



Course Specification

— (Bachelor)

Course Title: Digital Signal Processing
Course Code: CEN 1401
Program: Bachelor in Computer Engineering
Department: Computer Engineering
College: Faculty of Computers and Information Technology
Institution: University of Tabuk
Version: 1.0
Last Revision Date: 27 July 2022



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A. General information about the course:

1. Course Identification

1. Credit hours: (4)

2. Course type

A. University College Department Track Others
B. Required Elective

3. Level/year at which this course is offered: (7 / 4)

4. Course general Description:

This course covers the following topics, History and overview; sampling theorem, aliasing; sampled signals, periodic signals, non-periodic signals; impulse response and convolution; digital spectra analysis; discrete Fourier transform, fast Fourier transform; z-transform; digital filters, FIR and IIR filter design; windowing; effect of finite word length in digital signal processors; Application in audio and image processing.

5. Pre-requirements for this course (if any):

CEN 1303

6. Co-requisites for this course (if any):

N/A

7. Course Main Objective(s):

1. Understand the Sampling Theorem and how this relates to Aliasing and Folding.
2. Identify if a system is a Linear Time-Invariant (LTI) System.
3. Understand Z transforms and discrete time Fourier transforms to analyze a digital system.
4. Define and use Discrete Fourier Transforms (DFTs).
5. Describe simple finite impulse response filters.
6. Explain signal flow-graphs and digital filter structures.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning	-	-
3	Hybrid <ul style="list-style-type: none"> ● Traditional classroom ● E-learning 	-	-
4	Distance learning	-	-



3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	30
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Outline the history and overview of sampling theorem, sampled signals, periodic signals and non-periodic signals	K1	<ul style="list-style-type: none"> • Lectures • Class Discussions • Lab Sessions 	<ul style="list-style-type: none"> • Exams • Quizzes • HomeWork • Labwork
1.2	Describe Fourier transform and z-transform	K3		
1.3	Define digital filters, FIR and IIR filter design	K1, K4		
1.4	Demonstrate the effect of finite word length in digital signal processors	K5		
2.0	Skills			
2.1	Explain sampling and reconstruction of signals	S2	<ul style="list-style-type: none"> • Lectures • Class Discussions • Lab Sessions 	<ul style="list-style-type: none"> • Exams • Quizzes • HomeWork • Labwork
2.2	Develop signal flow-graphs and digital filter structures	S2, S3		
2.3	Evaluate Effects of quantization and finite word length arithmetic in digital filters	S3		
3.0	Values, autonomy, and responsibility			
3.1				
3.2				
...				



C. Course Content

No	List of Topics	Contact Hours
1.	<ul style="list-style-type: none"> Overview of digital signal processing concepts Lab: Introduction to digital signal processing Lab 	5
2.	<ul style="list-style-type: none"> Sampling of signals Lab: Sampling signals Implementation using MATALAB software 	5
3.	<ul style="list-style-type: none"> Reconstruction of signals Lab: Implementing Reconstruction of signals using MATALAB software 	5
4.	<ul style="list-style-type: none"> Convolution between two signals. Lab: Implementing convolution between two signals using MATALAB software 	5
5.	<ul style="list-style-type: none"> Discrete and Fast Fourier Transforms (DFT and FFT) Lab: Discrete and Fast Fourier Transforms implementation using MATLAB software 	5
6.	<ul style="list-style-type: none"> Z-transform: definition; inverse (part 1) Lab: Implementation of Z-transform using MATLAB software (part 1) 	5
7.	<ul style="list-style-type: none"> Z-transform: useful transform relationships; Parseval's theorem; difference equations (part 2) Lab: Implementation of Z-transform using MATLAB software (part 2) 	5
8.	<ul style="list-style-type: none"> Discrete Transfer function Lab: Analysis of Discrete Transfer function using MATLAB software 	5
9.	<ul style="list-style-type: none"> Signal flow-graphs and digital filter structures (part 1) Lab: Implementing the above topic 	5
10.	<ul style="list-style-type: none"> Signal flow-graphs and digital filter structures (part 2) Lab: Implementing the above topic 	5
11.	<ul style="list-style-type: none"> FIR filter design Lab: FIR low pass filter implementation 	5
12.	<ul style="list-style-type: none"> IR filter design (part 1) Lab: Design and verify Filter IIR frequency response by using Filter design and Analysis Tool. (part 1) 	5
13.	<ul style="list-style-type: none"> IR filter design and implementation (part 2) Lab: Design and verify Filter IIR frequency response by using Filter design and Analysis Tool. (part 2) 	5
14.	<ul style="list-style-type: none"> Adaptive filtering Lab: Implementing of adaptive filtering using MATLAB software 	5
15.	<ul style="list-style-type: none"> Effects of quantization and finite word length arithmetic in digital filters Lab: Implementing quantization and finite word length arithmetic in digital filters using MATLAB software 	5
Total		75



D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes- HomeWork, Labwork	2-15	20%
2.	Mid-Exam 1	6 or 7	20%
3.	Mid- Exam 2	11 or 12	20%
4	Final Exam	16	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	<ul style="list-style-type: none"> Li Tan, Digital Signal Processing Fundamentals and Applications, 2008, Elsevier. John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing. Principles, algorithms, and applications, 4th Ed., 2007, Prentice Hall.
Supportive References	Oppenheim A. and Willsky A. with S. Nawab, Signals and Systems, 2nd Ed., 1997, Prentice Hall.
Electronic Materials	<ul style="list-style-type: none"> Faculty members websites www.free-ebooks.net Blackboard Platform
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom, laboratory
Technology equipment (projector, smart board, software)	projector
Other equipment (depending on the nature of the specialty)	MATLAB software

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Teaching	Faculty, Program Leaders, and Advisory Board	Both Direct and Indirect
	Students	Indirect





Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Students Assessment	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Both Direct and Indirect
Quality of Learning Resources	Faculty, Students, and Advisory Board	Indirect
The Extent to which CLOs have been Achieved	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Direct (as in section B) and Indirect/Surveys
	Students	Indirect
Other	-	-

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

