EE6802: ADVANCES IN DIGITAL SIGNAL PROCESSING

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Advances in Digital Signal Processing

Subject Code
EE - Electrical Engineering
Course Number
6802

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
EE5410 Signal Processing; or EE4015 Digital Signal Processing; or equivalent

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

The course aims to provide students with theoretical and practical knowledge in selected topics of Advanced Digital Signal Processing oriented toward contemporary research and practice in signal processing and related technologies and with a particular emphasis on multi-rate signal processing techniques and systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the essence of Digital Signal Processing. Gain advanced skills in continuous-time and discrete-time sampling. Apply DFT techniques for fast computation.		x	x	x
2	Describe the concepts apply mathematical formulations and framework of Digital Signal Processing and their essential building blocks.		x	x	x
3	Develop skills in multirate filterbank processing systems. Express and apply techniques in Digital Signal Processing.		x	x	x
4	Apply and integrate knowledge in practice.		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Fundamental concepts, essential techniques, and key algorithms are presented.	1, 2, 3, 4	2 hrs/wk
2	Tutorial	Key concepts and techniques are strengthened by working on closely related problems.	1, 2, 3	1hr/wk (Some of the tutorials will be conducted in the laboratory)
3	Assignments	Develop skills by problem solving.	1, 2, 3	

4	Mini project	Mini-projects are designed for students to gain practical experience in real world design problems and to be aware of the latest developments.	3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test (min: 1)	1, 2, 3, 4	25	
2	Homework assignments	1, 2, 3, 4	15	
3	Mini project (1)	1, 2, 3, 4	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remark: To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

Assessment Rubrics (AR)

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal level

Assessment Task

Coursework (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B) Medium

Marginal
(B-, C+, C) Low

Failure
(F) Not even reaching marginal level

Assessment Task
Coursework (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B) Medium

Marginal
(B-, C+, C) Low

Failure

(F) Not even reaching marginal level

Additional Information for AR

Constructive Alignment with Programme Outcomes

PILO 1, 2, 3 The course provides students with adequate opportunities in acquiring knowledge of the Digital Signal Processing technologies, and familiarize with the applications of mathematics and engineering problem solving skills The learning experience will be enhanced and broadened by case studies on latest developments in the field.

PILO 4, 5 Students are required to work on mini-projects to gain practical experience in implementing real world Digital Signal Processing applications.

Part III Other Information

Keyword Syllabus

Essence of Digital Signal Processing

Fourier and z Transform, Sampling and Reconstruction, Discrete Sampling, DFT, FFT.

Fundamentals of Multi-rate System

Decimation, Interpolation, Aliasing Error, Polyphase Components, Equivalent Structures, Signal Analysis and Compression LPTV Systems Analysis.

Advance Multi-rate Signal Processing

2 Bank Filter, Regular Binary Subband Tree Structure, M-bank Structure, Perfect Reconstruction (PR), Higher Order PR System.

Advanced Topics and Applications

Forward and Inverse Wavelet Transform, Wavelet families, Multi-resolution analysis, EZW Coding, Application in Image Processing and Compression Case Studies.

Reading List

Compulsory Readings

	Title
1	P.P. Vaidyanathan: Multirate Systems and Filter Banks (Prentice Hall, 1992).

Additional Readings

	Title
1	A.N. Akansu et. al.: Multiresolution Signal Decomposition (2nd edition, Academic Press, 2001).
2	T.B. Welch: Real-Time Digital Signal Processing from Matlab to C with the TMS320C6x DSK (CRC, 2005).
3	P.Embree: Real-Time Digital Signal Processing from Matlab to C with the TMS320C6x DSK (Prentice Hall PTR; US Ed edition May 27, 1995).