-CLASS WORKLOAD: (weekly)	6 hours of lecture, 4 hours of lab activities (2x 2hrs)
WEEKLY SCHEDULE:	Lecture: Mon (13:30 – 14:20), Wed (08:30 – 09:20) Wed(14:30 – 16:20), Fri (08:30 – 10:20) Labs: Mon (14:30 – 16:20), Thurs (12:30 -14:20)
LOCATION:	Lecture: TEC 174 Lab: TEC 229
INSTRUCTOR:	Dr. Sahitya Kandur
CONTACT INFO:	TEC 264, KandurS@camosun.bc.ca
TEXT: (online resources on D2L also)	“Fundamentals of DSP” by Van de Vegte

Important Dates: Monday, May 20th, Monday, July 1st, Monday, August 5th → College Closed, No Classes

- Test 1 Friday May 24th (week 3) → Topics: Sec #1 - #3
- Test 2 Friday June 14th (week 7) → Topics: Sec #4 - #7
- Test 3 Friday July 19th (week 11) → Topics: Sec #8 - #9
- Final Exam Week of August → Topics: All / Cumulative

Labs:

Lab 1	DSP applications
Lab 2	Spectra of common signals
Lab 3	Antialiasing filter
Lab 4	Sampling & quantization
Lab 5-6	Sample & hold (2 lab periods)
Lab 7	Introduction to MATLAB
Lab 8	More signals and spectra in MATLAB
Lab 9	Convolution
Lab 10	Correlation and finding a known signal in noise
Lab 11	Non-recursive difference equations and moving average filters
Lab 12	Recursive difference equations
Lab 13	Poles, zeros and stability
Lab 14	bode plots
Lab 15-16	Filter specifications and performance
Lab 17	Windowing & FIR filter design in MATLAB
Lab 18	IIR Filter design
Lab 19	Introduction to audio weaver
Lab 20-21	Audio effects (2 lab periods)
Lab 22	FIR filtering in audio weaver
Lab 23	Voice scrambling

Course Topics:

1. Overview Applications of DSP Signals Spectra A/D and D/A conversion Filters Linear time invariant systems	4 h	(week #1)
2. A/D and D/A Conversion* Simple DSP system Sampling Quantization A/D conversion D/A conversion	8 h	(week #1 - #2)
3. Digital Signals Notation and representation 1D digital signals (impulse, step, exponential, sinusoidal) 2D digital signals (images, sonar)	4 h	(week #3)
4. Difference Equations Digital filtering Difference equation structure Non-recursive difference equations Moving average filters Recursive difference equations Difference equation diagrams Impulse response (FIR and IIR) Step response & General outputs	6 h	(week #4)
5. Convolution Filtering by convolution Moving average filters by convolution Filtering digital images	4 h	(week #5)
6. Correlation and Autocorrelation Correlation definition and uses Autocorrelation definition and uses Signal detection in noise	4 h	(week #5 - #6)
7. z Transforms Table of z transforms Transfer functions Poles, zeros and stability Inverse z transforms Computing filter outputs	8 h	(week #6 -#7)
8. Filters Filter behaviour Filter types Bode plots	2 h	(week #8)

9. Frequency Response and Signal Spectrum	10 h	(week #9 - #10)
Fourier transforms Frequency response Filter shape from poles and zeros Spectra of digital signals		
10. Finite Impulse Response Filters	12 h	(week #11-#12)
FIR filter specification and characteristics Phase distortion Ideal low pass filter Windowing Designing low pass FIR filters Band pass, high pass and band stop FIR filters Practical considerations		
11. Discrete Fourier Transform (DFT) and Fast Fourier Transform	7 h	(week #13)
Computing the DFT DFT resolution Interpreting the DFT Spectrograms Relationship between FFT and DFT		
12. DSP Hardware	3 h	(week #14)
DSP architectures Features of DSP chips Special DSP hardware and software Fixed point vs floating Point DSPs C vs assembly		
13. Signal and Image Processing Applications	4 h	(week #14)
DND Applications (CANTASS Sonar, STIR Fire Control, LINK-11) Digital audio, Speech recognition, Image processing		

* Some of the concepts relating to A/D & D/A will be further investigated in the Controls course.

<u>Evaluation:</u>	Quizzes 7	→	15%
	Tests 3	→	30%
	Labs 22	→	20%
	Final Exam	→	35%

Students must obtain a minimum of 60% in the course (both lecture and labs) a minimum of 50% on the final exam. All lab reports must be submitted before final exam to release your grade

Letter Grading:

Letter grades will be awarded in accordance with College policy.