	INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS) **FAKULTAS TEKNOLOGI ELEKTRO DAN INFORMATIKA CERDAS** **DEPARTEMEN TEKNIK ELEKTRO** **Program Studi Magister (S2) Teknik Elektro**

1	**Nama Mata Kuliah / *Course Name***	:	Pemrosesan Sinyal Multidimensi / *Multidimensional Signal Processing*
2	**Course Code**	:	EE235142
3	**Kredit / *Credits***	:	3 SKS
4	**Semester / *Semester***	:	1

Deskripsi Mata Kuliah / *Course Description*

Mata kuliah Pemrosesan Sinyal Multidimensi membahas tentang teori dan algoritma sinyal, sistem dan transformasi diskrit multidimensi dan konsep sistem LTI waktu diskrit, aplikasi sistem multidimensi dalam bidang citra dan video. Secara khusus topik yang dibahas adalah realisasi sinyal dan sistem diskrit multidimensi, analisa Fourier (DFT, FFT) diskrit multidimensi, transformasi diskrit kosinus (DCT), analisa spektral STFT (*Short Time Fourier Transform*), filter *Finite Impulse Response* (FIR) dan *Infinite Impulse Response* (IIR) 1D-2D, transformasi wavelet kontinyu dan diskrit, serta konsep dasar *Compressed sensing*.

The Multidimensional Signal Processing course discusses signal theory and algorithms, multidimensional discrete systems and transforms and the concept of discrete-time LTI systems, applications of multidimensional systems in the fields of image and video. Specifically, the topics discussed are the realization of multidimensional discrete signals and systems, multidimensional discrete Fourier analysis (DFT, FFT), discrete cosine transform (DCT), spectral analysis of STFT (Short Time Fourier Transform), Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) 1D-2D filters, continuous and discrete wavelet transforms, and basic concepts of Compressed sensing.

Capaian Pembelajaran Lulusan (CPL) Yang Dibebankan Mata Kuliah / *Program Learning Outcomes Charged to The Course*

1. (CPL-02) Mampu mengembangkan dan memecahkan permasalahan ipteks dalam bidang keilmuannya melalui riset dengan pendekatan inter atau multidisiplin hingga menghasilkan karya inovatif dan teruji, serta mendapat pengakuan nasional dan internasional.

   (PLO-02) Able to develop and solve science and technology problems in their scientific field through research with an inter or multidisciplinary approach to produce innovative and tested work, and receive national and international recognition.

2. (CPL-04) Mampu menguasai konsep, prinsip keilmuan secara komprehensif, prinsip rekayasa, dan pengetahuan faktual tentang Teknologi Informasi untuk

mengembangkan prosedur dan strategi yang diperlukan pada analisis dan perancangan sistem terkait bidang Teknik Elektro.

(PLO-04) Able to master concepts, scientific principles comprehensively, engineering principles, and factual knowledge about Information Technology to develop procedures and strategies required in the analysis and design of systems related to the field of Electrical Engineering.

3. (CPL-05) Mampu mengimplementasikan penyelesaian permasalahan rekayasa yang memperhatikan faktor-faktor ekonomi, kesehatan dan keselamatan publik, kultural, sosial dan lingkungan.

   (PLO-05) Able to implement engineering problem solving that takes into account economic, public health and safety, cultural, social and environmental factors.

Capaian Pembelajaran Mata Kuliah / *Course Learning Outcomes*

1. Menguasai konsep representasi, klasifikasi, dan operasi sinyal multidimensi diskrit / *Mastering the concept of representation, classification, and operation of discrete multidimensional signals*
2. Menguasai konsep sampling dan rekonstruksi / *Mastering the concept of sampling and reconstruction*
3. Menguasai komputasi transformasi sinyal menggunakan algoritma DFT, FFT dan DCT / *Mastering signal transformation computation using DFT, FFT and DCT algorithms*
4. Menguasai teknik disain filter digital FIR dan IIR (1D & 2D) / *Mastering FIR and IIR digital filter design techniques (1D & 2D)*
5. Menguasai teknik analisa spektral STFT (1D & 2D) / *Mastering STFT spectral analysis techniques (1D & 2D)*
6. Menguasai komputasi transformasi sinyal menggunakan algoritma CWT dan DWT (1D & 2D) / *Mastering signal transformation computation using CWT and DWT algorithms (1D & 2D)*
7. Menguasai konsep *Compressed sensing / Mastering the concept of Compressed sensing*

Pokok Bahasan / *Contents*

1. Konsep sinyal dan sistem mutidimensi diskrit. / *Concept of discrete multidimensional signals and systems*.
2. Sampling dan Rekonstruksi. (1D & 2D) / *Sampling and Reconstruction. (1D & 2D)*
3. DFT, FFT dan DCT. / *DFT, FFT and DCT.*
4. Disain Filter Digital FIR dan IIR (1D & 2D) / *FIR and IIR Digital Filter Design (1D & 2D)*
5. Analisa spektral STFT sinyal 1D & 2D / *STFT spectral analysis of 1D & 2D signals*
6. CWT dan DWT (1D & 2D) / *CWT and DWT (1D & 2D)*
7. Introduksi *Compressed sensing / Introduction to Compressed sensing*

Prasyarat / *Pre-requisite*

-
Pustaka / *Reference*
Utama / *Primary*: 1. John W. Woods, “Multidimensional Signal, Image, and Video Processing and Coding,” 2nd ed., Academic Press, 2012. 2. Saeed V. Vaseghi, Multimedia Signal Processing, Joh Wiley & sons Ltd., England, 2007 3. Viney K Ingle and John G Proakis, Digital Signal Processing using Matlab, 4th Ed., CENGAGE Learning, USA, 2014. 4. Vishal M. Patel and Rama Chellappa Sparse Representations and Compressive Sensing for Imaging and Vision, Springer New York Heidelberg Dordrecht London, 2023.