	National Institute of Technology Meghalaya An Institute of National Importance		CURRICULUM
Programme	**Bachelor of Technology in Electrical and Electronics Engineering**	Academic Year of Regulation	**2018-19**
Department	**Electrical Engineering**	Semester	**VII**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EE415	**Digital Filter Design**	**3**	**1**	**0**	**4**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	To learn the foundation of digital filter design techniques		CO1	**Able to acquire knowledge about linear phase filter design, FIR design process and techniques.**
	To develop ability and skill to implement digital filters		CO2	**Able to acquire knowledge about analog filter design, IIR design process and techniques, filter transformation techniques.**
	To understand the issues in implementing digital filters and identify the application areas.		CO3	**Able to understand hardware knowledge in relation to filter design and analyse the issues of finite word length and quantization methods.**
			CO4	**Able learn block diagram representation to integrate in realization methods, and computational analysis.**
			CO5	**Able to employ signal processing strategies at multidisciplinary team activities.**

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
1	CO1	**3**	**3**	**3**	**2**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**2**	**0**	**3**
2	CO2	**3**	**3**	**3**	**2**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**2**	**0**	**3**
3	CO3	**3**	**3**	**2**	**2**	**2**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**2**	**1**	**3**
4	CO4	**3**	**3**	**3**	**2**	**2**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**2**	**3**	**1**
5	CO5	**3**	**3**	**2**	**2**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**2**	**3**	**3**

SYLLABUS

No.	Content	Hours	COs
I	**FIR FILTER DESIGN:** Review of conditions needed for precise linear phase design techniques for linear phase FIR filters: Windowing method, Frequency sampling method, Approximation method.	**08**	**CO1**
II	**IIR FILTER DESIGN:** Analog filter design – Butterworth, Chebyshev, Elliptic; Analog-to-Discrete filter transformation methods – differentials, impulse invariant transformation, bilinear transformation, matched z-transform; Digital filter transform methods.	**08**	**CO2**
III	**EFFECTS OF FINITE WORD LENGTH IN DIGITAL FILTERS:** Binary representation of numbers – Fixed point representation and floating point representation; Quantization process– truncation and rounding; Quantization errors – error due to coefficient quantization, error due to addition quantization, error due to multiplication quantization; Quantization effects on realization process - quantization effects in DFT computation, quantization effects in FFT computation, quantization effects in in FIR filter design, limit cycle oscillations.	**08**	**CO3**
IV	**FILTER REALIZATION:** Realization system transfer function – FIR filter and IIR filter; FIR filter realization structures – Direct-form structure, cascade form structure, linear-phase structure, ploy phase structure, sampling frequency structure, Lattice structure; IIR filter realization structures – Direct Form-1 structure, Direct-Form II structure, cascade form structure, ploy phase structure, Lattice structure.	**07**	**CO4**
V	**MULTIRATE SAMPLING:** Introduction to multirate DSP, decimation and interpolation, polyphase decomposition, uniform DFT filter banks, quadrature mirror filters and perfect reconstruction.	**05**	**CO5**
	Total Hours	**36**	

Essential Readings

1. J. G. Proakis, D. G. Manobakis, "Digital Signal Processing, Principles, Algorithms and Applications", PHI, 3th edition 2007
2. Sanjit K. Mitra, "Digital Signal Processing" 3rd edition, Tata McGraw-Hill Publishing Co. Ltd., 3rd edition, 2013
3. Leland B. Jackson, "Digital Filters and Signal Processing" 3rd edition, 1996, Kluwer Academic, Boston, 1st edition 1996.
4. Andreas Antoniou, "Digital Filters: Analysis, Design, and Applications" Tata McGraw-Hill Publishing Co. Ltd., 1st edition 1993

Supplementary Readings

1. Lawrence R. Rabiner and Bernard Gold, "Theory and Application of Digital Signal Processing" Prentice-Hall of India Pvt. Ltd., 1st edition 1975.
2. Andreas Antoniou, "Digital Signal Processing" Tata McGraw-Hill Publishing Co. Ltd., 2nd edition 2006.