

## National Institute of Technology Meghalaya

An Institute of National Importance

CURRICULUM

Program Departm Course Code	nme															
Course	Programme															
	nent	Elec	ctrical En	ngineering	9							Semes	ster		VI	
Code									Structure Marks Distrib							
		Digital Eilter Design							L	T	P	C	INT	MID	END	Tota
EE415		Digital Filter Design							3	1	0 Able to ac	4 Cavire knov	50 vledge abor	50 ut linear ph	100 ase filter de	200 sign, FI
	To learn the foundation of digital filter design techniques design process and tec								echniques.	ques.						
	To de	To develop ability and skill to implement digital filters CO2 Able to acquire knowledge at design process and technique											bout analog filter design, IIR es, filter transformation techniques			
Course	applic	To understand the issues in implementing digital filters and identify the application areas.Able to understand hardwar design and analyse the issuesCOURSECO3Able to understand hardwar design and analyse the issues									nardware k he issues of	e knowledge in relation to filter				
Objectives		COuld office   Able learn block diagram regreation methods, and common structure of the second structure of									gram repr					
										CO5	team activ		•			•
No. CO	s –	01	PO2	PO3	PO4	Napping v PO5	vith Progra	am Outco PO7	omes (POs) PO8	PO9	PO10	PO11	PO12	Map PSO1	ping with F	PSOs PSC
1 CO <sup>-</sup>		3	<u> </u>	<b>3</b>	P04 2	P05 0	P06	P07 0	P06 0	1	<b>0</b>	<b>0</b>	1	2	P302	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 CO		3	3	2	2	1	1	0	0	1	0	0	1	2	3	3
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				1				SYLLA	BUS		I		I			
No.	. Content												Hours	Hours COs		
FIR	R FILTER DESIGN:												C		CO1	
	ew of conditions needed for precise linear phase design techniques for linear phase FIR filters: Windowing method, uency sampling method, Approximation method.												ethod,	08		
Frequ	uency sa	amplin	ig method	I, Approxi	mation me	ethod.										
	FILTER DESIGN:															
		log filter design – Butterworth, Chebyshev, Elliptic; Analog-to-Discrete filter transformation methods – differentials, ulse invariant transformation, bilinear transformation, matched z-transform; Digital filter transform methods.														CO2
Anal	og filter	-			•	-	-						ntials,	08		CO2
Analo	og filter	-			•	-	-						ntials,	08		CO2
II Analo impu	og filter Ilse inva	riant t	ransforma	ation, bilir	ear transfo	ormation,	matched z	z-transfo					ntials,	08		
II Analo impu EFFI Binar	og filten ilse inva ECTS ( ry repre	OF FI	ransforma <b>NITE W</b> ( ion of nu	ation, bilin ORD LEN Imbers – H	ear transfe IGTH IN Fixed poin	DIGITA t represent	matched z	z-transfo <b>RS:</b> d floatin	orm; Digital f	filter tran	on; Quanti	hods.	ocess-	08		CO2 CO3
II Anale impu EFFI Binar III trunc	og filten Ilse inva ECTS ( ry repre cation at	<b>OF FI</b> csentation	ransforma <b>NITE W</b> ( ion of nu inding; Q	ation, bilin ORD LEN Imbers – I uantization	NGTH IN Fixed point n errors –	DIGITA t representer	matched z	z-transfo RS: d floatin cient qu	orm; Digital f	filter tran	on; Quanti to additio	hods.	ocess– ation,	08		
II Anale impu EFFI Binar III trunc error	og filten Ilse inva ECTS ( ry repre- cation and due to	<b>OF FI</b> esentation of rou	nansforma NITE We ion of nu inding; Q tiplication	ation, bilin ORD LEN Imbers – I uantization I quantiza	<b>NGTH IN</b> Fixed point n errors – tion; Qua	DIGITA DIGITA t represen error due ntization	matched z	z-transfo <b>RS:</b> d floatin cient qu n realiza	ng point repr antization, e ation proces	resentationerror due	on; Quanti to addition	hods. zation pro on quantiz effects in	ocess– cation, DFT			
II Analo impu EFFI Binar trunc error comp FILT	og filten Ilse inva ECTS ( ry repre cation an due to putation	DF FII Sentation of rou of mult of quant	nITE We ion of nu inding; Q tiplication tization el ZATION:	ation, bilin ORD LEN umbers – I uantization quantiza ffects in F	<b>IGTH IN</b> Fixed point n errors – tion; Qua FT compu	DIGITA t represent error due ntization tation, qu	<b>L FILTE</b> ntation and to coeffi effects of antization	z-transfo RS: d floatin cient qu n realiza effects i	ng point repr antization, e ation proces in in FIR filte	resentation resentation error due ss - quas er design	on; Quanti to addition ntization of , limit cyc	hods. zation pro on quantiz effects in le oscillat	ocess– cation, DFT ions.			
II Analo impu EFFI Binar III trunc error comp FILT Reali	og filter ilse inva ECTS ( ry repre- cation and due to putation FER RI ization s	DF FII Second Tour Tou	nite we ion of nu inding; Q tiplication tization el ZATION: n transfer	ation, bilin ORD LEN umbers – H uantization quantiza ffects in F function -	NGTH IN Fixed point n errors – tion; Qua FT compu	DIGITA t represent error due ntization tation, qu	matched z L FILTE ntation and to coeffi effects of antization	z-transfo RS: d floatin cient qu n realiza effects i R filter	orm; Digital f ng point repr antization, e ation process in in FIR filto realization s	Filter tran resentatic error due ss - qua er design	on; Quanti to addition ntization o , limit cyc s – Direct	hods. zation pro on quantiz effects in le oscillat	ocess– cation, DFT ions.	08		CO3
II Analo impu EFFI Binar III trunc error comp FILT Reali IV casca	ectrs ( contaction and contaction and contaction contac	DF FII esentation of rou of mult of mult cALIZ system n struc	nitre we ion of nu inding; Q tiplication tization et ZATION: n transfer cture, line	ation, bilin ORD LEN umbers – H uantization quantiza ffects in F function - car-phase s	NGTH IN Fixed point n errors – tion; Qua FT compu – FIR filte structure, j	DIGITA t represent error due ntization tation, que er and IIR ploy phas	matched z L FILTE ntation and to coeffi effects of antization c filter; FI e structure	z-transfo RS: d floatin cient qu n realiza effects i R filter e, sampl	ng point repr antization, e ation process in in FIR filte realization s ling frequence	resentationer resentationer error due ss - quan er design structures cy structures	on; Quanti to addition ntization of , limit cyc s – Direct- ure, Lattic	hods. zation pro on quantiz effects in le oscillat form stru e structur	ocess– cation, DFT ions. icture, e; IIR			CO3
II Analo impu EFFI Binar trunc error comp FILT Reali IV casca filter	ects of the sector of the sect	DF FII esentation o mult , quant EALIZ system n struc- tion s	nitre we ion of nu inding; Q tiplication tization et ZATION: n transfer cture, line	ation, bilin ORD LEN umbers – H uantization quantiza ffects in F function - car-phase s	NGTH IN Fixed point n errors – tion; Qua FT compu – FIR filte structure, j	DIGITA t represent error due ntization tation, que er and IIR ploy phas	matched z L FILTE ntation and to coeffi effects of antization c filter; FI e structure	z-transfo RS: d floatin cient qu n realiza effects i R filter e, sampl	orm; Digital f ng point repr antization, e ation process in in FIR filto realization s	resentationer resentationer error due ss - quan er design structures cy structures	on; Quanti to addition ntization of , limit cyc s – Direct- ure, Lattic	hods. zation pro on quantiz effects in le oscillat form stru e structur	ocess– cation, DFT ions. icture, e; IIR	08		CO3
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II Analo impu EFFI Binar trunc error comp FILT Reali ill casca filter struct	ectrs ( ry repre- cation and due to putation <b>TER RH</b> ization s ade form realiza ture, La	DF FII esentation o mult , quant EALIZ system n struc- tion s ttice st	NITE We ion of nu inding; Q tiplication tization ef ZATION: n transfer cture, line structures tructure.	ation, bilin <b>ORD LEN</b> umbers – I uantization quantization ffects in F: function ear-phase s – Direct G:	<b>IGTH IN</b> Fixed point n errors – tion; Qua FT compu – FIR filte structure, j Form-1 s	DIGITA t represent error due ntization tation, quite er and IIF ploy phas structure,	matched z <b>L FILTE</b> ntation and to coeffi effects or antization c filter; FI e structure Direct-Fo	z-transfo RS: d floatin cient qu n realiza effects i R filter e, sampl orm II st	orm; Digital f ng point repr antization, e ation proces in in FIR filto realization s ling frequence structure, cas	resentation error due er design structures cy structures scade for	on; Quanti to addition ntization of limit cyc s – Direct- ure, Lattic rm structu	hods. zation pro on quantiz effects in le oscillat form stru e structur re, ploy	ocess- cation, DFT ions. acture, e; IIR phase	08 07		CO3
II Analo impu EFFI Binar trunc error comp FILT Reali filter struct	og filter ilse inva ECTS ( ry repre- cation and due to outation FER RH ization s ade form realiza ture, La LTIRA	DF FII esentation o mult o mult cALIZ system n struc- ttion s ttice st TE SA to m	number of the second se	ation, bilin <b>ORD LEN</b> umbers – I uantization quantization ffects in F: function ear-phase s – Direct G:	<b>NGTH IN</b> Fixed point in errors – tion; Qua FT compu - FIR filte structure, j Form-1 s	DIGITA t represent error due ntization tation, quiter and IIR ploy phase structure,	matched z <b>L FILTE</b> ntation and to coeffi effects or antization c filter; FI e structure Direct-Fo	z-transfo RS: d floatin cient qu n realiza effects i R filter e, sampl orm II st	ng point repr antization, e ation process in in FIR filte realization s ling frequence	resentation error due er design structures cy structures scade for	on; Quanti to addition ntization of limit cyc s – Direct- ure, Lattic rm structu	hods. zation pro on quantiz effects in le oscillat form stru e structur re, ploy	ocess- cation, DFT ions. acture, e; IIR phase	08		CO3

## 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, 1<sup>st</sup> edition 1996.
- 4. Andreas Antoniou, "Digital Filters: Analysis, Design, and Applications" Tata McGraw-Hill Publishing Co. Ltd., 1<sup>st</sup> 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., 2<sup>nd</sup> edition 2006.