	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**M.Tech/Ph.D**	Year of Regulation	**2021**
Department	Electronics and Communication Engineering	Semester	**I**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 523	**Advanced Digital Signal Processing**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	roducing of transform methods of signal processing	Course Outcomes	CO1	Able to apply transform methods in various signal processing applications
	roducing of concepts of wavelets		CO2	Able to apply wavelet transform in various signal processing applications
	Introducing of multi-rate signal processing and statistical signal processing techniques		CO3	le to design and implement digital filters for various applications
			CO4	Able to use multi-rate signal processing techniques in various applications
			CO5	Able to use statistical signal processing methods in real time applications

No.	Cos	Mapping with Program Outcomes (POs)												Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	CO1	2	1	0	0	1	0	0	0	0	0	0	0	2	0	1	0
2	CO2	1	2	2	2	0	0	0	0	0	0	0	1	2	0	2	0
3	CO3	0	2	2	1	2	0	0	0	0	0	0	2	2	2	2	0
4	CO4	0	2	0	1	2	0	0	0	0	0	0	2	2	2	2	0

SYLLABUS

No.	Content	Hours	COs
I	Transform Method of Signal Processing: Introduction of DFT, Z transform with Applications. FFT (Radix 2, Radix 3, and Composite Radix) Algorithm. DCT, DST. Haar, Hadamard and Walsh transform. Introduction to two dimensional signal and systems – 2D – DFT Transforms – Properties and applications – Discrete Hilbert Transform and Discrete Cosine Transform – Properties and Applications – Short term Fourier Transform – Gabor Transform – Properties and Applications.	07	CO1
II	Wavelets: Wavelet Analysis – The Continuous Wavelet Transform – scaling – shifting – scale and frequency – The Discrete Wavelet Transform – One Stage filtering – Approximation and Details – Filter bank analysis – Multilevel Decomposition – Number of levels – Wavelet reconstruction – Reconstruction filter- Reconstructing Approximations and details- Multilevel Reconstruction – Wavelet packet synthesis- Typical Applications.	10	CO2
III	Digital Filters: Digital Filter Structure &Implementation: Linearity, time- invariance &causality, the transfer function, stability tests, steady state response, Amplitude &Phase characteristics, stabilization procedure, Ideal LP Filter, Physical reliability &specifications. FIR Filters, Truncation windowing &Delays, design example, IIR Filters: Review of design of analog filters & analog frequency transformation. Digital frequency transformation.	06	CO3
IV	Multirate Digital Signal Processing: Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion. Multistage Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass Signals.	07	CO4
V	Statistical Signal Processing: Method of least squares (LS). Recursive LS. Consistency of estimates. Observer, full and reduced order. Kalman filter. Parameter estimation. Nonparametric Estimation: Correlation and spectral analysis. Cepstrum. Yule-Walker equation. Singular Value Decomposition (SVD). Higher order statistics, triple correlation and bi-spectrum.	06	CO5
Total Hours		36	

Essential Readings

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing", Pearson Education India; 4th Edition, 2007.

2. Alam V. Oppenheim and Ronald W. Schafer, "Digital Signal Processing", Pearson, 1975.

Supplementary Readings

1. Lawrence R Rabiner and Bernard Gold, "Theory & application of digital Signal Processing", Prentice Hall of India, 1st Edition, 2014.