CAMOSUN COLLEGE - ELECTRONICS DEPARTMENT

ELEN 186 – DIGITAL SIGNAL PROCESSING

Course Outline – Summer 2020

IN-CLASS WORKLOAD: (weekly)	6 hours of lecture, 4 hours of lab activities (2x 2hrs)	
WEEKLY SCHEDULE:	Lecture:	Mon (11:30 – 12:20), Tue (12:00 – 13:50) Wed(13:30 – 14:20), Fri (10:30 – 12:20)
	Labs:	Mon (14:30 – 16:20), Tue (14:00 -15:50)
LOCATION:	Lecture:	online D2L-Blackboard virtual class
	Lab:	online- MultiSim and MATLAB
INSTRUCTOR:	Dr. Sahitya Yadav 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 18th, Monday, July 1st , Monday, August 3rd → College Closed, No Classes

- Test 1 — Friday May 22nd (week 3) → Topics: Sec #1 - #3
- Test 2 — Friday June 19th (week 7) → Topics: Sec #4 - #7
- Test 3 — Friday July 17th (week 11) → Topics: Sec #8 - #9
- Final Exam — Week of August → Topics: All / Cumulative

Labs: (Might change due to online teaching)

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

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

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

Evaluation:	Quizzes 7	→	15%
	Tests 3	→	30%
	Labs 23	→	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.