			SEMESTER - III				
S.No	Category	Course Code	Course Title	L	T	P	С
Theory	1						
1	PC	PCS23301	VLSI for Wireless Communication	3	0	0	3
2	PC	PCS231**	Professional Elective IV	3	0	0	3
3	PC	PCS231**	Professional Elective V	3	0	0	3
4	OE	*****	Open Elective I	3	0	0	3
	tical					10	
1	PC	PCS23302	Project Work (Phase I)	0	0	12	6
			TOTAL	12	0	12	18
			SEMESTER - IV				
S.No	Category	Course Code	Course Title	L	T	P	C
Practi	ical				1 =		1 10
1	PC	PCS23401	Project Work (Phase II)	0	0	24	12
			TOTAL	0	0	24	12



LIST OF PROGRAMME ELECTIVES

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	PCS23151	Multimedia Compression Techniques	3	0	0	3
2	PE	PCS23152	Electromagnetic Interference and Compatibility in system design	3	0	0	3
3	PE	PCS23153	Advanced Digital Image Processing	3	0	0	3
4	PE	PCS23154	MEMS and NEMS	3	0	0	3
5	PE	PCS23155	Broadband Wireless Technology	3	0	0	3
6	PE	PCS23156	Millimeter Wave Communication	3	0	0	3
7	PE	PCS23157	Pattern Recognition and Computational Intelligence	3	0	0	3
8	PE	PCS23158	Communication Protocols for IoT	3	0	0	3
9	PE	PCS23159	Satellite Communication and Navigation Systems	3	0	0	3
10	PE	PCS23160	Optimization Techniques	3	0	0	3
11	PE	PCS23161	Digital Communication Receivers	3	0	0	3
12	PE	PCS23162	Soft Computing and Machine Learning	3	0	0	3
13	PE	PCS23163	Cognitive Radio Networks	3	0	0	3
14	PE	PCS23164	High Performance Communication Networks	3	0	0	3
15	PE	PCS23165	Advanced Antenna Design	3	0	0	3
16	PE	PCS23166	Ultra Wide Band Communications	3	0	0	3
17	PE	PCS23167	Real Time Embedded Systems	3	0	0	3
18	PE	PCS23168	Wavelets and Sub-band Coding	3	0	0	3
19	PE	PCS23169	Speech Processing	3	0	0	3
20	PE	PCS23170	Telecommunication System Modeling and Simulation	3	0	0	3

OPEN ELECTIVE

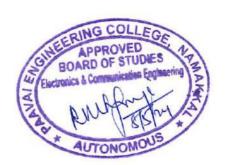
S.No	Category	Course Code	Course Title	L	T	P	С
1	OE	PED23901	Industrial Safety	3	0	0	3
2	OE	PSE23901	Climate change and Adaptation	3	0	0	3
3	OE	PPS23901	Alternate Energy Sources	3	0	0	3
4	OE	PCS23901	Design of Digital Elements	3	0	0	3
5	OE	PCE23901	Big Data Analytics	3	0	0	3



5. Sch

	23301	VLSI FOR WIRELESS COMMUNICATION	3	0	0	3
COU	RSE OB	JECTIVES				
To ena	able the s	students to				
1.	unders	tand the concepts of basic wireless communication concepts.				
2.	study t	he parameters in receiver and low noise amplifier design.				
3.	study t	he various types of mixers designed for wireless communication.				
4.	study a	nd design PLL and VCO.				
5.	unders	stand the concepts of transmitters and power amplifiers in wireles	s commun	icatio	n.	
UNIT	ΓI	COMMUNICATION CONCEPTS		_		9
Introd	uction –	Overview of Wireless systems – Standards – Access Methods –	Modulati	on sc	heme	s –
Classi	cal chanr	nel – Wireless channel description – Path loss – Multipath fading	– Standar	d Tra	nslati	on.
UNIT	. II	RECEIVER ARCHITECTURE AND LOW NOISE AMPL	IFIERS	T		9
Recei	ver fron	t end – Filter design – Non-idealities – Design parameters –	Noise fig	ure a	& In	out
		 t. LNA Introduction – Wideband LNA design – Narrow band Lore amplifier. 	NA desigi	ı: Imp	oedar	ice
UNIT Balan	5953227. 	MIXERS ver - Qualitative Description of the Gilbert Mixer - Conversion	on Gain –	Disto	ortion	9
Balan Noise Unbal	cing Mix - A Co	MIXERS Aver - Qualitative Description of the Gilbert Mixer - Conversion Complete Active Mixer. Switching Mixer - Distortion, Conversion Switching Mixer - A Practical Unbalanced Switching Mixer Ain, Distortion, Intrinsic & Extrinsic Noise in Single Ended Samp	sion Gain er. Sampl	& Ning N	loise	i –
Balan Noise Unbal	cing Mix - A Collanced Sersion Ga	ker - Qualitative Description of the Gilbert Mixer - Conversion of the Gilbert Mixer - Conversion omplete Active Mixer. Switching Mixer - Distortion, Conversion of the Gilbert Mixer - Conversion of the Gilbert	sion Gain er. Sampl	& Ning N	loise	i –
Balan Noise Unbal Conve UNIT PLL – Phas	- A Collanced Sersion Ga	exer - Qualitative Description of the Gilbert Mixer - Conversion omplete Active Mixer. Switching Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Conversion of	sion Gain er. Sampl bling Mixe tors – Rin	& Ning M	loise Mixer	in - 9
Balan Noise Unbal Conve UNIT PLL - – Phas	- A Collanced Sersion Garantee Phase de noise ency syn	ker - Qualitative Description of the Gilbert Mixer - Conversion omplete Active Mixer. Switching Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion	sion Gain er. Sampl bling Mixe tors – Rin sign examp	& Ning M	loise Mixer	in - 9
Balan Noise Unbal Conve UNIT PLL – Phas Frequ UNIT	cing Mix - A Collanced Sersion Ga - Phase desenoise ency syn	ker - Qualitative Description of the Gilbert Mixer - Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion of the Gilbert M	sion Gain er. Sampl bling Mixe tors – Rin sign examp	& Ning M	loise Mixer	in - 9 Ors
Balan Noise Unbal Conve UNIT PLL – Phas Frequ UNIT	cing Mix - A Collanced Sersion Ga - Phase desenoise ency syn	ker - Qualitative Description of the Gilbert Mixer - Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion of the Gilbe	sion Gain er. Sampl bling Mixe tors – Rin sign examp	& Ning M	loise Mixer	9 Ors) –
Balan Noise Unbal Conve UNIT PLL – – Phas Frequ UNIT	cing Min - A Co lanced S ersion Ga LIV - Phase d se noise - ency syn V mitter ba	ker - Qualitative Description of the Gilbert Mixer - Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Intrinsic & Extrinsic Noise in Single Ended Samp FREQUENCY SYNTHESIZERS Letector - Dividers - Voltage Controlled Oscillators - LC oscillater - Loop filters & design approaches - A complete synthesizer desthesizer with fractional divider. TRANSMITTER ARCHITECTURES AND POWER AMP ck end design - Quadrature LO generator - Power amplifier design	sion Gain er. Sampl bling Mixe tors – Rin sign examp	& Ning No.	Mixer Mixer Cillate	9 Ors) –
Balan Noise Unbal Conve UNIT PLL - Phas Frequ UNIT Transi	cing Mix - A Collanced Sersion Gar - IV - Phase desenoise ency syn - V - Mitter ba	ker - Qualitative Description of the Gilbert Mixer - Conversion omplete Active Mixer. Switching Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Intrinsic & Extrinsic Noise in Single Ended Samp FREQUENCY SYNTHESIZERS Letector - Dividers - Voltage Controlled Oscillators - LC oscillater - Loop filters & design approaches - A complete synthesizer destates with fractional divider. TRANSMITTER ARCHITECTURES AND POWER AMP ock end design - Quadrature LO generator - Power amplifier design - TOTAL PER CONTROL - Conversion of the Gilbert Mixer - Conversion	sion Gain er. Sampl ling Mixe tors – Rin ign examp PLIFIERS gn. RIODS	& Ning Ning Ning Ning Ning Ning Ning Ning	Mixer Dillate ECT	9 ors 9 45
Balan Noise Unbal Conve UNIT PLL - Phas Frequ UNIT Transi	cing Mix - A Collanced Sersion Gallerian Galle	ser - Qualitative Description of the Gilbert Mixer - Conversion omplete Active Mixer. Switching Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Conversion of the Gilbert Mixer - Distortion, Intrinsic & Extrinsic Noise in Single Ended Samp FREQUENCY SYNTHESIZERS Letector - Dividers - Voltage Controlled Oscillators - LC oscillater - Loop filters & design approaches - A complete synthesizer destructional divider. TRANSMITTER ARCHITECTURES AND POWER AMP - Ck end design - Quadrature LO generator - Power amplifier design - Complete Synthesizer - TOTAL PER - TCOMES	sion Gain er. Sampl er. Sampl eling Mixe tors – Rin sign examp eLIFIERS gn. RIODS	& Ning Ming Ming Ming Ming Ming Ming Ming M	Mixer	9 ors 9 45
Balan Noise Unbal Conve UNIT PLL - Phas Frequ UNIT Transi	cing Mix - A Co lanced S ersion Ga IV - Phase d se noise- ency syn V mitter ba RSE OU end of th analys	ker - Qualitative Description of the Gilbert Mixer - Conversion omplete Active Mixer. Switching Mixer - Distortion, Conversion of the Gilbert Mixer - Conversion omplete Active Mixer. Switching Mixer - A Practical Unbalanced Switching Mixer and Distortion, Intrinsic & Extrinsic Noise in Single Ended Samp FREQUENCY SYNTHESIZERS Letector - Dividers - Voltage Controlled Oscillators - LC oscillated - Loop filters & design approaches - A complete synthesizer desthesizer with fractional divider. TRANSMITTER ARCHITECTURES AND POWER AMP ck end design - Quadrature LO generator - Power amplifier design TOTAL PER TCOMES his course, the students will be able to the basic wireless communication concepts. tand the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the students will be able to the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in receiver and design a low noise the parameters in	sion Gain er. Sampl er. Sampl bling Mixe tors – Rin sign examp PLIFIERS gn. RIODS BT M (High	& Ning Ning Ning Ning Ning Ning Ning Ning	Dillate ECT PED evel)	9 ors 9 45

CO4	design PLL at	nd VCO.			Applyin	g (K3)
CO5	apply the con- wireless comr	30 A	tters and utilize	the power amplifiers in	Applyin	g (K3)
REFE	RENCES					
1.	Bosco H Leur	ng "VLSI for Wi	ireless Communi	cation", Pearson Educat	ion, 2002.	
2.	B.Razavi ,"R	F Microelectron	ics", Prentice-H	all ,1998.		
3.	Behzad Raza	vi, "Design of A	nalog CMOS Int	egrated Circuits" McGra	aw-Hill, 19	99.
4.	Emad N Fara	ng and Mohame	d I Elmasry, "M	ixed Signal VLSI wire	less design	- Circuits &
			Publishers, 2000			
CC	O-PO MAPPING);				
				ith Programme Outcome 3 – Strong , 2 – Medium		
			Po	O's		
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	_ 1	2	2
CO2	2	1	2	1	2	2
CO3	2	1	2	1	2	2
CO4	2	1	2	1	2	2
					2	



PCS	823302		PROJECT WORK (PHASE I)	0	0	12	6
COUI	RSE OBJE	CTIVES	10 07-1				
To ena	able the stud	lents to					
1.	improve	the skills in lit	erature survey and to extract the relevant inform	nation by vast	readi	ng.	
2.		ecessary exposin the research	ure on the latest developments in the relevant f work.	ield and to use	the c	urrent	field
3.	develop t	he abilities for	identifying and defining correct problem form	ulation in thei	r chos	en fiel	d.
4.	V 76 3350 33	the presentation g problems.	n and documentation skills in order to dissemin	nate solution to	the r	eal wo	rld

The project topic should be selected to ensure the satisfaction need to establish a direct link between education, national development and productivity and reduce the gap between the world of work and the world of study.

The project should have the following

- ✓ Relevance to social needs of society
- ✓ Relevance to value addition to existing facilities in the institute
- ✓ Relevance to industry need
- ✓ Problems of national importance
- ✓ Research and development in various domain

The student should complete the following for Phase I

- ✓ Literature survey and Problem Formulation
- ✓ Motivation for study and Objectives
- ✓ Preliminary design approaches
- ✓ Implementation and Verification
- ✓ Report and presentation
- ✓ Presenting the work in Reputed journals and International Conferences

	TOTAL PERIO	DDS 18
COU	RSE OUTCOMES	BT MAPPED
At the	end of this course, the students will be able to	(Highest Level)
CO1	identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas.	Applying (K3)
CO2	create a suitable method from different methodologies and forms of analysis to produce research design.	Applying (K3)
CO3	demonstrate the developed /implemented system in the form of hardware and/or software and complement to the society.	Applying (K3)
CO4	present the technical findings in written report/ product and be able to present the ideas in reputed journals and/or International Conferences.	Applying (K3)

		•	O's		
PO1	PO2	PO3	PO4	PO5	PO6
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
	PO1 2 2 2 2 2 2	PO1 PO2 2 2 2 2 2 2 2 2 2 2	PO1 PO2 PO3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	PO1 PO2 PO3 PO4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	PO1 PO2 PO3 PO4 PO5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2



PCS	S23401		PROJECT WORK (PHASE II)	0	0	24	12
COU	RSE OBJ	ECTIVES					
To en	able the st	udents to					
1.	improv	e the skills in li	terature survey and to extract the relevant inform	nation by vast	readi	ng.	
2.		necessary expos	sure on the latest developments in the relevant for work.	ield and to use	e the o	urrent	field
3.	develop	the abilities fo	r identifying and defining correct problem form	ulation in thei	r chos	en fiel	ld.
4.		e the presentation ging problems.	on and documentation skills in order to dissemi	inate solution	to the	e real v	world

The project topic should be selected to ensure the satisfaction need to establish a direct link between education, national development and productivity and reduce the gap between the world of work and the world of study.

The project should have the following

- ✓ Relevance to social needs of society
- ✓ Relevance to value addition to existing facilities in the institute
- ✓ Relevance to industry need
- ✓ Problems of national importance
- ✓ Research and development in various domain

The student should complete the following for Phase II

- ✓ Literature survey and Problem Formulation
- ✓ Motivation for study and Objectives
- ✓ Preliminary design approaches
- ✓ Implementation and Verification
- ✓ Report and presentation
- ✓ Presenting the work in Reputed journals and International Conferences

	TOTAL PERIO	DDS 3	360
COUI	RSE OUTCOMES	BT MAPPE	D
At the	end of this course, the students will be able to	(Highest Leve	el)
CO1	identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas.	Applying (K3)	le E
CO2	create a suitable method from different methodologies and forms of analysis to produce research design.	Applying (K3)	i i
CO3	demonstrate the developed /implemented system in the form of hardware and/or software and complement to the society.	Applying (K3)	i.
CO4	present the technical findings in written report/ product and be able to present the ideas in reputed journals and/or International Conferences.	Applying (K3)	

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) $(1/2/3 \ indicates \ the \ strength \ of \ correlation) \ 3-Strong \ , \ 2-Medium \ , \ 1-Weak$

COs			PC)'s		
C03	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	2	2	2
CO2	2	2	2	2	2	2
CO3	2	2	2	2	2	2
CO4	2	2	2	2	2	2



					_
COURSE	OBJECTIVES	T-0			
To enable t	he students to	11777			
1. un	derstand the concepts of multimedia techniques.				45-2
2. ge	t familiarized with text compression concepts.				
_	t acquainted with various compression techniques for audio sources.				
	arn the basics of image compression				
5. kn	ow about video compression concepts.				
VINITE V			4		
UNIT I	MULTIMEDIA CONCEPTS tures of Multimedia; Graphics and Image Data Representations; Fundar				9
Taxonomy	Digital Audio; Storage requirements for multimedia applications; Need of compression techniques; Overview of source coding; source models a theory; Evaluation techniques; Error analysis and methodologies.				
UNIT II	TEXT COMPRESSION		1		9
Entropy en	on principles - source encoders and destination encoders; Lossless and I coding; Source encoding, Text compression - Static Huffman Coding,	Dynar	nic F	luffn	an
Entropy end Coding; A	coding; Source encoding, Text compression - Static Huffman Coding, rithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Com	Dynar	nic F	luffn	an
Entropy end Coding; A Fano coding	coding; Source encoding, Text compression - Static Huffman Coding, rithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Com	Dynar	nic F	luffn	an
Entropy end Coding; A Fano coding UNIT III	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comg.	Dynar	nic F	luffir Shann	on 9
Entropy end Coding; A Fano coding UNIT III Audio comp	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comg. AUDIO COMPRESSION	Dynar pression	nic Fon; S	luffn Shann	on 9
Entropy end Coding; A Fano coding UNIT III Audio composition	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comg. AUDIO COMPRESSION pression methods - ADPCM coding; Linear predictive coding, Code e	Dynar pression control of the contro	nic Fon; S	hann , Aud	on 9 dio
Entropy end Coding; A Fano coding UNIT III Audio compression cond coding	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comeg. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code en techniques - μ-Law and A-Law Companding, Frequency domain and fing, Application to speech coding, Application to audio coding, MPI in techniques – LPC and CELP.	Dynar pression control of the contro	nic Fon; S	hann , Aud	on 9 dio
Entropy end Coding; A Fano coding UNIT III Audio compression compression compression	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Community. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code en techniques - μ-Law and A-Law Companding, Frequency domain and fing, Application to speech coding, Application to audio coding, MPI	Dynar pression control of the contro	nic Fon; S	hann , Aud	on 9 dio
Entropy end Coding; A Fano coding UNIT III Audio complete compression compression compression compression compression compression	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comeg. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code en techniques - μ-Law and A-Law Companding, Frequency domain and fing, Application to speech coding, Application to audio coding, MPI in techniques – LPC and CELP.	Dynar pression activities automatical designation of the control o	LPC g, Ba	Aud Aud Shann Aud Sic su Spee	9 dio b- ch
Entropy end Coding; A Fano coding UNIT III Audio compression compression compression UNIT IV Predictive of	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comes. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code entechniques - μ-Law and A-Law Companding, Frequency domain and fing, Application to speech coding, Application to audio coding, MPI in techniques – LPC and CELP. IMAGE COMPRESSION	Dynar pression activities automorphism in the control of the contr	LPC Badio,	, Aud Speed	9 dio on
Entropy end Coding; A Fano coding UNIT III Audio compression compression UNIT IV Predictive of standard; L	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comes. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code en techniques - μ-Law and A-Law Companding, Frequency domain and fing, Application to speech coding, Application to audio coding, MPI in techniques – LPC and CELP. IMAGE COMPRESSION Ending - Lossless predictive coding; Optimum predictors; JPEG loss	Dynar pression and	LPC LPC dio,	, Audoressic su Spee	9 dio lb-ch
Entropy end Coding; A Fano coding UNIT III Audio complete compression compression UNIT IV Predictive contained the compression UNIT IV Audio compression UNIT IV	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comeg. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code entechniques - μ-Law and A-Law Companding, Frequency domain and fig., Application to speech coding, Application to audio coding, MPI in techniques – LPC and CELP. IMAGE COMPRESSION Coding - Lossless predictive coding; Optimum predictors; JPEG loss cossy predictive coding; DPCM coding; Transform Coding, Sub-band	Dynar pression and	LPC LPC dio,	, Audoressic su Spee	9 dio lb-ch
Entropy end Coding; A Fano coding UNIT III Audio complete compression Compression UNIT IV Predictive contained and ard; L Wavelet base UNIT V Video comp	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comeg. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code entechniques - μ-Law and A-Law Companding, Frequency domain and fig., Application to speech coding, Application to audio coding, MPI in techniques – LPC and CELP. IMAGE COMPRESSION Coding - Lossless predictive coding; Optimum predictors; JPEG loss cossy predictive coding; DPCM coding; Transform Coding, Sub-band and compression, EZW, SPIHT coders, JPEG 2000 standards, JBIG, JBIC VIDEO COMPRESSION Oversion techniques and standards - MPEG Video Coding I; MPEG 1 and coding and standards - MPEG Video Coding I; MPEG 1 and coding I; MPEG I and c	Dynar pression action of the pression of the p	LPC LPC comp galge dards	, Audorithmoressic surprisessic surprisessi	9 dio lb-ch 9 on ls,
Entropy end Coding; A Fano coding UNIT III Audio complete compression Compression UNIT IV Predictive contained and ard; L Wavelet base UNIT V Video comp	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comes. AUDIO COMPRESSION December of techniques - μ-Law and A-Law Companding, Frequency domain and fing, Application to speech coding, Application to audio coding, MPI in techniques - LPC and CELP. IMAGE COMPRESSION Coding - Lossless predictive coding; Optimum predictors; JPEG loss cossy predictive coding; DPCM coding; Transform Coding, Sub-band and compression, EZW, SPIHT coders, JPEG 2000 standards, JBIG, JBIG, VIDEO COMPRESSION	Dynar pression action of the pression of the p	LPC LPC comp galge dards	, Audorithmoressic surprisessic surprisessi	9 dio lb-ch 9 on ls,
Entropy end Coding; A Fano coding UNIT III Audio complete compression compression UNIT IV Predictive contained and coding Estandard; L Wavelet bas UNIT V Video complete coding II; II	coding; Source encoding, Text compression - Static Huffman Coding, crithmetic coding; Lempel-Ziv (LZ)coding; Lempel Ziv-Welsh Comeg. AUDIO COMPRESSION Dression methods – ADPCM coding; Linear predictive coding, Code entechniques - μ-Law and A-Law Companding, Frequency domain and fig., Application to speech coding, Application to audio coding, MPI in techniques – LPC and CELP. IMAGE COMPRESSION Coding - Lossless predictive coding; Optimum predictors; JPEG loss cossy predictive coding; DPCM coding; Transform Coding, Sub-band and compression, EZW, SPIHT coders, JPEG 2000 standards, JBIG, JBIC VIDEO COMPRESSION Oversion techniques and standards - MPEG Video Coding I; MPEG 1 and coding and standards - MPEG Video Coding I; MPEG 1 and coding I; MPEG I and c	Dynar pression action of the pression of the p	LPC LPC comp galge dards	, Audorithmoressic surprisessic surprisessi	9 dio lb-ch 9 on ls,

COUR	SE OUTCOMES	BT MAPPED
At the	end of this course, the students will be able to	(Highest Level)
CO1	analyze the various multimedia techniques	Analyzing (K4)
CO2	ellaborate various text compression techniques.	Understanding (K2)
CO3	evaluate the performances of various algorithms employed for audio compression.	Analyzing (K4)
CO4	interpret various techniques involved in image compression.	Applying (K3)
CO5	analyze the different standards applicable for video compression.	Analyzing (K4)

- 1. Fred Halshall "Multimedia Communication Applications, Networks, Protocols and - Standards", Pearson Education, 2007
- 2. Tay Vaughan, "Multimedia: Making It Work" McGraw-Hill Professional, 2006.
- 3. Peter Symes, "Digital Video Compression", McGraw Hill, FirstEdition, 2003.
- 4. KR. Rao, ZS Bojkovic, DA Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007

COs _		PO's								
COs	PO1	PO2	PO3	PO4	PO5	PO6				
CO1	2	-		-	1	1				
CO2	2	-	-	-	1	-1				
CO3	2	4	-	-	1	1				
CO4	2	-	-		1	1				
CO5	2	-		-	1	1				



To enable the students to 1. identify the various types and mechanisms of electromagnetic interference 2. find solution to EMI problems in PCB level / subsystem and system level design 3. realize the different types of shielding, grounding methods and material used for the same 4. be familiar with EMC design circuits. 5. understand the different types of EMI/EMC measurement techniques and meas equipments UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission a Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupling rand Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462.	0 3	0	3	D		IAGNETIC INTERFER FIBILITY IN SYSTEM I		S23152	PCS2				
To enable the students to 1. identify the various types and mechanisms of electromagnetic interference 2. find solution to EMI problems in PCB level / subsystem and system level design 3. realize the different types of shielding, grounding methods and material used for the same 4. be familiar with EMC design circuits. 5. understand the different types of EMI/EMC measurement techniques and meas equipments UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission a Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Indu coupling and Radiated coupling; Conductive coupling - Common mode Conductive coupliferential-mode conduction; Near field cable to cable coupling; Field to cable coupling; Power rand Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI (EC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS								URSE OR	COL				
1. identify the various types and mechanisms of electromagnetic interference 2. find solution to EMI problems in PCB level / subsystem and system level design 3. realize the different types of shielding, grounding methods and material used for the same 4. be familiar with EMC design circuits. 5. understand the different types of EMI/EMC measurement techniques and meas equipments UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission as Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inductional Properties of Emission and Emission Capacitive coupling; Properties of Emission and Emission Capacitive coupling; Properties of Emission Emission Capacitive Coupling; Properties of Emission Capacitive C						*		X-11XX-13.XX-14XX-12.XX-1					
2. find solution to EMI problems in PCB level / subsystem and system level design 3. realize the different types of shielding, grounding methods and material used for the same 4. be familiar with EMC design circuits. 5. understand the different types of EMI/EMC measurement techniques and meas equipments UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission as Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inductoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupling freential-mode conduction; Near field cable to cable coupling; Field to cable coupling; Power mand Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS				faranca	o anatia intarfa	machanisms of alastroma			100000000000000000000000000000000000000				
a. realize the different types of shielding, grounding methods and material used for the same 4. be familiar with EMC design circuits. 5. understand the different types of EMI/EMC measurement techniques and meas equipments UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission as Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupliferential-mode conduction; Near field cable to cable coupling; Field to cable coupling; Power rand Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding: precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS									222				
4. be familiar with EMC design circuits. 5. understand the different types of EMI/EMC measurement techniques and meas equipments UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission a Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupling and Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding: Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS									3.				
UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission as Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupling and Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	ne	e san	sed for th	terial us	nods and mater								
UNIT I EMI/EMC CONCEPTS EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission as Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive couplifferential-mode conduction; Near field cable to cable coupling; Field to cable coupling; Power mand Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding : EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calculat Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS													
EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission as Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II	easuring	d me	ques an	techniq	easurement te	rpes of EMI/EMC mea			5.				
Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupling and Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9	T				PTS	EMI/EMC (IT I	UNIT				
Susceptibility; Units of Parameters; Sources of EMI; Case Histories, Radiation Hazards to humans UNIT II EMI COUPLING MECHANISMS Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupling and Power supply coupling. UNIT III EMI CONTROL METHODS AND FIXES Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	on and	nissio	EMI En	diated	icted and Radia	Victims of EMI; Conduct	initions; Sourc	I-EMC defi	EMI-				
Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupling and Power supply coupling. UNIT III													
Classification of Coupling Mechanisms - Conductive coupling, Capacitive coupling, Inducoupling and Radiated coupling; Conductive coupling - Common mode Conductive coupliferential-mode conduction; Near field cable to cable coupling; Field to cable coupling; Power rand Power supply coupling. UNIT III	9		A DELL'AND CONTRACTOR OF THE PARTY OF THE PA	111-	- The control of the								
coupling and Radiated coupling; Conductive coupling - Common mode Conductive coupliferential-mode conduction; Near field cable to cable coupling; Field to cable coupling; Power rand Power supply coupling. UNIT III	nductive	α I	couplir	ncitive	unling Canaci								
Shielding; Grounding; Bonding; EMI Filtering; EMI gasket; Isolation transformer; Transuppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and alk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chartine impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI EC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	er mains	Powe											
suppressors; EMI Suppression Cables; Test beds for ESD and EFT. UNIT IV EMC DESIGN FOR CIRCUITS AND PCB Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calculated Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chart Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS		Powe			ing; Field to cal	eld cable to cable coupling	ode conduction oly coupling.	ferential-mo	Diffe and P				
Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9		oupling;	cable co	ing; Field to cal	eld cable to cable coupling	ode conduction oly coupling.	ferential-mo Power supp IT III	Diffe and P				
talk control; Component selection and mounting; PCB design - PCB Trace Impedance Calcular Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9		oupling;	cable co	ing; Field to cal	eld cable to cable coupling ETHODS AND FIXES EMI Filtering; EMI gas	ode conduction oly coupling. EMI CONT ounding; Bond	Fower support III elding; Gro	Diffe and P UNIT Shield				
Controlled Routing; power Distribution decoupling; Zoning and grounding; precautions for PCB design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9 Fransient		oupling;	cable co	ing; Field to cal S asket; Isolatio EFT.	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E	ode conduction oly coupling. EMI CONT ounding; Bonc MI Suppression	Fower support IT III elding; Groppressors; EM	Diffe and P UNIT Shield suppr				
design. UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9 Fransient 9	er; T	oupling;	tion tra	ing; Field to cal S asket; Isolatio EFT. B	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E	ede conduction oly coupling. EMI CONT ounding; Bonc MI Suppression EMC DESIG	ferential-mo Power supp IT III elding; Gro pressors; EN	Diffe and P UNIT Shield suppr				
UNIT V EMI MEASUREMENTS Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9 Transient 9 and cross	er; T	ansform	tion tra	ing; Field to cal sasket; Isolatio EFT. B Cross talk in to	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C	ede conduction oly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF THE PROPERTY OF THE PR	Power support III elding; Gropressors; EM IT IV se from Re	Diffe and P UNIT Shield suppr UNIT Noise				
Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic char Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9 Transient 9 and cross	er; T	ansform	tion tra	ing; Field to cal sasket; Isolatio EFT. B Cross talk in tr n - PCB Trace	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design	ede conduction oly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF THE PROPERTY OF THE PR	Power support IT III elding; Group pressors; EM IT IV se from Recontrol; Co	Diffe and P UNIT Shield suppr UNIT Noise talk o				
Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9 Transient 9 and cross	er; T	ansform	tion tra	ing; Field to cal sasket; Isolatio EFT. B Cross talk in tr n - PCB Trace	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design	ede conduction oly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF THE PROPERTY OF THE PR	Ferential-mo Power supp IT III elding; Gro pressors; EN IT IV se from Re control; Controlled Rou	Diffe and P UNIT Shield suppr UNIT Noise talk c				
Line impedance stabilization networks; EMI Rx, Spectrum analyzer; Civilian standards -FCC, CI IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	9 Transient 9 and cross	er; T	ansform	tion tra	ing; Field to cal sasket; Isolatio EFT. B Cross talk in tr n - PCB Trace	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design on decoupling; Zoning and	ede conduction oly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF SUPPRESSION OF SUPPRESS	Power support of the pressors; EN IT IV se from Recontrol; Controlled Rough.	Diffe and P UNIT Shield suppr UNIT Noise talk c Contradesign				
IEC, EN; Military standards -MIL STD 461D/462. TOTAL PERIODS	Fransient 9 and cross culations, CB EMC	er; T	ansformanission I	tion transmace Imp	ing; Field to cal sasket; Isolatio EFT. B Cross talk in to in - PCB Trace and grounding;	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design on decoupling; Zoning and	ede conduction oly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF SUPPRESSION OF SUPPRESS	Power support of the pressors; EM IT IV se from Recontrol; Controlled Routing. IT V	Diffe and P UNIT Shield suppr UNIT Noise talk of Control design UNIT				
TOTAL PERIODS	9 and cross sulations, CB EMC	ine ar Calcu	ansformanission I pedance autions f	tion transmace Imp	ing; Field to cal	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design on decoupling; Zoning and ENTS st shielded chamber and s	ede conduction obly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF SUPPRESSION OF SUPPRES	Power support of the	Diffe and P UNIT Shield suppr UNIT Noise talk of Control design UNIT Open				
	9 and cross sulations, CB EMC	ine ar Calcu	ansformanission I pedance autions f	tion transmace Imp	ing; Field to cal	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design on decoupling; Zoning and ENTS st shielded chamber and s s; EMI Rx, Spectrum ana	ede conduction obly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF SUPPRESSION OF SUPPRES	Power support of the pressors; EM IT IV se from Recontrol; Controlled Routign. IT V en area test the impedance	Diffe and P UNIT Shield suppr UNIT Noise talk of Contradesign UNIT Open Line				
COURSE OUTCOMES BT MAPPEI	ransient 9 and cross culations, CB EMC 9 chamber;	ine ar Calcu	ansformanission I pedance nutions f	tion transmace Impg; preca	ing; Field to cal	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design on decoupling; Zoning and ENTS st shielded chamber and s s; EMI Rx, Spectrum ana	ede conduction obly coupling. EMI CONT ounding; Bonc of Suppression EMC DESIGNATION OF SUPPRESSION OF SUPPRES	Power support of the pressors; EM IT IV se from Recontrol; Controlled Routign. IT V en area test the impedance	Diffe and P UNIT Shield suppr UNIT Noise talk contradesign UNIT Open Line				
At the end of this course, the students will be able to (Highest Leve	9 Fransient 9 and cross sulations, CB EMC 9 chamber; , CISPR,	ine ar Calcurate PC	ansformations of anechandards -	tion transmace Impg; preca	ing; Field to cal	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design on decoupling; Zoning and ENTS st shielded chamber and s s; EMI Rx, Spectrum ana	ede conduction oby coupling. EMI CONT ounding; Bonco of Suppression of EMC DESIGNATION OF SUPPRESSION OF SUPPR	Ferential-mo Power supp IT III elding; Gro pressors; EN IT IV se from Re control; Controlled Rou ign. IT V en area test e impedance c, EN; Milita	Diffe and P UNIT Shield suppr UNIT Noise talk of Control design UNIT Open Line IEC,				
CO1 diagnose and solve basic electromagnetic compatibility problems. Applying (K3)	9 Transient 9 and cross sulations, CB EMC 9 chamber; , CISPR,	ine ar Calcu	ansformations of an analysis and an	tion transmace Impg; preca	ing; Field to cal	ETHODS AND FIXES EMI Filtering; EMI gas ; Test beds for ESD and E R CIRCUITS AND PCB nlinearities in Circuits; C d mounting; PCB design on decoupling; Zoning and ENTS st shielded chamber and s s; EMI Rx, Spectrum ana D 461D/462.	EMI CONT Dunding; Bonce MI Suppression EMC DESIGN Lays and Switce Component selecting; power Discrete State EMI MEAS Site; TEM cells Estabilization Lary standards - Lays and ards - Lays COMES	Power support of the pressors; EM IT IV se from Recontrol; Controlled Routign. IT V en area test to impedance of EM; Military MIRSE OUT	Diffe and P UNIT Shield suppr UNIT Noise talk of Control design UNIT Open Line IEC,				

CO2	design coupling systems in EMIC.	Applying (K3)
CO3	evaluate the various EMI control methods	Analyzing (K4)
CO4	implement EMC circuit design for various applications.	Applying (K3)
CO5	explain the measurement concepts of EMIC.	Understanding (K2)

- 1. V Prasad Kodali, "Engineering Electromagnetic Compatibility", IEEE Press, New York, 2001.
- Henry W. Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons Inc, New York, 2009
- 3. Daryl Gerke and William Kimmel, "EDN's Designer's Guide to Electromagnetic Compatibility", Elsevier Science & Technology Books, 2002.
- 4. C.R.Paul, Introduction to Electromagnetic Compatibility, John Wiley and Sons, Inc, 2006

CO-PO MAPPING:

			PC	O's		
COs _	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	1	1	1	1
CO2	2	.=	1	1	1	1
CO3	2	-	1	1	1	1
CO4	2	-	1	1	1	1
CO5	2	-	1	1	1	1



PCS23153	ADVANCED DIGITAL IMAGE PROCESSING	3	0	0	3
COURSE OB					
To enable the	students to				
	the concepts of digital image processing				
2. unders	tand the various models used in image processing.				
3. be fam	iliar with the concepts of morphological image processing.				
	s knowledge on segmentation and its representation.				
5. learn a	bout object recognition and its applications.				
UNIT I	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	G			9
Elements of V	isual Perception-Image acquisition; digitization; Histogram; Ima	ige enhanc	emen	t, Spa	atial
	othing and sharpening, Discrete2D transforms-DFT; DCT; Wals form, Haar wavelet.	h- Hadam	ard, S	lant,	KL,
UNIT II	COLOUR IMAGE PROCESSSING				9
Colour Image	Fundamentals, Colour Models - RGB;CMY;CMYK and HIS	Colour M	odels	. Pse	udo
	sing, Colour Transformation, Colour Image Smoothing a Noise in Colour Images.	nd Sharp	ening,	Co	lour
UNIT III	MORPHOLOGICAL IMAGE PROCESSING				9
Basic Concept	s from Set Theory, Logic Operations Involving Binary Image.	s, Dilation	and	Eros	ion,
Opening and	Closing, Hit-or-Miss Transformation, Basic Morphological	Algorithm	ns, B	ounc	lary
Extraction, Reg	gion Filling, Extraction of Connected Components, Convex Hul	l, Thinnin	g, Thi	cken	ing,
Skeletons, Prui	ning, Gray-Scale Morphology				
UNIT IV	SEGMENTATION, REPRESENTATION AND DESCRIP	PTION	T		9
Edge Detection	, Edge Linking and Boundary Detection, Thresholding, Segmen	tation by I	Morph	olog	ical
Watershed Seg	mentation Algorithm, Use of Markers, Representation and Boun	dary.			
UNIT V	OBJECT RECOGNITION AND IMAGE PROCESSING				9
	APPLICATIONS				
Patterns and I	Pattern Classes ,Recognition Based on Decision, Theoretic	Methods	, Ma	tchin	g,
Optimum Stat	stical Classifiers, Neural Networks, Fuzzy Systems , Imag	e compre	ssion-	, JPI	ΞG,
JPEG2000, JBI	G standards, Watermarking-Steganography				
	TOTAL PE	RIODS			45
COURSE OU	TCOMES	BT	MAPI	PED	
	is course, the students will be able to	(High	nest L	evel)	
	strate knowledge of image acquisition, digitization and spatial	Understa	ınding	g (K2)
Inters	for enhancement				

CO ₂	explain the va	arious models use	ed in image proc	essing.	Underst	anding (K2)
CO3	apply morpho	ological image pr	ocessing algorith	ıms.	Applyin	ıg (K3)
CO4	analyze and	extract potential f	eatures of interes	t from the image.	Analyzi	ng (K4)
CO5	implement th	e image processi	ng for various ap	plications.	Applyin	ıg (K3)
REFE	RENCES					
	1. Rafael C. G	onzalez, "Digital	Image Processin	ng", Pearson Educat	ion, Inc.,3 rd Ec	lition, 2008.
	2. Milman So	nka VaclavHlava	c. Roger Boyle	, "Image Processin	g, Analysis a	and Machine
		inca, racia i marc	ic, riegor bojie	,		
	Vision",					
3	3. Khalid Sav	ood."DataCompr	ession".Morgan	Kaufmann Publish	ers (Elsevier)	3rd Edition
	Alexa Section (Contraction of Contraction)	ood, Batacomp.	,			
	2006					
	4. Rafael C. C	Gonzalez, Richar	ds E.Woods, Ste	ven Eddins, "Digit	al Image Prod	cessing using
				S70	350	
	MATLAB		: I 2004			
		Pearson Educat	ion,Inc.,2004.			
CO	O-PO MAPPINO		ion,Inc.,2004.			
C		G:		th Programme Outc	omes (PO's)	
CC	Марр	G: oing of Course Ou	tcomes (CO's) wi	th Programme Outc		
CC	Марр	G: oing of Course Ou	tcomes (CO's) wi	3 - Strong, 2 - Med		
	Марр	G: oing of Course Ou	tcomes (CO's) wi			
	Марр	G: oing of Course Ou	tcomes (CO's) wi	3 - Strong, 2 - Med		
COs	Марр (1/2/3 inc	5 : oing of Course Ou dicates the strengt	tcomes (CO's) wi h of correlation)	3 – Strong , 2 – Med	ium , 1 – Wea	k
	Mapp (1/2/3 inc	G: bing of Course Ou dicates the strengt	tcomes (CO's) wi h of correlation) PC PO3	3 – Strong , 2 – Med	ium , 1 – Wea	k
COs	Mapp (1/2/3 inc	G: bing of Course Ou dicates the strengt PO2	tcomes (CO's) wi h of correlation) PO PO3	3 – Strong , 2 – Med	PO5	PO6



-

CO4

CO5

	23154	MEMS AND NEMS	3	0	0	3				
COU	RSE OB	JECTIVES								
To en	able the s	tudents to								
1.	know tl	he concepts of micro and nano electromechanical devices								
2.	learn th	learn the fabrication process of Microsystems								
3.	underst	and the design concepts of micro sensors and micro actuators								
4.	be fami	iliar about micro actuators								
5.	acquire	knowledge about the concepts of quantum mechanics and nano	systems							
UNIT	· T	INTRODUCTION TO MEMS AND NEMS				9				
		Design of MEMS and NEMS, Overview of Nano and M	licro elec	trom	echan	cal				
NEM UNIT		, silicon compounds, polymers, metals. MEMS FABRICATION TECHNOLOGIES				9				
Photo	lithograpl	hy, Ion Implantation, Diffusion, Oxidation, CVD, Sputterin	g Etchir	ig te	chniqu	ies,				
	**************************************	g: Bulk Micromachining, Surface Micromachining, LIGA.		_	•					
UNIT		MICRO SENSORS		T		9				
MEM	S Sensor	s: Design of Acoustic wave sensors, Vibratory gyroscope, Capa	citive Pre	essure	e sens	ors,				
		ezoelectric energy harvester								
UNIT	· IV	MICRO ACTUATORS				9				
Desig	n of Actu	lators: Actuation using thermal forces, Actuation using shape me	mory All	oys, A	Actuat	ion				
using	piezoelec	etric crystals, Actuation using Electrostatic forces, Case Study: Ri	F Switch.							
UNIT	·V	NANO DEVICES				9				
	ic Structu ensor.	ires and Quantum Mechanics, Shrodinger Equation, ZnO nanoro		NEM	S devi					
Gas s		TOTAL PE		The state of the state of		45				
			RT	MAP	PPED					
COU		TCOMES	(a)	20 02						
COU At the	e end of th	nis course, the students will be able to	(Hig	hest I	- 15					
COU	e end of the	ret the basics of micro/nano electromechanical systems.	(Hig Underst	andin	ng (K2)				
COU At the	e end of the	nis course, the students will be able to	(Hig	andin	ng (K2)				
COU At the	e end of the interpretation	ret the basics of micro/nano electromechanical systems.	(Hig Underst	andir andir	ng (K2 ng (K2)				
COU At the	interpretation in terpretation	ret the basics of micro/nano electromechanical systems. ate the use of materials in micro fabrication process.	(Hig Underst Underst	andin andin ig (K	ng (K2 ng (K2 3))				

- 1. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
- 2. Stephen D. Senturia, "Micro system Design", Kluwer Academic Publishers, 2001
- 3. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mcraw Hill, 2002.
- 4. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002.

CO-PO MAPPING:

COs _			PC)'s		
Cos	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	H	-	-	1	1
CO2	2	-	-	-	1	1
CO3	2	-	-	-	1	1
CO4	2	+	-	(*)	1	1
CO5	2	-			1	1



PCS23155	BROADBAND WIRELESS TECHNOLOGY 3 0 0								
COURSE C	DBJECTIVES								
To enable th	e students to								
1. knov	w about MIMO channel model capacity								
2. unde	Kilow about Minio Shainer Model expansis								
3. learn									
4. incu	lcate knowledge on millimeter wave communication								
5. be fa	amiliar with software defined radio and cognitive radio								
UNIT I	INFORMATION THEORETIC ASPECTS OF MIMO								
	SISO fading communication channels, MIMO Channel models, Classi	1 : J							
	requency selective and correlated channels models, Capacity of MIMO capacity, capacity bounds and influence of channel properties on the capacity.			Erc	igod				
UNIT II	MIMO DIVERSITY AND SPATIAL MULTIPLEXING			17	ç				
UNITI	mino biveksii i mio si ii mie si obini esime								
	I types of diversity, analysis under Rayleigh fading, Diversity and	channe	el k	now	ledg				
Sources and									
Sources and Alamouti sp	I types of diversity, analysis under Rayleigh fading, Diversity and								
Sources and Alamouti sp	I types of diversity, analysis under Rayleigh fading, Diversity and of types code; MIMO spatial multiplexing - Space time receivers, M								
Sources and Alamouti sp Sphere deco	I types of diversity, analysis under Rayleigh fading, Diversity and of ace time code; MIMO spatial multiplexing - Space time receivers, Ming, BLAST receivers, Diversity multiplexing trade - off.	1L, ZI	F, M	IMS	E ar				
Sources and Alamouti sp Sphere deco- UNIT III Introduction	I types of diversity, analysis under Rayleigh fading, Diversity and of pace time code; MIMO spatial multiplexing - Space time receivers, Normal ding, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM	assive	F, N	IMS.	E ar				
Sources and Alamouti sp Sphere deco- UNIT III	I types of diversity, analysis under Rayleigh fading, Diversity and of pace time code; MIMO spatial multiplexing - Space time receivers, Ming, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for ma	assive	F, N	IMS.	E ar				
Sources and Alamouti sp Sphere deco- UNIT III Introduction Resource all	I types of diversity, analysis under Rayleigh fading, Diversity and of pace time code; MIMO spatial multiplexing - Space time receivers, Ming, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Characteristics.	assive	F, M	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco UNIT III Introduction Resource all UNIT IV Spectrum re	I types of diversity, analysis under Rayleigh fading, Diversity and of pace time code; MIMO spatial multiplexing - Space time receivers, Ming, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chambelle MILLIMETER WAVE COMMUNICATION	assive	Moo	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco UNIT III Introduction Resource all UNIT IV Spectrum re	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Mindog, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber of MILLIMETER WAVE COMMUNICATION	assive	Moo	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco UNIT III Introduction Resource all UNIT IV Spectrum re mobility, Be	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Mindog, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber of MILLIMETER WAVE COMMUNICATION	assive	Moo	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco UNIT III Introduction Resource all UNIT IV Spectrum remobility, Be Transmissio UNIT V	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Mindog, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber MILLIMETER WAVE COMMUNICATION	assive annel ns, arc	F, M Moo	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco- UNIT III Introduction Resource all UNIT IV Spectrum remobility, Be Transmissio UNIT V SDR - Defin	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Mindog, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber MILLIMETER WAVE COMMUNICATION gulation, Channel propagation, Hardware technology for MMW system forming techniques, Beam finding, Physical layer techniques - Duplen Scheme. SOFTWARE DEFINED RADIO AND COGNITIVE RADIO	assive annel ns, arc	F, M Modeline Chite Tims.	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco- UNIT III Introduction Resource all UNIT IV Spectrum remobility, Be Transmissio UNIT V SDR - Defin Radio - Defined and a second and a seco	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Mindog, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber of MILLIMETER WAVE COMMUNICATION	assive annel ns, arc	F, M Modeline Chite Tims.	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco- UNIT III Introduction Resource all UNIT IV Spectrum remobility, Be Transmissio UNIT V SDR - Defin Radio - Defined and a second and a seco	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Mindog, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber of MILLIMETER WAVE COMMUNICATION	assive annel as, arc ex scl	F, M Modeline Chite Tims.	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco UNIT III Introduction Resource all UNIT IV Spectrum remobility, Be Transmissio UNIT V SDR - Defin Radio - Defontology ba	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Mindog, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber of MILLIMETER WAVE COMMUNICATION	assive annel as, arc ex scl	F, M Moo	IMO dels.	E ar				
Sources and Alamouti sp Sphere deco- UNIT III Introduction Resource all UNIT IV Spectrum remobility, Be Transmissio UNIT V SDR - Defin Radio - Defontology ba	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Normal Massive MIMO system - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber MILLIMETER WAVE COMMUNICATION gulation, Channel propagation, Hardware technology for MMW system forming techniques, Beam finding, Physical layer techniques - Duplem Scheme. SOFTWARE DEFINED RADIO AND COGNITIVE RADIO Inition, Origin, key characteristic, hardware and software architecture, we finitions, Cognitive theories, architectures, Cognitive radio as self-seed cognitive radio. TOTAL PERIOD	assive annel as, archex sch	Ehitemem	IMO dels. Cog gray sy	E ar				
Sources and Alamouti sp Sphere deco- UNIT III Introduction Resource all UNIT IV Spectrum remobility, Be Transmissio UNIT V SDR - Defin Radio - De Ontology ba COURSE C At the end o	I types of diversity, analysis under Rayleigh fading, Diversity and of face time code; MIMO spatial multiplexing - Space time receivers, Miding, BLAST receivers, Diversity multiplexing trade - off. MASSIVE MIMO SYSTEM - MIMO for LTE, capacity of massive MIMO, Pilot Design for mocation and transceivers design, Base band and RF implementation, Chamber of MILLIMETER WAVE COMMUNICATION	assive annel as, archex schewich control of the con	Ehite Mooling MA	IMO dels. Cog ag sy	E ar				

CO3	design massive MIMO systems.	Applying (K3)
CO4	implement the concepts of millimeter wave communication.	Applying (K3)
CO5	explain about software defined and cognitive radios	Understanding (K2)

- David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press 2005.
- 2. Hamid Jafarkhani, "Space Time Coding: Theory and Practices", Cambridge University Press, 2005.
- 3. Mischa Dohler, Jose F. Monserrat Afif Osseiran "5G Mobile and Wireless Communication Technology", Cambridge University.
- Mieczyslaw M Kokar, Lezek Lechowicz, "Cognitive Radio Interoperability through Waveform Reconfiguration" ARTECH House 2016.

CO-PO MAPPING:

			PC)'s		
COs _	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	1	1	1	1
CO2	2	-	1	1	1	1
CO3	2	-	1	1	1.	1
CO4	2	-	1	1	1	1
CO5	2	-	1	1	1	1



PCS23	3156	MIL	LIMET	TER WAV	E COM	MUNIC	ATION	li .	3	0	0	3
COU	RSE OB	JECTIVES										
To ena	able the	students to										
1.	learn t	he fundamentals	s of milli	meter wav	e devices	s and circ	uits.					
2.	know	about the millim	neter dev	ices and ci	rcuits							
3.	unders	tand the various	compor	nents of mi	illimeter v	wave cor	nmunic	ation s	ystems.			
4.	acquir	e knowledge abo	out mm	wave MIM	IO system	ns.						
5.	explor	e about the anter	nna desi	gn at millir	meter way	ve freque	encies.					
UNIT	I	MILLIMET	ER WA	VES								9
Millim	neter w	ave characteris	stics- m	illimeter	wave w	vireless,	implen	entati	on chal	lenge	s; R	adio
wavep	ropagat	ion for mm wav	ve; Larg	e scale pro	pagation	channel	effects	; smal	scale c	hann	el eff	ects;
Outdo	or and I	ndoor channel m	nodels; E	Emerging a	pplication	ns of mil	limeter	wave o	commun	icatio	ns	
UNIT	II	mm WAVE	DEVIC	ES AND C	CIRCUIT	TS						9
S-Para	meters,	Z-Parameters, `	Y-Paran	neters, and	ABCD-	Paramete	ers; Sim	nulatio	n, Layo	ut, ai	nd CN	MOS
Produc	ction of	mmWave Circu			1-1- C	. mmWa	ve Tran	sistors	- BSIN	1 Mo	del. 1	EKV
		min wave chec	uits; Ad	vanced Mo	odels for	min wa				I IVIC	, .	
Model	Transis	tor Configuratio										J1 (
UNIT	III lations	tor Configuratio mm WAVE (for millimeter v	COMM	log mmWa	ION SYS	ponents; STEMS OK, PSE	Consur K, FSK	nption	Factor	Theorem	y Millin	9 neter
UNIT Modul wave Oscilla consid	III lations d link be lator; M lerations	mm WAVE of millimeter values; Transcei illimeter wave	commons; Ana COMM wave co iver ar calibra	UNICATION TO THE PROPERTY OF T	ION SYStions: OC Transc	ponents; STEMS OK, PSK ceiver v	Consur K, FSK	, QAN	Factor M, OFD	M; l	y Millin wit	9 neter hout esign
UNIT Modul wave Oscilla consid UNIT	III lations filink beator; Merations	mm WAVE of mm WAVE of millimeter wave	commons; Ana COMM wave consiver ar calibra	UNICATION TO SYSTEMS	ION SYStions: OC Transc	ponents; STEMS OK, PSk ceiver v and mar	Consur X, FSK, vithout nufactur	, QAM mixe e; Mi	Factor M, OFD er; Rec	M; i eiver	Millin wit	9 neter hout esign
UNIT Modul wave Oscilla consid UNIT Massiv	lations to link be lator; Merations IV	mm WAVE of the millimeter wave mm WAVE of the millimeter wave mm WAVE of the mm WAVE of the mm WAVE of the mm WAVE of the millimeter wave	commons; Ana COMMonse consider are calibra MIMO ations;	UNICATION DESCRIPTION OF THE PROPERTY OF THE P	ION SYStions: OC Transculation a	STEMS OK, PSK ceiver v and mar	Consur K, FSK vithout nufactur	, QAM mixe e; Mi	Factor M, OFD er; Rec Illimeter Multi	M; I eiver way	Millin wit we de	9 neter hout esign 9 nnas,
UNIT Modul wave Oscilla consid UNIT Massiv Multip	lations delator; Merations IV Ve MIN oleTrans	for Configuration mm WAVE of the formula millimeter wave in mm WAVE of the following mm WAVE of the following ceivers; Noise of the following millimeter wave the following millimeter wave of the fo	COMM wave consider an ealibra MIMO ations; coupling	UNICATION COMMUNICATION COMMUN	ION SYStions: OC Transculuction a	ponents; STEMS OK, PSk ceiver v and mar of Ante	Consur X, FSK. vithout nufactur enna A	, QAM mixe e; Mi	Factor M, OFD er; Rec llimeter Multi for mm	M; I eiver way	Millin wit de de	9 neter hout esign 9 nnas, tems
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati	lations factor; Materations IV Ve MIN bleTrans ial, Tem	mm WAVE of the man wave of the	COMM wave co iver ar calibra MIMO ations; coupling	UNICATION TO SYSTEMS Spatial dig in MIM versity; Dy	ION SYStions: OC Transculuction a Siversity O system	ponents; STEMS OK, PSk ceiver v and mar of Ante	Consur X, FSK. vithout nufactur enna A	, QAM mixe e; Mi	Factor M, OFD er; Rec llimeter Multi for mm	M; I eiver way	Millin wit de de	9 neter hout 9 nnas, 10 nnas, 11 nnas,
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati	lations to later the later than the	mm WAVE of the millimeter wave and the communication of the control of the contro	COMM wave conviver are calibra MIMO ations; coupling aency div	UNICATION MUNICATION M	ION SYStions: OC Transc duction a Siversity O system mamic space.	of Ante	Consur K, FSK, vithout unfactur enna A	, QAM mixe e; Mi	Factor M, OFD er; Rec Illimeter Multi or mm odulatio	M; 1 eiver way	Millin with Millin Anter	9 neter hout 9 nnas, tems 9
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn	lations delations derations IV Ve MIN bleTrans ial, Tem V	mm WAVE of the millimeter wave illimeter wave mm WAVE of the mm WAVE of the millimeter wave mm WAVE of the millimeter wave of the millime	COMM wave consider an ealibra MIMO ations; coupling ency div	UNICATION COMMUNICATION COMUNICATION COMMUNICATION COMMUNICATION COMMUNICATION COMMUNICATION COMMUNICATION COMMUNICATION COMMUNICATION COMMUNICATION COMMUNI	ION SYStions: OC Transculuction a Siversity of System namic spanications	of Anter catial, free EMS Anter	Consur X, FSK. vithout nufactur enna A tial ben quency	mption , QAM mixe e; Mi rrays efits f and me	Factor M, OFD er; Rec llimeter Multi for mm odulatio on; Bea	M; 1	with with with with which with which with with with which with with with with with with with wit	9 neter 9 nnnas, tems n. 9
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn Protoc	lations to link but be lator; M lerations IV ve MIN bleTransial, Tem V na Topo cols - 8	mm WAVE of the millimeter wave illimeter wave mm WAVE of the millimeter wave mm WAVE of the millimeter wave and the millimeter wave mm WAVE of the millimeter wave and the millimeter wave of the millimeter w	COMM wave conviver are calibra MIMO ations; coupling aency divided by the conviction of the convictio	UNICATION TO SYSTEMS Spatial dig in MIM versity; Dynam WAVI Communication was a series of the communication with the communication was a series of the communication with the communication was a series of the co	ION SYStions: OC Transculuction a Siversity O system mamic space E SYSTE	of Anter catial, free Channel	Consur C, FSK, without nufactur enna A tial ben quency	mption , QAM mixe e; Mi rrays efits f and me arizati ion R	Factor M, OFD er; Rec llimeter Multi for mm odulatio on; Bea elaying	M; 1	Millin wit with the decision with the system of the decision with the system of the sy	9 neter hout esign 9 nnas, tems n. 9 nation erage
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn Protoc Extens	lations fallink beator; Merations IV Ve MIN bleTrans ial, Tem V na Topo sols - 8 sion; Cha	mm WAVE of the millimeter wave addet; Transcei illimeter wave mm WAVE of the millimeter wave and Communicate poral and Freque and Freque and Freque and Freque aracterization of the millimeter wave aracterization of the millimeter wave and the mil	committee of the commit	In MIM versity; Dy mm WAVI Communicate distribution; procession of the communicate distribution of the communicate distributio	ION SYStions: OC Transculuction a Siversity O system mamic space E SYSTE	of Anter catial, free Channel	Consur C, FSK, without nufactur enna A tial ben quency	mption , QAM mixe e; Mi rrays efits f and me arizati ion R	Factor M, OFD er; Rec llimeter Multi for mm odulatio on; Bea elaying	M; 1	Millin wit with the decision with the system of the decision with the system of the sy	9 neter hout esign 9 nnas, tems n. 9 nation erage
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn Protoc Extens	lations fallink beator; Merations IV Ve MIN bleTrans ial, Tem V na Topo sols - 8 sion; Cha	mm WAVE of the millimeter wave illimeter wave mm WAVE of the millimeter wave mm WAVE of the millimeter wave and the millimeter wave mm WAVE of the millimeter wave and the millimeter wave of the millimeter w	committee of the commit	In MIM versity; Dy mm WAVI Communicate distribution; procession of the communicate distribution of the communicate distributio	ION SYStions: OC Transculuction a Siversity O system mamic space E SYSTE	of Anter catial, free Channel	Consur X, FSK. vithout aufactur enna A tial ben quency	rrays efits fand me	Factor M, OFD er; Rec llimeter Multi for mm odulatio on; Bea elaying e comm	M; 1	Millin wit with the decision with the system of the decision with the system of the sy	9 neter hout esign 9 nnas, tems n. 9 nation erage over
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn Protoc Extens 5G sys	lations of link between the later; More MIN bleTransial, Tem Voice of the later of	mm WAVE of the millimeter wave and mm WAVE of the millimeter wave of	committee of the commit	In MIM versity; Dy mm WAVI Communicate distribution; procession of the communicate distribution of the communicate distributio	ION SYStions: OC Transculuction a Siversity O system mamic space E SYSTE	of Anter catial, free Channel	Consur C, FSK, without nufactur enna A tial ben quency	rrays efits fand me	Factor M, OFD er; Rec llimeter Multi or mm odulatio on; Bea elaying e comm	M; 1	Millin with with the decision with the system	9 neter hout esign 9 nnas, tems n. 9 ntion erage over
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn Protoc Extens 5G sys	lations fall lations for the later; More MIN bleTransial, Tem V later Topo cols - 8 sion; Chastems; D	mm WAVE of the millimeter wave addet; Transcei illimeter wave mm WAVE of the millimeter wave and Communicate poral and Freque ANTENNAS plogies for mm 202.15.3c, IEEE aracterization of the esign techniques	COMM wave consider an ealibra MIMO ations; coupling tency divided and wave E 802.1 f On-Chirts of 5G to	Iog mmWa UNICATI Dimmunicate chitecture; tion; proc SYSTEMS Spatial di g in MIM versity; Dy nm WAVI Commun lad, Back ip Antenna mobile.	iversity O system namic spa E SYSTE nications khaul, Cla	of Anter catial, free Channel	Consur X, FSK. vithout aufactur enna A tial ben quency	rrays efits fand me	Factor M, OFD er; Rec llimeter Multi or mm odulatio on; Bea elaying e comm RIODS BT	M; I deliver wave ple wave n allo	Millin wit with the desired Anter Anter System Cover C	9 neter hout esign 9 nnas, tems n. 9 ntion erage over
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn Protoc Extens 5G sys	lations to later; More MIN betwee	mm WAVE of the millimeter wave and the millimeter wave of the millim	COMM wave consider an ealibra MIMO ations; coupling tency diver an Wave E 802.1 f On-Chies of 5G to the students of the students of the coupling tency diversity and the coupling tency diversity and the coupling tency diversity at the coupling tence of the couplin	Iog mmWa UNICATI ommunicate chitecture; tion; process SYSTEMS Spatial diag in MIM versity; Dy nm WAVI Communicate and a Back ip Antenna mobile.	iversity O system namic spa E SYSTE nications khaul, Cla	of Anter catial, free Channel	Consur X, FSK. vithout aufactur enna A tial ben quency	rrays efits fand me	Factor M, OFD er; Rec llimeter Multi for mm odulatio on; Bea elaying e comm RIODS BT (High	M; 1	Millin with with which will be systemations. When the systemation with the systematic content of	9 neter hout esign 9 nnas, tems n. 9 ntion erage over 45
UNIT Modul wave Oscilla consid UNIT Massiv Multip ; Spati UNIT Antenn Protoc Extens 5G sys	lations to later; More MIN berations IV We MIN berations IV To	mm WAVE of the millimeter wave addet; Transcei illimeter wave mm WAVE of the millimeter wave and Communicate poral and Freque ANTENNAS plogies for mm 202.15.3c, IEEE aracterization of the esign techniques	COMM wave consider an ealibra MIMO ations; coupling tency divider an wave E 802.1 f On-Chings of 5G to trudents and trude	Iog mmWa UNICATI ommunicat chitecture; tion; proc SYSTEMS Spatial di g in MIM versity; Dy nm WAVI Commun lad, Back ip Antenna mobile. will be able er waves.	ION SYStions: OC Transc duction a Siversity of System namic spanications khaul, Clark Performance to the control of the contro	ponents; STEMS OK, PSK ceiver v and mar of Ante m; Potent eatial, free EMS - Anter channel	Consur X, FSK. vithout aufactur enna A tial ben quency	rrays efits fand me	Factor M, OFD er; Rec llimeter Multi or mm odulatio on; Bea elaying e comm RIODS BT	M; 1	Millin with with the system of	9 neter hout esign 9 nnas, tems n. 9 45 0 1)

CO3	analyse the mi	llimeter wave co	mmunication sys	tems	Analyzir	ng (K4)
					Understa	inding (K2)
CO4	17.0	llimeter wave M				and a second of
05	design antenna	s using millimet	er wave technolo	ogy.	Applyin	g (K3)
REFE	RENCES					
1.	K.C. Huang, Z	. Wang, "Millime	eter Wave Comn	nunication System	ns", Wiley-IEEE	Press, Marc
	2011.					
2.	Robert W. Hea	th, Robert C. Da	niel, James N. T	heodore S. Rapp	aport, Murdock,	"Millimeter
		s Communication				
		al, V.K. Jain, Sul			munication", Sr	oringer India
3.			bratkar, Free S	Jace Optical Con		
	N D-11: 20	017				
	New Delhi, 20	017.			~ . 2016	
4.	New Deini, 20	eng, K; Shen, X.	S; "5G Mobile C	ommunications:	Springer, 2016.	
	Xiang, W; Zhe	eng, K; Shen, X.S				
	. Xiang, W; Zho	eng, K; Shen, X.S : ing of Course Ou	tcomes (CO's) wi	th Programme O	utcomes (PO's)	
	. Xiang, W; Zho	eng, K; Shen, X.S	tcomes (CO's) wi	th Programme O	utcomes (PO's)	k
C	. Xiang, W; Zho	eng, K; Shen, X.S : ing of Course Ou	tcomes (CO's) wi	th Programme O	utcomes (PO's) Aedium , 1 – Wea	
C	. Xiang, W; Zho	eng, K; Shen, X.S : ing of Course Ou	tcomes (CO's) wi	th Programme O	utcomes (PO's) Aedium , 1 – Wea PO5	PO6
COs	Xiang, W; Zho FO-PO MAPPING Mapp (1/2/3 ind	eng, K; Shen, X.S i: ing of Course Ou licates the strengt	tcomes (CO's) wi th of correlation)	th Programme O 3 – Strong , 2 – M	utcomes (PO's) Aedium , 1 – Wea	PO6
COs	CO-PO MAPPING Mapp (1/2/3 ind PO1	eng, K; Shen, X.S i: ing of Course Ou licates the strengt	tcomes (CO's) with of correlation) PO	th Programme O 3 – Strong , 2 – N 's PO4	utcomes (PO's) Aedium , 1 – Wea PO5	PO6 1 1
COs CO1 CO2	Mapp (1/2/3 ind	eng, K; Shen, X.S. i: ing of Course Ou licates the strengt	tcomes (CO's) with of correlation) PO PO3	th Programme O 3 – Strong , 2 – M O's PO4	utcomes (PO's) Aedium , 1 – Wea PO5	PO6
	PO1 2 2	eng, K; Shen, X.S. ing of Course Ou licates the strengt	tcomes (CO's) with of correlation) PO PO3 1 1	th Programme O 3 – Strong , 2 – M)'s PO4 1	utcomes (PO's) Aedium , 1 – Wea PO5 1	PO6 1 1



PCS2	3157	PATTERN I		CLLIGENC		UTATION	AL	3	0	0	3
COUL	RSE OB	JECTIVES									-
To ena	able the s	tudents to									_
1.	learn th	e fundamentals of	oattern class	ifier.							
2.	know a	bout the various clu	istering con	cepts.				_		-	
3.	underst	and the structural p	attern recog	nition and f	feature ex	traction.					
4.	acquire	knowledge about of	oncept learn	ning and de	cision tre	es.		-			
5.	be fam	liar with recent adv	ances in pat	tern recogn	nition tech	nniques.		-			_
UNIT	I	PATTERN CLA	SSIFIER			- 2			T		9
Overv	iew of F	attern recognition	: Discrimin	ant functio	ns :Supe	rvised learr	ning : D	ecis	ion T	heor	ν.
		elihood Estimation			77		S#8 E				
		ern classification by	20 OH 12-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-) (2000) -	4 00-000
UNIT		CLUSTERING		,							9
Laxes (e) And and	3390	unsupervised lear	ning and c	lassification	n Image	segmentatio	on and c	omr	ressio		
1 Altern	ative Vie	w of EM: Hierar				_	tworks :	Mar	kov R	tando	om
1		ew of EM; Hierar	chical cluste			_	tworks;	Mar	kov F	Rando	om
Field;	Inference	in Graphical Mod	chical cluste	ring proced	dures ; Ba	ayesian Net		Mar	kov F	Rando	
1	Inference	in Graphical Mod	chical cluste els.	ring proced	dures ; Ba	ayesian Net		Mar	kov R	Rando	
Field; UNIT	Inference	FEATURE EXT	chical clusterels. RACTION	AND STR	dures ; Ba	ayesian Net	ERN				9
Field; UNIT	Inference III ransforms	FEATURE EXT RECOGNITION 5 - Feature selection	chical clusterels. RACTION n through f	AND STR	dures ; Ba	AL PATTI	ERN ry select	ion;			9
Field; UNIT KL Tr formal	Inference III ransforms	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descri	chical clusterels. RACTION n through f ption; Stoch	AND STR	dures; Ba RUCTUR approxima mars; Stru	AL PATTI ation; Binar	ERN ry select	ion;			9 of
Field; UNIT KL Tr formal UNIT	Inference III ransforms gramma IV	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descri	chical clusterels. RACTION n through f ption; Stoch	AND STR unctional a astic gramm	RUCTUR Approxima mars; Stru HON TRI	AL PATTI ation; Binar actural repre	ERN ry select	ion; n.	Elem	nents	9 of
Field; UNIT KL Tr formal UNIT Learni	Inference III ransforms gramma IV ng Probl	FEATURE EXT RECOGNITION S - Feature selection rs; Syntactic description CONCEPT LEA ems - Designing Le	Chical clusterels. CRACTION In through f ption; Stoch CRNING AF earning system	AND STR unctional a astic gramm ND DECIS ems, Perspe	RUCTUR Approximate mars; Struction TRI ectives an	AL PATTI ntion; Binar actural repre	ern ry select esentation	ion; n. Learn	Elem	nents Versi	of 9
Field; UNIT KL Tr formal UNIT Learni Spaces	Inference III ransforms gramma IV ng Probl s, Candid	FEATURE EXT RECOGNITION s - Feature selections; Syntactic descri CONCEPT LEA ems - Designing Lea late Elimination A	chical clusterels. RACTION In through f ption; Stoch RNING An earning systerel gorithm; In	AND STR unctional a astic gramm ND DECIS ems, Perspe	RUCTUR Approximate mars; Struction TRI ectives an	AL PATTI ntion; Binar actural repre	ern ry select esentation	ion; n. Learn	Elem	nents Versi	of 9
Field; UNIT KL Tr formal UNIT Learni Spaces Algori	Inference III ransforms gramma IV ng Probl s, Candid thm , He	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descrit CONCEPT LEA ems - Designing Lea late Elimination A uristic Space Search	RACTION In through f ption; Stoch RNING AN earning syste Igorithm; In	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia	RUCTUR Approxima mars; Stru HON TRI ectives an as; Decisi	AL PATTI ation; Binar actural repre EES d Issues, Co	ern ry select esentation	ion; n. Learn	Elem	nents Versi	of 9
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT	Inference III ransforms gramma IV ng Probl s, Candid thm , He	FEATURE EXT RECOGNITION S - Feature selection rs; Syntactic descrit CONCEPT LEA ems - Designing Lea late Elimination A uristic Space Search RECENT ADVA	RACTION In through f ption; Stoch RNING Aff earning syste (gorithm; In h.	AND STR unctional a astic gramm ND DECIS ems, Perspe ductive bia	RUCTUR Approximation aris; Structures and aris; Decision RECOC	AL PATTI ation; Binar actural repre EES d Issues, Co on Tree lea	ern ry select esentation oncept L arning -	ion; n. .earm Rep	Eleming; 'oresen	Versi	9 of 9 ion , 9
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT Neural	Inference III ransforms gramma IV ng Probl s, Candic thm , He V	FEATURE EXT RECOGNITION S - Feature selection rs; Syntactic description of the concept Leaders - Designing Leaders - Designing Leader Elimination A puristic Space Search RECENT ADVA	ehical clusterels. RACTION In through fine prion; Stoch RNING AN earning system (gorithm; In h. ANCES IN In pattern rec	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia PATTERN ognition;	AUCTUR Approxima mars; Stru HON TRI ectives an as; Decisi H RECOC	AL PATTI ation; Binar actural representations of the second of the secon	ry select esentation oncept L arning -	ion; n. earm Rep	Eleming; oresen	Versi	of 9 ion 9 prs;
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT Neural Unsup	ransforms gramma IV ng Probl s, Candid thm , He V I network ervised I	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descrit CONCEPT LEA ems - Designing Lea late Elimination A uristic Space Search RECENT ADVA k structures for earning in neural	chical clusterels. RACTION In through f ption; Stoch RNING Aff earning system (gorithm; In ANCES IN I pattern recogniter recogniter recogniter recogniters)	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia PATTERN ognition; Se	AUCTUR Approxima mars; Stru HON TRI ectives an as; Decisi RECOC Neural n	AL PATTI ation; Binar actural representations EES d Issues, Coon Tree lease GNITION actwork baseing network	ry select esentation oncept L arning -	ion; n. earm Rep	Eleming; oresen	Versi	of 9 ofion n, 9 ors;
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT Neural Unsup	ransforms gramma IV ng Probl s, Candid thm , He V I network ervised I	FEATURE EXT RECOGNITION S - Feature selection rs; Syntactic description of the concept Leaders - Designing Leaders - Designing Leader Elimination A puristic Space Search RECENT ADVA	chical clusterels. RACTION In through f ption; Stoch RNING Aff earning system (gorithm; In ANCES IN I pattern recogniter recogniter recogniter recogniters)	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia PATTERN ognition; Se	AUCTUR Approximate approximat	AL PATTI ation; Binar actural representation of the second	ry select esentation oncept L arning -	earm Rep	Eleming; oresen	Versi utatio	of 9 ofin 9 ors;
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT Neural Unsup patterr	Inference III ransforms gramma IV ng Probl s, Candic thm , He V I networ ervised I	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descrit CONCEPT LEA ems - Designing Lea late Elimination A suristic Space Search RECENT ADVA k structures for earning in neural pers, Pattern classific	chical clusterels. RACTION In through f ption; Stoch RNING Aff earning system (gorithm; In ANCES IN I pattern recogniter recogniter recogniter recogniters)	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia PATTERN ognition; Se	AUCTUR Approximate approximat	AL PATTI ation; Binar actural representations EES d Issues, Coon Tree lease GNITION actwork baseing network	ry select esentation oncept L arning -	Learn Rep	Eleming; voresen	Versi itatio	of 9 of 9 ors;
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT Neural Unsup patterr	Inference III ransforms gramma IV ng Probl s, Candid thm , He V I networ ervised I n classifie	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descrit CONCEPT LEA ems - Designing Lea late Elimination A uristic Space Search RECENT ADVA k structures for earning in neural pers, Pattern classific	chical clusterels. RACTION In through f ption; Stoch RNING Af earning system (gorithm; In h. ANCES IN 1 pattern reconstruction using	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia PATTERN ognition; I gnition; Se Genetic Alg	AUCTUR Approximate approximat	AL PATTI ation; Binar actural representation of the second	ry select esentation oncept L arning - ased patr rks; Fuz.	earm Reportern	Eleming; oresen asso	versionents Versionents versionents	of 9 of 9 ors; 2zzy
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT Neural Unsup patterr COUL At the	Inference III ransforms gramma IV ng Probl s, Candid thm , He V I networ ervised l n classifie RSE OU' end of th	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descrit CONCEPT LEA ems - Designing Lea late Elimination A uristic Space Search RECENT ADVA k structures for earning in neural pers, Pattern classific	chical clusterels. RACTION In through for through for through for through for the ption; Stock and the ption; Stock arning system (gorithm; In the pattern recognition using the pattern recognition using the ption in the ption	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia PATTERN ognition; I gnition; Se Genetic Alg	AUCTUR Approximate approximat	AL PATTI ation; Binar actural representation of the second	ry select esentation oncept L arning - used patterns; Fuzz	earm Rep	Eleming; oresen asso ogic -	Versi Versi viatatio	of 9 ion n, 9 ors; zzzy
Field; UNIT KL Tr formal UNIT Learni Spaces Algori UNIT Neural Unsup patterr	Inference III ransforms gramma IV ng Probl s, Candid thm , He V I networe ervised lead classified RSE OU' end of the identified	FEATURE EXT RECOGNITION S - Feature selections; Syntactic descrit CONCEPT LEA ems - Designing Lea late Elimination A uristic Space Search RECENT ADVA k structures for earning in neural pers, Pattern classific	chical clusterels. RACTION In through five prion; Stoch RNING AN earning system and the pattern reconstruction using ints will be an	AND STR functional a astic gramm ND DECIS ems, Perspe ductive bia PATTERN ognition; Se Genetic Alg	AUCTUR Approximate approximat	AL PATTI ation; Binar actural representation of the second	ry select esentation oncept L arning - ased patr rks; Fuz.	earn Rep	Eleming; oresen asso ogic -	Versi tatio ciato - Fuz ED evel)	9 of 9 ion , 9 ors; 45

CO3	analyze the given data set to extract and select features for pattern	Analyzing (K4)
	recognition.	
CO4	apply the decision tree and concept learning techniques.	Applying (K3)
CO5	use the concepts of recent advances in various applications.	Applying (K3)

- 1. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
- Morton Nadier and Eric Smith P., "Pattern Recognition Engineering", John Wiley & Sons, New York, 1993.
- 3. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
- Tou and Gonzalez, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) $(1/2/3 \ indicates \ the \ strength \ of \ correlation) \ 3-Strong \ , 2-Medium \ , 1-Weak$

		PC)'s		
PO1	PO2	PO3	PO4	PO5	PO6
2	-	1	1	1	1
2	-	1	1	1	1
2	-	1	1	1	1
	-	1	1	1	1
2		1	1	1	1
	PO1 2 2 2 2 2 2 2	PO1 PO2 2 - 2 - 2 - 2 -		PO's PO1 PO2 PO3 PO4 2 - 1 1 2 - 1 1 2 - 1 1 2 - 1 1 2 - 1 1	not pot pos



3158	COMMUNICATION PROTOCOLS FOR IOT	3	0 0	3				
RSE OB.	JECTIVES							
able the s	tudents to							
know t	ne IoT data link protocol.							
underst								
acquire								
1				9				
		gbee S	mart En	ergy;				
Γerm Eva	aluation A; LORAWAN.			1				
П	NETWORK LAYER LINK PROTOCOL			9				
ng Protoc	ol for Low power Lossy Networks; CORPL; 6LoWPAN; Dynamic	Host C	Configu	ation				
ol; IPV6								
III	SESSION LAYER PROTOCOLS			9				
5.4, 6LoV	VPAN , Application Layer	T Prote	ocols - I					
7.77.200	a sum plice to contrat the medium of the contration of the contrat			9				
erry PI -	Setting up web services; Publishing to web services; Case Stu			C-1-1				
rial Auto City.	omation and Building automation, Connected Car, Connected Hor							
City.	IoT APPLICATIONS	me, Di	gital H	ealth,				
City. Vare for t	IoT APPLICATIONS he IoT; Classes of Constrained Devices; Hardware Platforms; T	me, Di	gital He	9 a Z1,				
City. Vare for t	IoT APPLICATIONS	me, Di	gital He	9 a Z1,				
City. V vare for t Mote, A	IoT APPLICATIONS he IoT; Classes of Constrained Devices; Hardware Platforms; T	me, Di	gital He	9 a Z1,				
City. V vare for t Mote, A	IoT APPLICATIONS he IoT; Classes of Constrained Devices; Hardware Platforms; Trduino; Intel Galileo; Raspberry Pi; Software for the IoT - Open WS	me, Di	gital He	9 a Z1,				
City. V vare for t Mote, An , RIOT, C	IoT APPLICATIONS the IoT; Classes of Constrained Devices; Hardware Platforms; Torduino; Intel Galileo; Raspberry Pi; Software for the IoT - Open WS Contiki OS	relosB;	gital He	9 a Z1, Free				
V vare for t Mote, An , RIOT, C	IoT APPLICATIONS the IoT; Classes of Constrained Devices; Hardware Platforms; Torduino; Intel Galileo; Raspberry Pi; Software for the IoT - Open WS Contiki OS TOTAL PERIO	relosB; SN, Ti	Zolertiany OS ,	9 a Z1, Free 45				
V vare for t Mote, Ai , RIOT, C	IoT APPLICATIONS he IoT; Classes of Constrained Devices; Hardware Platforms; Trduino; Intel Galileo; Raspberry Pi; Software for the IoT - Open WS Contiki OS TOTAL PERIO TCOMES is course, the students will be able to	TelosB; SN, Ti DDS BT M (Higher	Zolertiany OS ,	9 a Z1, Free 45				
V vare for t Mote, An , RIOT, C RSE OUT end of th	IoT APPLICATIONS he IoT; Classes of Constrained Devices; Hardware Platforms; Trduino; Intel Galileo; Raspberry Pi; Software for the IoT - Open WS Contiki OS TOTAL PERIO TCOMES is course, the students will be able to arize the protocols in IoT Data Link Layer. Un	TelosB; SN , Ti DDS BT M (Highenderstan	Zolertiany OS ,	9 a Z1, Free 45				
V vare for t Mote, An RSE OUT end of th analyz	IoT APPLICATIONS the IoT; Classes of Constrained Devices; Hardware Platforms; Torduino; Intel Galileo; Raspberry Pi; Software for the IoT - Open WS Contiki OS TOTAL PERIO TCOMES tis course, the students will be able to arize the protocols in IoT Data Link Layer. Under the protocols used in network Layer. And Constrained Devices; Hardware Platforms; Torduino;	TelosB; SN, Ti DDS BT M (Highenderstan	Zolertiany OS ,	9 a Z1, Free 45 0 11)				
V vare for t Mote, An , RIOT, C RSE OUT end of th summa analyz illustra	IoT APPLICATIONS the IoT; Classes of Constrained Devices; Hardware Platforms; Torduino; Intel Galileo; Raspberry Pi; Software for the IoT - Open WS Contiki OS TOTAL PERIO TCOMES tis course, the students will be able to arize the protocols in IoT Data Link Layer. The the protocols used in network Layer. Under the session layer protocols and security in IoT protocols. Under the protocols.	TelosB; SN, Ti DDS BT M (Highenderstan	Zolertiany OS , IAPPER est Levending (kg (K4) ending (kg)	9 a Z1, Free 45 0 11)				
1	RSE OB. able the s know the learn abounderst build the acquire of the second s	RSE OBJECTIVES able the students to know the IoT data link protocol. learn about the different concepts of network layer link protocol. understand the theory of session layer protocols. build the IoT solutions for various services. acquire knowledge about IoT in hardware and software. I IoT DATA LINK PROTOCOL 802.15.4; IEEE 802,11; Wireless HART; Z-Wave; Bluetooth Low Energy; Zifferm Evaluation A; LORAWAN. II NETWORK LAYER LINK PROTOCOL ag Protocol for Low power Lossy Networks; CORPL; 6LoWPAN; Dynamic col; IPV6. III SESSION LAYER PROTOCOLS ge Queuing Telemetry Transport; Advanced Message Queuing Protocol Protocol Extensible Messaging and Presence Protocol; Security in Iof 5.4, 6LoWPAN, Application Layer IV BUILDING IoT SOLUTIONS	RSE OBJECTIVES able the students to know the IoT data link protocol. learn about the different concepts of network layer link protocol. understand the theory of session layer protocols. build the IoT solutions for various services. acquire knowledge about IoT in hardware and software. I IoT DATA LINK PROTOCOL 802.15.4; IEEE 802,11; Wireless HART; Z-Wave; Bluetooth Low Energy; Zigbee S Term Evaluation A; LORAWAN. II NETWORK LAYER LINK PROTOCOL ag Protocol for Low power Lossy Networks; CORPL; 6LoWPAN; Dynamic Host Col; IPV6. III SESSION LAYER PROTOCOLS ge Queuing Telemetry Transport; Advanced Message Queuing Protocol; cation Protocol Extensible Messaging and Presence Protocol; Security in IoT Protocol, 24, 6LoWPAN, Application Layer	RSE OBJECTIVES able the students to know the IoT data link protocol. learn about the different concepts of network layer link protocol. understand the theory of session layer protocols. build the IoT solutions for various services. acquire knowledge about IoT in hardware and software. I IoT DATA LINK PROTOCOL 802.15.4; IEEE 802,11; Wireless HART; Z-Wave; Bluetooth Low Energy; Zigbee Smart Enform Evaluation A; LORAWAN. II NETWORK LAYER LINK PROTOCOL ng Protocol for Low power Lossy Networks; CORPL; 6LoWPAN; Dynamic Host Configuration; IPV6. III SESSION LAYER PROTOCOLS ge Queuing Telemetry Transport; Advanced Message Queuing Protocol; Construction Protocol Extensible Messaging and Presence Protocol; Security in IoT Protocols - No. 4, 6LoWPAN, Application Layer				

- Tsiatsis, Vlasios, Stamatis Karnouskos, Jan Holler, David Boyle, and Catherine Mulligan "Internet of Things: Technologies and applications for a new age of intelligence", Academic Press, 2019.
- Lea, Perry," Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security", Packt Publishing Ltd, 2018.
- Minoli, Daniel, "Building the internet of things with IPv6 and MIPv6: The evolving world of M2M communications", John Wiley and Sons, 2013
- 4. Peter Waher "Learning Internet of Things" Packt Publishing, 2015.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) $(1/2/3 \ indicates \ the \ strength \ of \ correlation) \ 3-Strong \ , 2-Medium \ , 1-Weak$

T	10		PC)'s		
COs _	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	1	1	1	1
CO2	2	-	1	1	1	1
CO3	2		1	1	1	1
CO4	2		1	1	1	1
CO5	2	-	1	1	1	1



PCS23159	SATELLI	TE COMMUNICATION AND NAVIGATION SYSTEMS	3	0	0	3
COURSE OB	JECTIVES					
To enable the s	tudents to					
1. learn th	ne overview of the	ne satellite communication.				
2. underst	and M2M devel	opments and satellite applications.				
3. acquire	knowledge abo	ut satellite communication in IPv6 environment.				
4. know tl	he concepts of s	atellite navigation and global positioning system.		_		
5. underst	and deep space	networks				
UNIT I	OVERVIEW	OF SATELLITE COMMUNICATION		T		9
Overview of s	atellite commun	nication and orbital mechanics; Link budget Paran	neters;	Lin	k buc	lget
calculations; A	uxiliary Equatio	ons; Performance Calculations.				
UNIT II	M2M DEVE	LOPMENTS AND SATELLITE APPLICATION	S	-		9
Occamilant of th		Line and MOM MOM Analization Francisco	d Sate	ellite	Supr	ort
		hings and M2M - M2M Applications, Examples an applications, Antennas for Satellite M2M Applicat		M2N	1 Ma	
Satellite Roles Opportunities f Satellites and K	Context and A For Satellite Ope Ca/Ku Spot Bear	applications, Antennas for Satellite M2M Applicat rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Se	ions, s; Hig ervices	h Th		rket
Satellite Roles Opportunities f	Context and A For Satellite Ope Ca/Ku Spot Bear	applications, Antennas for Satellite M2M Applicat rators; Ultra HD Video/TV and Satellite Implication	ions, s; Hig ervices	h Th		rket
Satellite Roles Opportunities f Satellites and K UNIT III	Context and A For Satellite Ope Ka/Ku Spot Bear SATELLITE	applications, Antennas for Satellite M2M Applicat rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Se	ions, s; Hig ervices	gh Th	rough	rket nput
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP	Context and A for Satellite Ope Ca/Ku Spot Bear SATELLITE Ov6 and its benefit	Applications, Antennas for Satellite M2M Applications rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Section COMMUNICATION IN IPV6 ENVIRONMENT	ions, s; Hig ervices	th Thes.	rough	rket iput 9
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and	Context and A For Satellite Ope Ka/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepar	applications, Antennas for Satellite M2M Applications; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Section COMMUNICATION IN IPV6 ENVIRONMENT Fits for Satellite Networks - Migration and Coexistence	ions, s; Hig ervices	th Thes.	nenta Prote	put 9 tion
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6;	Context and A For Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepare Impact of IPv	Applications, Antennas for Satellite M2M Applications, and Satellite Implication on Technologies; Aeronautical, Maritime, Mobility Section COMMUNICATION IN IPV6 ENVIRONMENT of Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite	ions, s; Hig ervices	th Thes.	nenta Prote	put 9 tion
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6;	Context and A For Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepar Impact of IPv constration over	Applications, Antennas for Satellite M2M Applications rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Set COMMUNICATION IN IPV6 ENVIRONMENT at Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services- I	ions, s; Hig ervices	th Thes.	nenta Prote	put 9 tion
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem	Context and A For Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepar Impact of IPv constration over	applications, Antennas for Satellite M2M Applications, rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Section COMMUNICATION IN IPV6 ENVIRONMENT at Satellite Networks - Migration and Coexistence at ions for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services- I satellites - Key results and recommendations.	ions, s; Hig ervices	th Thes.	nenta Prote	9 tion pocol
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV	Context and A For Satellite Ope Ka/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepar Impact of IPv constration over SATELLITE SYSTEM	applications, Antennas for Satellite M2M Applications, rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Section COMMUNICATION IN IPV6 ENVIRONMENT at Satellite Networks - Migration and Coexistence at ions for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services- I satellites - Key results and recommendations.	ions, s; Hig ervices ce In te spe Detaile	nplen cific ded tra	nenta Prote	9 tion ocol onal
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of Ra	Context and A For Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepar Impact of IPv constration over SATELLITE SYSTEM adio and Satelline	Applications, Antennas for Satellite M2M Applications, and Satellite Implication on Technologies; Aeronautical, Maritime, Mobility Set COMMUNICATION IN IPV6 ENVIRONMENT of Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services-I satellites - Key results and recommendations. NAVIGATION AND GLOBAL POSITIONING	ions, s; Hig ervices ce In te spe Detaile	nplen cific ded tra	nenta Prote ansitie	9 gnal
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of Ranch Requisition; M	Context and A for Satellite Ope Ca/Ku Spot Bear SATELLITE V6 and its benefit support- Prepar Impact of IPv constration over SATELLITE SYSTEM adio and Satellite athematical modern	Applications, Antennas for Satellite M2M Applicate rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Set COMMUNICATION IN IPV6 ENVIRONMENT at Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services-I satellites - Key results and recommendations. NAVIGATION AND GLOBAL POSITIONING the Navigation; GPS Principles; Signal model and Coexistence at Satellites - Key results and recommendations.	ions, s; Hig ervices ce In te spe Detaile	nplen cific ded tra	nenta Prote ansitie	9 gnal
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of Ranch Requisition; M	Context and A For Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepare Impact of IPv constration over SATELLITE SYSTEM adio and Satellite athematical mode Differential GPS	Applications, Antennas for Satellite M2M Application rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Section of Communication in IPV6 ENVIRONMENT in Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services- I satellites - Key results and recommendations. INAVIGATION AND GLOBAL POSITIONING the Navigation; GPS Principles; Signal model and Coefficient of GPS observables; Methods of processing GPS delayed and GPS observables; Methods of processing GPS	ions, s; Hig ervices ce In te spe Detaile des; S data;	nplen cific datelli	nenta Prote ansitie	9 tion put 9 gnal
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of R Acquisition; M Operation and I UNIT V	Context and A For Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepar Impact of IPv constration over SATELLITE SYSTEM adio and Satellite athematical mod Differential GPS DEEP SPAC	Applications, Antennas for Satellite M2M Application rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Section COMMUNICATION IN IPV6 ENVIRONMENT its for Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services-Insatellites - Key results and recommendations. ENAVIGATION AND GLOBAL POSITIONING the Navigation; GPS Principles; Signal model and Coefficient of GPS observables; Methods of processing GPS is; IRNSS, GAGAN, GLONASS.	ions, s; Hig ervices ce In te spe Detaile des; S data;	npplen ccific dd tra	nenta Proto nensitio	9 gnal iver
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of Ra Acquisition; M Operation and I UNIT V Introduction, F	Context and A for Satellite Ope Ca/Ku Spot Bear SATELLITE V6 and its benefit support- Prepar Impact of IPv constration over SATELLITE SYSTEM adio and Satellite athematical mode Differential GPS DEEP SPAC Functional description	Applications, Antennas for Satellite M2M Applicate rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Set COMMUNICATION IN IPV6 ENVIRONMENT atts for Satellite Networks - Migration and Coexistent ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services-I satellites - Key results and recommendations. NAVIGATION AND GLOBAL POSITIONING ate Navigation; GPS Principles; Signal model and Coexistent at Navigation; GPS Principles; Signal model at Navigation; GPS Principles; Signal model at Navigation; GPS Principles; Signal model at Navig	ions, s; Hig ervices ce In te spe Detaile des; S data;	nplen reific ed tra	nenta Proto ansitio	9 gnal iver 9
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of Ra Acquisition; M Operation and I UNIT V Introduction, F Rover Mission	Context and A for Satellite Ope Ca/Ku Spot Bear SATELLITE To 6 and its benefit support- Prepare Impact of IPv constration over SATELLITE SYSTEM adio and Satellite athematical moduliferential GPS DEEP SPAC Functional descriptions of the support of	Applications, Antennas for Satellite M2M Application rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Set COMMUNICATION IN IPV6 ENVIRONMENT its for Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services-I satellites - Key results and recommendations. NAVIGATION AND GLOBAL POSITIONING ite Navigation; GPS Principles; Signal model and Coexistence of GPS observables; Methods of processing GPS is; IRNSS, GAGAN, GLONASS. E NETWORKS AND INTER PLANETARY MISTIPLION, Design procedure; performance criterion;	ions, s; Hig ervices ce In te spe Detaile des; S data; SSION Mars	npplen cific datelli	nenta Proto ansitio	9 gnal iver 9 gnal iver 9 gnal iver
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of Ra Acquisition; M Operation and I UNIT V Introduction, F Rover Mission Telecom subsy	Context and A for Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support. Prepar Impact of IPv constration over SATELLITE SYSTEM adio and Satellite athematical mode Differential GPS DEEP SPAC Functional descriptions of the system; Link per Statellite system; Link per S	Applications, Antennas for Satellite M2M Application rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Set COMMUNICATION IN IPV6 ENVIRONMENT its for Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services-I satellites - Key results and recommendations. NAVIGATION AND GLOBAL POSITIONING ite Navigation; GPS Principles; Signal model and Coexistence of GPS observables; Methods of processing GPS is; IRNSS, GAGAN, GLONASS. E NETWORKS AND INTER PLANETARY MISTER PLANETARY MIS	des; S data; SSION Mars Groun are; C	nnplen cific datelli GPS	nenta Proto tte Sig Rece	9 gnal iver 9 gnal iver 9 ion; em; n-1
Satellite Roles Opportunities f Satellites and K UNIT III Overview of IP scenarios and s issues in IPv6; plan- IPv6 dem UNIT IV Overview of Ra Acquisition; M Operation and I UNIT V Introduction, F Rover Mission Telecom subsy Mission - Miss	Context and A for Satellite Ope Ca/Ku Spot Bear SATELLITE Pv6 and its benefit support- Prepare Impact of IPv constration over SATELLITE SYSTEM adio and Satellite athematical mood Differential GPS DEEP SPAC Functional description, spacecraft supports on	Applications, Antennas for Satellite M2M Application rators; Ultra HD Video/TV and Satellite Implication in Technologies; Aeronautical, Maritime, Mobility Section of Communication in Technologies; Aeronautical, Maritime, Mobility Section of Communication in Technologies; Aeronautical, Maritime, Mobility Section of Technologies; Aeronautical, Maritime, Mobility Section of Communication in Technologies; Aeronautical, Maritime, Mobility Section of Satellite Networks - Migration and Coexistence ations for IPv6 in Satellite communication; Satellite on Satellite Network architecture and services-Insatellites - Key results and recommendations. ENAVIGATION AND GLOBAL POSITIONING of the Navigation; GPS Principles; Signal model and Coexistence of GPS observables; Methods of processing GPS of the Section of the Navigation, GPS Principles; Signal model and Coexistence of the Navigation; GPS Principles; Signal model and Coexistence of GPS observables; Methods of processing GPS of the Navigation, GPS Principles; Signal model and Coexistence of GPS observables; Methods of processing GPS of the Navigation of GPS observables; Methods of processing GPS of the Navigation of the Navigation of the Navigation of GPS observables; Methods of processing GPS of the Navigation	des; S data; Ground Ground	atelli GPS IS Sexped Subhanded Subh	nenta Proto tte Się Rece	9 gnal iver 9 gnal iver 9 gnal iver

COUR	SE OUTCOMES	BT MAPPED
At the	end of this course, the students will be able to	(Highest Level)
CO1	elaborate concepts of satellite communication.	Understanding (K2)
CO2	design antenna for various applications.	Applying (K3)
CO3	analyse the IPv6 environment.	Analyzing (K4)
CO4	explain about satellite navigation and GPS.	Understanding (K2)
CO5	analyse the different case studies of satellite mission.	Analyzing (K4)
CO5	analyse the different case studies of satellite mission.	

- 1. Adimurthy.V," Concept design and planning of India's first interplanetary mission", Current Science, Vol. 109, No. 6, 1054 25, 2015.
- 2. Anil K. Maini, Varsha Agrawal, 'Satellite Technology: Principles and Applications', Third Edition, Wiley, 2014.
- 3. Daniel Minoli' "Innovations in Satellite Communication and Satellite Technology" Wiley, 2015
- 4. Daniel Minoli, "Satellite Systems Engineering in an IPv6 Environment", CRC Press, First Edition, 2009.

			PC	O's		
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	1	1	1	1
CO2	2	-	1	1	1	1
CO3	2	-	1	1	1	1
CO4	2	-	1	1	1	1
CO5	2	-	1	1	1	1



1 002	23160	OPTIMIZATION TECHNIQUES	3	0	0	3
COUR	RSE OB	JECTIVES				
To ena	ble the s	students to				
1.	explain	the theory of classical optimization techniques.				
2.	learn al	bout linear programing.				
3.	underst	and the concepts in non-linear programing.				29-111
4.	acquire	knowledge about dynamic programing process.				
5.	be fami	iliar with modern optimization methods.				
UNIT	I	CLASSICAL OPTIMIZATION TECHNIQUES				9
prograi	mming p	Equipment of the control of the cont	consti	raints	; con	
UNIT		LINEAR PROGRAMMING d - Definitions and Theorems , Solution of a System of Linear Simul			1172	9
Pivotal		ion of a General System of Equations, Two Phases of the Simplex	Mei	hod;	Dua	ity;
Sensiti	vity, Po	st optimality Analysis; Karmarkar's Interior Method.				
UNIT	111	st optimality Analysis; Karmarkar's Interior Method. NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique	ies -	Dire	ct sea	9 arch
UNIT Elimina method	III ation me ds- Indir ds.	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct				rect
UNIT Elimina method method	III ation me ds- Indir ds. IV	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING	metl	nods,	Indi	rect
Elimina method method UNIT Multist procedu	ation meds- Indirectly IV tage decure in controls	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic	metl	nods,	Indi	rect 9 onal
Elimina method method UNIT Multist procedu	ation meds- Indirectly IV tage decure in couous Dy	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optima	metl	nods,	Indi	9 9 9 9 9 9 9 9 9
Elimina method method UNIT Multist procedu Continu	ation medis- Indirectly IV tage decirate in couous Dy	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming.	lity;	comp	Indi	9 onal ing;
Elimina method method UNIT Multist procedu Continu UNIT	ation meds- Indirectly large decourse in a course by the Course of the C	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming. MODERN OPTIMIZATION METHODS	lity; mic l	comp	Indi outatio amm	9 9 onal ling; 9 ion;
Elimina method method UNIT Multist procedu Continu UNIT Genetic	ation meds- Indirectly IV tage decure in course by V c Algorial Aspec	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming. MODERN OPTIMIZATION METHODS ithms; Simulated annealing; Particle Swarm optimization; Ant co	lity; mic l	comp	Indi outatio amm	9 9 onal ling; 9 ion;
Elimina method method UNIT Multist procedu Continu UNIT Genetic	ation meds- Indirectly IV tage decure in course by V c Algorial Aspec	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming. MODERN OPTIMIZATION METHODS ithms; Simulated annealing; Particle Swarm optimization; Ant concept of Optimization; Reduction of Size of an Optimization Problem	lity; mic lony	comp	Indi outatio amm	9 ponal ing; 9 yysis
Elimina method method UNIT Multist procedu Continu UNIT Genetic Technic	ation meds- Indirectly large decourse in a cuous Dy Vac Algorial Aspectagues, Decours, Decours, Decours Decour	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming. MODERN OPTIMIZATION METHODS ithms; Simulated annealing; Particle Swarm optimization; Ant concept of Optimization; Reduction of Size of an Optimization Problem erivatives of Eigenvalues and Eigenvectors.	metl	comp	Indi uutatid amm mizat eanal	9 ponal ing; 9 yysis
Elimina method method UNIT Multist procedu Continu UNIT Genetic Technic	ation meds- Indirectly large deciration of the large d	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming. MODERN OPTIMIZATION METHODS ithms; Simulated annealing; Particle Swarm optimization; Ant concept of Optimization; Reduction of Size of an Optimization Problem erivatives of Eigenvalues and Eigenvectors. TOTAL PERIOR TROMES	metl	optin	Indi uutatio amm mizat eanal	9 9 9 ion; 9 45
Elimina method method UNIT Multist procedu Continu UNIT Genetic Technic	ation meds- Indirectly Individual Indirectly Individual Individual Individual Individual Individual Indirectly Individual	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming. MODERN OPTIMIZATION METHODS ithms; Simulated annealing; Particle Swarm optimization; Ant concept of Optimization; Reduction of Size of an Optimization Problem errivatives of Eigenvalues and Eigenvectors. TOTAL PERIOD TCOMES his course, the students will be able to	metllity; emic llony llony BT i	optin	Indi uutatid aamm mizat eanal	9 9 9 ion; ysis
Elimina method method UNIT Multist procedu Continu UNIT Genetic Technic COUR	ation meds- Indirectly Individual Indirectly Individual Individual Individual Individual Individual Individual Individual Individual Indirectly Individual	NON-LINEAR PROGRAMMING ethods; Interpolation methods; Unconstrained optimization technique rect search methods; Constrained Optimization methods - Direct DYNAMIC PROGRAMMING ision process; Concept of sub optimization and principle of optimal dynamic programming; Linear Programming as a Case of Dynamic Programming. MODERN OPTIMIZATION METHODS ithms; Simulated annealing; Particle Swarm optimization; Ant concepts of Optimization; Reduction of Size of an Optimization Problem errivatives of Eigenvalues and Eigenvectors. TOTAL PERIOD TCOMES his course, the students will be able to attended annealing and Eigenvectors. Uncomes Uncomes Total period	metllity; mic llony DS BT! (High	optin optin optin optin and	Indi uutatid amm mizat eanal PED evel g (KZ	9 ponal ing; 9 ion; ysis

CO4	apply the concepts of dynamic programming.	Applying (K3)
CO5	execute modern optimization methodologies.	Applying (K3)
REFE	RENCES	

- and Sons, 2009
- 2. Xin-Sie Yang, "Nature Inspired Optimization Techniques", Elsevier, 2014.
- 3. Edwin K P Chong and Stanislaw S Zak, "An Introduction to Optimization", 4th Edition, John Wiley and Sons, 2013
- 4. Chander Mohan, Kusum Deep," Optimization Techniques" New Age Science, 2009

COs		PO's						
COs	PO1	PO2	PO3	PO4	PO5	PO6		
COI	2	-	1	1	1	1		
CO2	2	-	1	1	1	1		
CO3	2	-	1	1	1	1		
CO4	2	-	1	1	1	1		
CO5	2	-	1	1	1	1		



C C X 1 X	23161	DIGITAL COMMUNICATION RECEIVERS	3	0	0	3
COUL	RSE OBJ	ECTIVES				
To ena	ble the st	tudents to				
1.	underst	and the baseband communication concepts.				
2.	know a	bout the pass band communication over time invariant channels.				
3.	acquire	knowledge about the synchronization algorithms.				
4.	learn ab	out the performance of synchronizers with feedback systems.				
5.	explore	about the characterization of selective fading channels.				
UNIT	I	BASEBAND COMMUNICATION				9
circuit		Digital baseband communication-Baseband PAM; Clock Synchroracking and spectral - line generating synchronizers; Squaring a				
UNIT	II	PASSBAND COMMUNICATION OVER TIME INVARIA	NT	T		9
		CHANNELS				
Passba	and Tran	nsmission-Transmission methods, Channel Transceiver mod	del; Cha	nnel	moo	lels;
Receiv	vers for	PAM-Timing Recovery, Phase Recovery; Optimum ML re	eceivers;	Sync	chron	ized
detecti	ion; Digit	al matched filter.				
UNIT	Ш	SYNTHESIS OF SYNCHRONIZATION ALGORITHMS				9
ML sy	ynchroniz	ation algorithms - NDA Timing Parameter Estimation -DD ar	nd NDA;	Tim	ing E	rror
Feedb	ack Syste	ms - Phasor-Locked Loop; NDA Carrier Phasor Estimation.				
UNIT	IV	PERFORMANCE ANALYSIS OF SYNCHRONIZERS				9
Perfor	mance an	lalysis of carrier and symbol synchronizers; Decision-Directed Sy	ymbol Sy	nchre	onizaí	tion.
	ing Perfo	ormance Comparison; Feedback and feed forward synchron	nizers; C	'ycle	slip	
Tracki		ormance Comparison; Feedback and feed forward synchron carrier phase and symbol timing.	nizers; C	Ycle	slip	
Tracki	sition of o				slip	
Tracki Acqui UNIT	sition of o	carrier phase and symbol timing. PARAMETER SYNCHRONIZATION FOR SELECTIVE	FADING	3		ping 9
Tracki Acqui UNIT	v v g channel	carrier phase and symbol timing. PARAMETER SYNCHRONIZATION FOR SELECTIVE CHANNELS	FADING	inels;	; Opt	ping 9
Tracki Acquir UNIT	v g channel ers for de	PARAMETER SYNCHRONIZATION FOR SELECTIVE CHANNELS Is; Statistical characterization; Flat and frequency selective factors.	FADING	inels;	; Opt	ping 9
Tracki Acqui UNIT Fading	v g channel ers for de	PARAMETER SYNCHRONIZATION FOR SELECTIVE CHANNELS Is; Statistical characterization; Flat and frequency selective factorization and synchronization parameter estimation; Realizate	FADING	inels;	; Opt	ping 9
Tracki Acquir UNIT Fading receiv for syn	g channel ers for denchronize	PARAMETER SYNCHRONIZATION FOR SELECTIVE CHANNELS Is; Statistical characterization; Flat and frequency selective factata detection and synchronization parameter estimation; Realized detection.	FADING ding chan able received	nnels;	; Opt	9 imal cures
Tracki Acqui UNIT Fading receiv for syn	g channel ers for danchronize	PARAMETER SYNCHRONIZATION FOR SELECTIVE CHANNELS Is; Statistical characterization; Flat and frequency selective factata detection and synchronization parameter estimation; Realized detection. TOTAL PER	FADING ding chan able received RIODS BT	mnels;	; Opti	9 imal cures
Tracki Acqui UNIT Fading receiv for syn	g channel ers for danchronize	PARAMETER SYNCHRONIZATION FOR SELECTIVE CHANNELS Is; Statistical characterization; Flat and frequency selective factate detection and synchronization parameter estimation; Realized detection. TOTAL PER TCOMES	FADING ding chan able received RIODS BT	mnels; iver s	; Optistruct PPED Level	9 imal cures

CO3	use the synchronization algorithms for various applications.	Applying (K3)
CO4	analyze the generation and detection of symbol synchronizers.	Analyzing (K4)
CO5	design the parameters of flat and frequency selective fading channels.	Applying (K3)

- H.Meyer , M. Moeneclaey, and S. A. Fechtel, "Digital Communication Receivers", Wiley, 1998.
- U.Mengali, A.N.D.Andrea, "Synchronization Techniques for Digital Receivers", Kluwer, 1997.
- 3. H.Meyer, G.Ascheid, "Synchronization in Digital Communications", John Wiley, 1990.
- N.Benuveruto, G.Cherubini, "Algorithms for Communication Systems and its Applications", Wiley, 2002.

		PO's						
COs	PO1	PO2	PO3	PO4	PO5	PO6		
COI	2	-	1	1	1	i		
CO2	2	-	1	1	1	1		
CO3	2	-	1	1	1	1		
CO4	2	_	1	1	1	1		
CO5	2	-	1	1	1	1		



PCS23162	SOFT COMPUTING AND MACHINE LEARNING	3	0	0	3
COURSE C	DBJECTIVES				
	e students to			single la rrent Ne dine learr cture; Morol schen	
	erstand the basics of artificial neural network.				
			nd single I current Ne Online lear		
	the concepts of modelling and control of neural and fuzzy control	scnemes.			
	v about fuzzy set theory.			ngle I ent Ne elearn are; M schei zzifica liariza	
	miliar with concepts of machine learning.				
5. acqu	ire knowledge about linear methods for classification.				
UNIT I	ARTIFICIAL NEURAL NETWORK				9
Review of f	undamentals - Biological neuron, artificial neuron, activation fur	nction, ar	nd sin	igle 1	ayer
perceptron	Limitation; Multi-layer perceptron - Back Propagation Algori	thm; Red	currer	it Ne	ural
Network; A	daptive Resonance Theory based network; Radial basis function ne	twork; (Online	e lear	ning
algorithms; l	BP through time; RTRL algorithms; Reinforcement learning.				
UNIT II	NEURAL NETWORKS FOR MODELING AND CONTROL	OL	T		9
Modelling o	I f non-linear systems using ANN - Generation of training data; Opti	mal archi	tectur	re; M	odel
	Control of non-linear systems using ANN; Direct and indirect				
	uro controller; Familiarization with neural network toolbox.				
UNIT III	FUZZY SET THEORY		T		9
Modelling o	f non-linear systems using fuzzy models; TSK model; Fuzzy logic	controlle	r; Fuz	zifica	tion
	base; Decision making logic; Defuzzification; Adaptive fuzzy sy				
	ogic toolbox.				
UNIT IV	INTRODUCTION TO MACHINE LEARNING		T		9
	to Machine Learning; Supervised Learning - Support Vector Mach	ines - Ke	rnel N	Metho	nds -
	ed Methods - K-Nearest Neighbours; Unsupervised Learning - Clu				
	rarchical Clustering, Cluster Validity; Reinforcement Learning -	1-6	-		
	emporal Difference Learning	Licinonis	, 1010	act of	1500
					147
UNIT V	LINEAR METHODS FOR CLASSIFICATION				9
_	ression of an Indicator Matrix; Linear Discriminant Analysis	; Logisti	ic Re	gress	ion;
Separating-	Hyper planes; Wavelet Smoothing.				
	TOTAL PE	RIODS			45
COURSE O	UTCOMES	BT	MAP	PED	
At the end o	f this course, the students will be able to	(Hig	hest I	Level)
CO1 ex	plain the basics of artificial neural network.	Underst	andir	ıg (K	2)
CO2 an	alyse the different features of fuzzy logic and their modelling.	Analyzi	ng (k	(4)	

CO3	elaborate the	modelling and	control of neural	networks.	Underst	anding (K2)
CO4	outline the c	oncepts of mach	ine learning.		Underst	anding (K2)
CO5	classify the	different method	s for linear mode	ls.	Analyzi	ing (K4)
REFE	RENCES					
1.	Neural Netwo	rks and Learning	Machines, 3rd e	edition, Simon Ha	aykin, PHI Learn	ing, 2011.
2.	C. Timothy J.	Ross, "Fuzzy Lo	gic with Engine	ering Application	s", McGraw Hil	l Inc., 2021.
3.				Elements of Sta		
J.		110000114111, 3. 1				
	2017.					
4.	Christopher B	ishop, "Pattern F	Recognition and I	Machine Learnin	g", 2016.	
CC	O-PO MAPPING	7 :				
10505						
	Mann	ing of Course Ou	tcomes (CO's) w	ith Programme O	utcomes (PO's)	
				ith Programme O 3 – Strong , 2 – N		k
			th of correlation)	th Programme O 3 – Strong , 2 – M O's		k
COs			th of correlation)	3 - Strong, 2 - N		k PO6
	(1/2/3 ind	licates the streng	th of correlation) PC	3 - Strong, 2 - N	Aedium , 1 – Wea	
CO1	(1/2/3 ind	PO2	th of correlation) PO	3 - Strong, 2 - N	Aedium , 1 – Wea	
CO1	(1/2/3 ind	PO2	PO3	3 - Strong, 2 - N	Aedium , 1 – Wea	PO6
CO1	PO1 2 2	PO2	PO3 PO3 -	3 – Strong , 2 – M D's PO4 –	PO5 I	PO6 1



PCS	23163		COG	GNITIV	E RADI	O NE	TWO	KNS				3	0 0	3
COU	RSE OBJ	IECTIVES												
To er	able the s	tudents to												
1.	unders	tand the fundan	mental	concept	ots of cog	nitive	radio i	netwo	ks.					
2.	develo	p the cognitive	e radio,	, as well	l as techr	iques	for spe	ectrun	hole	detec	ction	that c	ogniti	ve
	radio t	akes advantage	es in o	rder to e	exploit it.									
3.	unders	tand the function	ions of	MAC la	layer and	Netwo	ork lay	er and	d its v	arious	s prot	ocols.		
4.		tand fundamer ement and tradi		ssues re	regarding	g dyna	mic	spectr	um a	ccess.	, the	e rad	io-resc	urce
5.	interpr	et the basics of	f secur	ity mana	agement	and th	e vari	ous at	tacks	& its o	coun	terme	asures	
U	NIT I	INTROE	DUCT	ION TO	O COG	NITIV	E R	ADIO						9
gni	tive radio,	Management, C Spectrum sens problem formu	nsing S nulation	ingle no	ode sensi performar	ng: en	ergy o	letecti based	on, cy	clo st	tation	nary a	nd wa	velet
	1770	ve sensing: diff	fferent	fusion r	rules, wi	debanc	i speci	rum						
NR.	Cooperati	ve sensing: diff	-0-3-1-0-4-0	vetto Williams (two-c		december 11794-1654		0 101 (0000)						9
NR. UNI ntro dlgor chara	Cooperation — duction — cteristics		RUM Soling - Perform	SENSIN - Multibormance mance m	band Sp e Measu measure	TRAI ectrum ectrum re & -Funda	DING Sens Designment	sing - gn Tr al lim	ade-O	ffs :	Rec e-off.	eiver Intro	opera oductio	ther ting n to
UNI Intro algor chara spect econo	Cooperation — duction — cteristics — rum tradi	SPECTR Spectrum Sens Comparison – Throughput F ng, classificationies in DSA (u	RUM S nsing — Performance Performance tion to utility,	SENSIN - Multibormance mance	band Sp e Measu measure	TRAI ectrum ere & Funda	DING Sens Designament	sing - gn Tr al lim	ade-O its and e pri	ffs: I trade eing,	Rec e-off. briet	eiver Intro f disc	opera oductio cussion	ther ting n to on
SNR. UNI Intro algor chara spect econe aucti	Cooperation — ithms — cteristics rum tradi pmics theo pms, concu	SPECTR Spectrum Sens Comparison — Throughput F ng, classificationies in DSA (unrent, sequentia	RUM S sing - Performance Performation to utility, ial)	Multibormance mance manc	band Sp e Measure measure rum tradi	ectrum ere & Funda ing, ra	DING Sens Designament dio refication	sing - gn Tr al lim esource on of a	ade-O its and e pri- auction	ffs: I trade eing, ns (sin	Recoff. brief	eiver Intro f disc	opera oductio cussion	ther ting n to on uble
SNR. UNI Intro algor chara spect econo aucti UNI	Cooperation III	SPECTR Spectrum Sens Comparison – Throughput F ng, classification ories in DSA (unrent, sequentian MAC PR	RUM S sing - Performation to utility, ial) ROTO	Multibormance mance manc	band Sp e Measure- rum tradi n theory),	TRAI ectrum re & Funda ing, ra classi	DING Sens Designament dio refication	sing - gn Tr al lim esource on of a	ade-O its and e pri-	ffs: I trade eing, ns (sin	Recoff.	eeiver Intro f disc auctio	opera oductio cussion ons, do	ther ting n to on uble
Intro algor chara spect econo aucti UNI Func	Cooperation III	SPECTR Spectrum Sens Comparison — Throughput F ng, classificationies in DSA (unrent, sequential MAC PR of MAC protocom	RUM Sensing — Performation to utility, ial) ROTO	Multibormance mance manc	band Sp e Measu measure rum tradi n theory), AND NI	TRAI ectrum ere & Funda ing, ra classi ETWO	DING Designment adio refication ORK L	sing - gn Tr al lim on of a	ade-O its and e pri- uction R DE Inter	ffs: I trade ting, ns (sin	Rece-off.	eiver Intro f disc auctio	opera oduction cussion ons, do	ther ting n to on uble
UNI Intro algoriance chara spect econo Func func func func func func func func f	Cooperation III duction — cteristics for the cooperation of the coope	SPECTR Spectrum Sens Comparison – Throughput F ng, classification ories in DSA (unrent, sequentian MAC PR	RUM Sessing — Performation to utility, ial) ROTO Ocol in utility	Multibormance mance manc	band Sp e Measure rum tradi n theory), AND NI um access n CRAH	TRAI ectrum ire & Funda ing, ra classi ETWO	DING Designament adio reffication ORK L Assiffication	sing - gn Tr al lim esource on of a AYE ation	ade-O its and e pri auction R DE Inter dels —	ffs: I trade ing, is (sin SIGN frame CSM	Recoff. brief	eiver Intro f disc auctio	opera oduction cussion ons, do	ther ting on to on uble
Intro algor chara spect econe aucti UNI Func chall proto	Cooperation III duction — cteristics from tradionics theorems, concurring tradionality of the cooperation o	SPECTR Spectrum Sens Comparison — Throughput Fing, classificationies in DSA (unrent, sequential MAC PR of MAC protocologos — Spectrum CRAHN — Rou	RUM Sensing — Performation to utility, ial) ROTO ocol in utility is outing in the puting in the results of the	Multibormance mance auction COLS A spectrularing in CRN	band Sp e Measu measure rum tradi n theory), AND NI um acces n CRAH	ectrum ectrum re & -Funda ing, ra classi ETWO ss -cla N -Cl alized	DING Designment dio refication ORK L assification RAHN and I	sing – gn Tr al lim esource on of a AYE ation J moo	ade-O its and e pri- uction R DE Inter dels —	ffs: I trade ting, ns (sin SIGN frame CSM protoc	Recoff. brief spale a	eiver Intro f disc auctio	opera oduction cussion ons, do	ther ting n to on uble 9
SNR. UNI Intro algor chara spect econo aucti UNI Func chall proto Proto UNI	Cooperation III duction — ithms — cteristics — rum tradionics theo cons, concurring tionality conges — (cols for (col	SPECTR Spectrum Sens Comparison — Throughput F ng, classificationies in DSA (unrent, sequential MAC PR of MAC protocol OOS — Spectru CRAHN — Rou DYNAM	RUM Sessing — Performation to to to to utility, ial) ROTO peol in the total putting is to the total pu	SENSIN - Multibormance in spectru auction COLS A spectru aring in in CRN	band Sp e Measure rum tradi n theory), AND NI um acces n CRAH N- Centr	TRAI ectrum ire & Funda ing, ra classi ETWO as -cla N -Cl alized	DING Designament adio reffication ORK L assification RAHN and I	sing - gn Tr al lim esource on of a AYE ation I mod Distrib	ade-O its and e pri- uction R DE Inter lels outed	ffs: I trade ting, as (sin SIGN frame CSM protoc MEN	Recoff. brief spanished a span	eiver Intro disc auctio	opera oduction cussion ons, do and M ased M ograph	ther ting on to on uble 9 IAC IAC iical
SNR. UNI Intro algor chara spect econd aucti- UNI Func chall proto Proto UNI Spect	Cooperation III duction — ithms — cteristics — rum tradionics theo ons, concur III cionality of cols for O col IIV rum brok	SPECTR Spectrum Sens Comparison — Throughput Fing, classificationies in DSA (unrent, sequentian MAC PR of MAC protocologo — Spectrum CRAHN — Rou DYNAM er, Dynamic sens	RUM Sessing — Performation to	Multibormance mance manc	band Sp e Measure rum tradi n theory), AND NI um access n CRAH N- Centr	ectrum re & -Funda ing, ra classi ETWO as -cla alized CESS	DING Designament adio refication ORK L AND re- ce	sing - gn Tr al lim esource on of a AYE ation J moo Distrib MAN ntraliz	R DE Interdels - Outed	ffs: I trade	Recoff. brief brief spanished at the spa	eiver Intro f disc auctio	opera	ther ting n to on uble 9 IAC IAC iical 9 ess,
SNR. UNI Intro algor chara spect econe aucti UNI Func chall proto Proto UNI Spect distri	Cooperation III duction — ithms — cteristics — rum tradionics theo cons, concurring cionality of enges — (Cool cool rum brok buted dyn	SPECTR Spectrum Sens Comparison — Throughput Fing, classificationies in DSA (universet, sequential MAC PR of MAC protocologos — Spectrum CRAHN — Rou DYNAM ter, Dynamic semic spectrum	RUM Sessing — Performation to	SENSIN - Multibormance mance	band Sp e Measure measure rum tradin theory), AND NI um access n CRAH N- Centr	ectrum re & Funda ing, ra classi ETWO ss -cla N -Cl alized CESS nitectur tra-RA	DING Designament adio refication ORK L AND re- ce	sing - gn Tr al lim esource on of a AYE ation J moo Distrib MAN ntraliz	R DE Interdels - Outed	ffs: I trade	Recoff. brief brief spanished at the spa	eiver Intro f disc auctio	opera	ther ting n to on uble 9 IAC IAC iical 9 ess,
SNR. UNIT Intro algor chara spect econo aucti UNIT Func chall proto UNIT Spect distri mana	Cooperation III duction — ithms — cteristics from tradionics theorems, concurring the cooperation of the co	SPECTR Spectrum Sens Comparison — Throughput F ng, classificationies in DSA (unrent, sequential MAC PR of MAC protoc QOS — Spectru CRAHN — Rou DYNAM er, Dynamic semic spectrum pectrum sharing	RUM Sessing — Performation to utility, ial) ROTO Decol in utility and in the puting in the puting in the puting in accessing, Spectrum accessing,	SENSIN Multible formance in spectrular auction COLS A spectrular in CRN PECTRU um access, Inter- ectrum in	band Sp e Measure measure rum tradi n theory), AND NI um access n CRAH N- Centr CUM ACc cess arch r- and in mobility	ectrum re & Funda ing, ra classi ETWO ss —cla N —Cl alized CESS nitectur tra-RA issues	DING Designament dio refication ORK L assification AND re- ce N dyn	sing - gn Tr al lim esource on of a AYE ation I mod Distrib MAN ntraliz	R DE Inter lets — AGE ade-O	ffs: I trade ting, as (sin SIGN frame CSM protoc MEN ynami rum a	Recoff. brief brief spanished at the spa	eiver Intro f disc auctio	opera	ther ting n to on to on the ting of the ti
SNR. UNI' Intro algor chara spect econe aucti UNI' Func chall prote UNI' Spect distri mana	Cooperation III duction — ithms — cteristics from tradionics theorems, concurring the cooperation of the co	SPECTR Spectrum Sens Comparison — Throughput F ng, classificationies in DSA (unrent, sequential MAC PR of MAC protoc OOS — Spectru CRAHN — Rou DYNAM ter, Dynamic seamic spectrum pectrum sharing TRUSTE	RUM Sessing — Performation to	SENSIN Multibormance in spectru auction COLS A spectru aring in CRN PECTRUM access, Inter-ectrum in CRNITI	band Sp e Measure rum tradi n theory), AND NI um access n CRAH N- Centr CUM ACc cess arch r- and in mobility TVE RA	TRAI ectrum ire & Funda ing, ra classi ETWO iss —cla N —Cl alized CESS nitectur tra-RA issues	DING Designament dio refication ORK L assification AND re- ce N dyn	sing - gn Tr al lim esource on of a AYE ation I mod Distrib MAN ntraliz	R DE Inter lets — AGE ade-O	ffs: I trade ting, as (sin SIGN frame CSM protoc MEN ynami rum a	Recoff. brief brief span span span span span span span span	eiver Intro f disc auctio	opera	ther ting n to on uble 9 IAC IAC iical 9 ess,
SNR. UNI' Intro algori chara spect econe aucti UNI' Func challe prote UNI' Spect distri mana	Cooperation III duction — ithms — cteristics from tradionics theo ons, concurring Cools for Cool Cool TIV rum broke buted dyn gement, S	SPECTR Spectrum Sens Comparison — Throughput F ng, classificationies in DSA (unrent, sequential MAC PR of MAC protoc QOS — Spectru CRAHN — Rou DYNAM er, Dynamic semic spectrum pectrum sharing	RUM Sessing — Performance Performation to utility, ital) ROTO ocol in utility spectrum accessing, Spectrum	SENSIN Multibormance mance ma	band Sp e Measure rum tradion theory), AND NI um access n CRAH N- Centre Cum ACcess arch r- and in mobility TIVE RA LENGES	ectrum re & Funda ing, ra classi ETWO as -cla N -Cl alized CESS nitectur tra-RA issues	DING Designment dio refication ORK L AND re- ce N dyn NETV	sing - gn Tr al lim esource on of a AYE ation I moo Distrib MAN ntraliz namic	R DE Interded AGE AGE AGE AGE AGE AGE AGE AG	ffs: I trade	Recoff. brief span AA/C cols	ceiver Intro f disc auctio CA ba George	opera	ther ting n to on uble 9 [AC [AC ical 9] ess, rum

 Route Disruption attacks –Jamming attacks –PU Emulation attacks. Network layer and transport layer issues, cross layer design for cognitive radio networks.

	TOTAL PE	RIODS	45
	SE OUTCOMES and of this course, the students will be able to		MAPPED hest Level)
CO1	analyze the fundamental concepts of cognitive radio networks.	Analyzi	ng (K4)
CO2	interpret the basics of various spectrum sensing techniques and algorithms.	Underst	anding (K2)
CO3	evaluate the functions of MAC layer and Network layer and its various protocols.	Analyzi	ng (K4)
CO4	apply the concepts of cooperative spectrum sensing and handoff process.	Applyir	ıg (K3)
CO5	understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.	Underst	anding (K2)

REFERENCES

- Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Hüseyin Arslan, Springer, ISBN 978-1-4020-5541-6 (HB), 2007.
- 2. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.
- 3. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
- 4. Cognitive Radio Technology", by Bruce A. Fette, Elsevier, ISBN 10: 0-7506-7952-2, 2006.

CO-PO MAPPING:

			PC)'s		
COs _	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	1
CO2	1	1	1	1	1	1
CO3	1	1	1	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	1	1	1	1



PCS23164	HIGH PERFORMANCE COMMUNICATION NETWORK	$S \mid 3$	0	0	3
COURSE OBJE					
To enable the stu	idents to				
1. understar	nd the high speed computer network architectures.				
2. understar	nd the concepts of multimedia networking.				
3. study the	e recent network concepts with reference to MPLS and VPN.				
4. study abo	out the mathematical models related to network performance anal	ysis.			
5. comprehe	end the current network management concept.				
UNIT I	SWITCHING NETWORKS				9
	eket switching - Ethernet, Token Ring, FDDI, DQDB, Frame I	Relay 9	SMDS	Cir	cuit
	NET, DWDM, DSL, Intelligent Networks - CATV, ATM -				
	outing, Header Structure, ATM Adaptation layer, Managem				-
		en co	nuoi,	DIS	DIN,
Internetworking	WITH ATM.				
TINITED TY	MAIN THREE IN NETWORKING APPLICATIONS				•
UNIT II	MULTIMEDIA NETWORKING APPLICATIONS			1	9
Streaming stored	Audio and Video, Best effort service, protocols for real time in		15050		ons,
Streaming stored			15050		ons,
Streaming stored	Audio and Video, Best effort service, protocols for real time in		15050		ons,
Streaming stored Beyond best eff	Audio and Video, Best effort service, protocols for real time in		15050		ons,
Streaming stored Beyond best eff services. UNIT III	I Audio and Video, Best effort service, protocols for real time in fort, scheduling and policing mechanism, integrated services,	RSVP	diffe	erenti	ons,
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac	I Audio and Video, Best effort service, protocols for real time in fort, scheduling and policing mechanism, integrated services, ADVANCED NETWORKS CONCEPTS	RSVP /PN.MI	diffe	perat	ons, ated
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac	Advanced Networks Concepts and use of FEC, Traffic Engineering, and MPLS based VPN,	RSVP /PN.MI	diffe	perat	ons, ated
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli	Advanced Networks Concepts and use of FEC, Traffic Engineering, and MPLS based VPN,	RSVP /PN.MI	diffe	perat	ons, ated
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv	ADVANCED NETWORKS CONCEPTS ceess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6.	/PN.Ml	diffe	pperat	ons, ated 9 ion, P2P
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem,	Advanced Networks Concepts and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS	RSVP /PN.MI overlag	PLS-c	operativorks	9 ion, P2P
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing system	ADVANCED NETWORKS CONCEPTS coess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabili	RSVP /PN.MI overlag ty -, M: M/D/1	diffe	operativorks	9 ion, P2P
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing systen models and Batch	ADVANCED NETWORKS CONCEPTS Cocess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabiling, Non-Markovian - Pollaczek-Khinchin Formula and M/G/1,	RSVP /PN.MI overlag ty -, M: M/D/1	diffe	operativorks	9 ion, P2P
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing system models and Batcl UNIT V	ADVANCED NETWORKS CONCEPTS cess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabiling, Non-Markovian - Pollaczek-Khinchin Formula and M/G/1, h-arrival model, Networks of Queues – Burke's theorem and Jack	PN.MI overlay ty -, M. M/D/I son Th	diffe	pperation of the second of the	9 9 1IFO 9 11FO 9
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing system models and Batch UNIT V Network Archite	Addio and Video, Best effort service, protocols for real time in fort, scheduling and policing mechanism, integrated services, ADVANCED NETWORKS CONCEPTS ceess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabilin, Non-Markovian - Pollaczek-Khinchin Formula and M/G/1, h-arrival model, Networks of Queues – Burke's theorem and Jack NETWORK MANAGEMENT & SNMP	PN.MI overlag ty -, M. M/D/I son Th	diffe	pperati vorks iian F iian F	9 ion, P2P 9 IFO nilar 9
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing system models and Batch UNIT V Network Archite	ADVANCED NETWORKS CONCEPTS Cocess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabilin, Non-Markovian - Pollaczek-Khinchin Formula and M/G/1, th-arrival model, Networks of Queues – Burke's theorem and Jack NETWORK MANAGEMENT & SNMP Ecture, SNMP Basics, SNMP Naming and OIDs, MIBs, SNMPV	PN.MI overlag ty -, M. M/D/I son Th	diffe	pperati vorks iian F iian F	9 ion, P2P 9 IFO nilar 9
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing system models and Batch UNIT V Network Archite Syntax and SNM	ADVANCED NETWORKS CONCEPTS Cocess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabilin, Non-Markovian - Pollaczek-Khinchin Formula and M/G/1, th-arrival model, Networks of Queues – Burke's theorem and Jack NETWORK MANAGEMENT & SNMP Ecture, SNMP Basics, SNMP Naming and OIDs, MIBs, SNMPV	rsvp /PN.Ml overlag ty -, M. M/D/l son Th	diffe	pperati vorks iian F iian F	9 ion, P2P 9 IFO nilar 9
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing system models and Batch UNIT V Network Archite Syntax and SNM	Advanced Networks Concepts cess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabilim, Non-Markovian - Pollaczek-Khinchin Formula and M/G/1, th-arrival model, Networks of Queues - Burke's theorem and Jack NETWORK MANAGEMENT & SNMP ceture, SNMP Basics, SNMP Naming and OIDs, MIBs, SNMPV MP, SNMP Tables, SNMP Operations, MIB Browsing, MIB-2	rsvp /PN.MI overlag ty -, M. M/D/I son Th 1 Data , SNM	diffe	pperati vorks ian F - sin 1.	ons, g ion, p2P g IFO nilar N.1 N.1
Streaming stored Beyond best eff services. UNIT III VPN-Remote-Ac Routing, Tunneli connectionsIPv UNIT IV Little's theorem, Queueing system models and Batch UNIT V Network Archite Syntax and SNN Encoding	Advanced Networks Concepts cess VPN, site-to-site VPN, Tunneling to PPP, Security in Ving and use of FEC, Traffic Engineering, and MPLS based VPN, 4 vs. V6. PACKET QUEUES AND DELAY ANALYSIS Birth and Death process, Queueing discipline- Control & stabilim, Non-Markovian - Pollaczek-Khinchin Formula and M/G/1, th-arrival model, Networks of Queues - Burke's theorem and Jack NETWORK MANAGEMENT & SNMP ceture, SNMP Basics, SNMP Naming and OIDs, MIBs, SNMPV MP, SNMP Tables, SNMP Operations, MIB Browsing, MIB-2	rsvP /PN.MI overlag ty -, M. M/D/I son Th l Data , SNM	diffe	operativorks iian F - sin s, AS d AS	9 ion, P2P 9 IFO nilar N.1 45

CO ₂	explain the applications of multimedia networks.	Applying (K3)
CO3	compare the various methods of providing connection-oriented services over an advanced network with reference to MPLS, VPN.	Understanding (K2)
CO4	analyze performance of packet queues and its related analysis	Analyzing (K4)
CO5	explore the concepts of network management.	Understanding (K2)

- 1. J.F. Kurose & K.W. Ross, "Computer Networking- A Top Down Approach Featuring the Internet", Pearson, 6th Edition, 2012.
- 2. Nader F.Mir, "Computer and Communication Networks", Pearson Education, 2nd Edition 2015.
- 3. Peter Dordal, "An Introduction to Computer Networks", Release 1.9.16, 2018.
- 4. Walrand J. Varatya, "High Performance Communication Network", Morgan Kaufmann publishers, 2 nd Edition, 2000

CO-PO MAPPING:

COs			PO*s						
COS	PO1	PO2	PO3	PO4	PO5	PO6			
CO1	2	1	1	1	1	1			
CO2	2	1	1	1	1	1			
CO3	2	1	1	1	1	1			
CO4	2	1	1	1	1	1			
CO5	2	1	1	1	1	1			



To enable the students to 1. understand the antenna radiation characteristics and arrays. 2. enhance the student knowledge in the area of various antenna design. 3. enhance the student knowledge in the area of antenna for practical applications. 4. learn the concept of mutual coupling on antennas, applications and numerical techniques. 5. understand about adaptive array concept. WITTI FUNDAMENTAL CONCEPTS Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity argain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. UNIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobin communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = \(\frac{1}{2}\), Tchebyscheff Array antennas. UNIT II SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic currents as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling-constant Jammer Constant Signal, Compensation of mutual coupling-constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing.	PCS23165	ADVANCED ANTENNA DESIGN	3	0	0	3
nhance the student knowledge in the area of various antenna design. enhance the student knowledge in the area of various antenna design. learn the concept of mutual coupling on antennas, applications and numerical techniques. muderstand about adaptive array concept. INIT I FUNDAMENTAL CONCEPTS Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity an gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. INIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobi communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = ½2, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling-constant Jammer Constant Signal, Compensation of mutual coupling-constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	COURSE OF	JECTIVES		-		
enhance the student knowledge in the area of various antenna design. denhance the student knowledge in the area of antenna for practical applications. learn the concept of mutual coupling on antennas, applications and numerical techniques. muderstand about adaptive array concept. INIT I FUNDAMENTAL CONCEPTS Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity an gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. INIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobic communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plantarrays with d = 3/2, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	To enable the	students to		7		11,11
enhance the student knowledge in the area of antenna for practical applications. Iearn the concept of mutual coupling on antennas, applications and numerical techniques. Inderstand about adaptive array concept. INIT I FUNDAMENTAL CONCEPTS Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity argain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. INIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobin communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = \(\lambda/2\), Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic currents as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	1. unde	stand the antenna radiation characteristics and arrays.				
enhance the student knowledge in the area of antenna for practical applications. learn the concept of mutual coupling on antennas, applications and numerical techniques. muderstand about adaptive array concept. INIT I FUNDAMENTAL CONCEPTS Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity an gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equational radiation integrals and auxiliary potential functions. INIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobic communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = ½2, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic currents as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	2. enhar	ace the student knowledge in the area of various antenna design.				Ī
4. learn the concept of mutual coupling on antennas, applications and numerical techniques. 5. understand about adaptive array concept. UNIT I FUNDAMENTAL CONCEPTS Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity an gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. UNIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobic communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plantarrays with d = λ/2, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.						
UNIT I FUNDAMENTAL CONCEPTS Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity an gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. UNIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobin communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plans arrays with d = \(\lambda \lambda \lambda \lambda \text{, Tchebyscheff Array antennas.} \) UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.				niaue	es.	
Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity at gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. UNIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobic communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = \(\frac{1}{2} \), Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic currents as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.						
Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity at gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. UNIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobic communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = \(\frac{1}{2} \), Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic currents as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	LL.					
gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. UNIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobic communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = \(\lambda \)2, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	UNIT I	FUNDAMENTAL CONCEPTS		T		9
gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation radiation integrals and auxiliary potential functions. UNIT II THIN LINEAR ANTENNAS AND ARRAYS Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobic communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = 1/2, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	Physical conc	ept of radiation, Radiation pattern, near- and far-field regions, reciprocity	v. di	recti	vity a	ını
Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobil communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = \$\frac{1}{2}\$, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic currents as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	35.00 W		18810)II е	quati	OH
communication, small circular loop, N-Element Linear Array, Antenna element spacing without grating lobes, Linear broadside array with non-uniform distributions, Gain of regularly spaced plant arrays with d = 1/2, Tchebyscheff Array antennas. UNIT III SECONDARY SOURCES AND APERTURE ANTENNAS Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV EFFECT OF MUTUAL COUPLING ON ANTENNAS Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	UNIT II	THIN LINEAR ANTENNAS AND ARRAYS				9
Magnetic currents, Duality, Images of electric and magnetic currents, electric and magnetic current as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV	arrays with d	= λ 2, Tchebyscheff Array antennas.				
as sheet sources, Impressed and induced current sources, Induction and equivalence theorems, Field of a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV	UNIT III	SECONDARY SOURCES AND APERTURE ANTENNAS				9
a secondary or Huygens source, Radiation from open end of a coaxial line, Radiation through a aperture in conducting screen, slot antenna. UNIT IV	Magnetic cur	ents, Duality, Images of electric and magnetic currents, electric and magnetic	agne	tic	currer	its
Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	as sheet source	es, Impressed and induced current sources, Induction and equivalence the	eore	ms,	Field	of
Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	a secondary	or Huygens source, Radiation from open end of a coaxial line, Radiat	tion	thro	ough	an
Accounting for mutual effects for dipole array compensation using open-circuit voltage compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	aperture in co	nducting screen, slot antenna.				
compensation using the minimum norm formulation, Effect of mutual coupling- constant Jammer Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	TIMITO IS?					
Constant Signal, Compensation of mutual coupling- constant Jammers, Constant Signal, Result of different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	UNITIV					9
different elevation angle. UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Arra Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.		EFFECT OF MUTUAL COUPLING ON ANTENNAS	ircui	it v	oltage	_
UNIT V ADAPTIVE ARRAY CONCEPT Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	Accounting	For mutual effects for dipole array compensation using open-ci			1.75	es,
Motivation of using Adaptive Arrays, Adaptive Array problem statement, Signal Environment, Array Element Spacing considerations, Array Performance, Concept of optimum Array Processing Recursive Methods for Adaptive Error Processing.	Accounting compensation	EFFECT OF MUTUAL COUPLING ON ANTENNAS for mutual effects for dipole array compensation using open-ci using the minimum norm formulation, Effect of mutual coupling- cor	nstai	nt Ja	ımme	es,
Element Spacing considerations, Array Performance, Concept of optimum Array Processing.	Accounting compensation Constant Signature	EFFECT OF MUTUAL COUPLING ON ANTENNAS for mutual effects for dipole array compensation using open-ci using the minimum norm formulation, Effect of mutual coupling- con al, Compensation of mutual coupling- constant Jammers, Constant Si	nstai	nt Ja	ımme	es, rs,
	Accounting compensation Constant Sign different elever	EFFECT OF MUTUAL COUPLING ON ANTENNAS for mutual effects for dipole array compensation using open-ci using the minimum norm formulation, Effect of mutual coupling- con nal, Compensation of mutual coupling- constant Jammers, Constant Si ution angle.	nstai	nt Ja	ımme	es, rs, of
	Accounting compensation Constant Sign different elever UNIT V Motivation of Element Spa	EFFECT OF MUTUAL COUPLING ON ANTENNAS for mutual effects for dipole array compensation using open-ci using the minimum norm formulation, Effect of mutual coupling- con nal, Compensation of mutual coupling- constant Jammers, Constant Si nation angle. ADAPTIVE ARRAY CONCEPT Tusing Adaptive Arrays, Adaptive Array problem statement, Signal Envi cing considerations, Array Performance, Concept of optimum Arr	igna iron	nt Ja	esult	of 9

	SE OUTCOMES	BT MAPPED (Highest Level)
	end of this course, the students will be able to	Understanding (K2)
CO1	acquire the knowledge about basic antenna parameters.	Understanding (KZ)
CO2	theoretically analyze wire antennas and arrays.	Understanding (K2)
CO3	identify secondary sources, aperture, broadband and frequency independent antennas.	Applying (K3)
CO4	apply the knowledge of mutual coupling on antennas, applications and numerical techniques.	Applying (K3)
CO5	acquire brief knowledge about adaptive array concept.	Understanding (K2)
REFE	RENCES	
1.	Balanis, C., Antennas, John Wiley and sons (2007) 3rd	
2.	Milligan, Thomas A., Modern Antenna Design 2nd edition, IEEE pt (2005).	
3.	Cambridge University Press 2005.	
4.	Neelakanta, Perambur S., and Chatterjee, Rajeswari, Antennas Skyways: An Exposition on Outdoor and Indoor Wireless Anter	for Information Supe nnas, Research Studie

CO-PO MAPPING:

Press Ltd. (2004).

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) $(1/2/3 \ indicates \ the \ strength \ of \ correlation) \ 3-Strong \ , 2-Medium \ , 1-Weak$

		PO's							
COs _	PO1	PO2	PO3	PO4	PO5	PO6			
CO1	2	2	1	1	2	2			
CO2	2	2	1	1	2	2			
CO3	2	2	1	1	2	2			
CO4	2.	2	1	1	2	2			
CO5	2	2	1	1	2	2			



PCS23166	ULTRA WIDE BAND COMMUNICATIONS	3	0	0	3
COURSE OBJ	ECTIVES				
To enable the s	udents to				
1. learn fu	ndamental concepts related to Ultra wide band.			111	
2. underst	and the channel model and signal processing for UWB.				
3. acquire	knowledge about UWB antennas and regulations.				
4. underst	and UWB signal processing.				
5. learn U	WB antenna applications.				
UNIT I	INTRODUCTION TO UWB		1		9
	lition, FCC Mask, UWB features, Benefits and challenges, U	WB Interi	erenc	e: IF	EE
5.0	erence, Signal to Interference ratio calculation, Interference with				
UNIT II	UWB TECHNOLOGIES AND CHANNEL MODELS				9
	, Pulsed Multiband, Multiband OFDM, features: Complexity,	Power (onsu	mnti	on.
	achievable data rate. MIMO Multiband OFDM, Differenti				
AND MARKET TO SERVICE					
Performance of	characterization, Ultra Wide Band Wireless Channels Char	inel moc	iei:	Impu	ise
Response Mo	deling of UWB Wireless Channels, IEEE UWB channel m	nodel, Pat	h loss	, De	ay
profiles, Time	and frequency modeling				
UNIT III	UWB SIGNAL PROCESSING				9
Data Modulati	on schemes, UWB Multiple Access Modulation, BER, Rak	e Receive	er, Ti	ansn	iit-
Reference (T-I	R) Technique, UWB Range- Data Rate Performance, UWB Ch	nannel Ca	pacity	, UV	VΒ
Wireless Loca	tioning: Position Locationing Methods, Time of Arrival Estim	ation, NL	OS I	Locati	on
Error, Locatio	ning with OFDM				
UNIT IV	UWB ANTENNAS				9
Antenna Requi	rements, Radiation Mechanism of the UWB Antennas, Types o	f Broad b	and a	ntenn	as,
Parameters, A	nalysis of UWB Antennas, Link Budget for UWB System	n. Design	exan	nples	of
broad band UV	VB antennas.				
UNIT V	UWB APPLICATIONS AND REGULATIONS				9
Ultra wideban	I d receiver architecture, Wireless Ad hoc Networking, UWB V	Vireless S	ensor	, RFI	D,
Consumer Ele	ctronics and Personal, Asset Location, Medical applications,	UWB Re	gulat	ion a	ınd
	rious countries, UWB Regulation in ITU, IEEE Standardization				
	TOTAL PE	RIODS			45
COURSE OU	COMES	BT	MAP	PED	- 137
	is course, the students will be able to	(High			
Manager I	stand the basic concepts of UWB.	understa			
under	stand the basic concepts of Owb.	understa	numg	5 (NZ	,

CO2	understand the basic concepts of UWB technologies.	understanding (K2)
CO3	assess the performance of UWB channels.	Applying (K3)
CO4	apply the UWB signal processing.	Applying (K3)
CO5	design UWB antenna for various applications.	Applying (K3)

REFERENCES

- Homayoun Nikookar and Ramjee Prasad, "Introduction to Ultra Wideband for Wireless Communications" 1st Edition, Springer Science & Business Media B.V. 2010.
- 2. Thomas Kaiser, Feng Zheng "Ultra Wideband Systems with MIMO", 1st Edition, John Wiley & Sons Ltd, New York, 2010.
- 3. W. Pam Siriwongpairat and K. J. Ray Liu, "Ultra-Wideband Communications Systems: Multiband OFDM approach" John Wiley and IEEE press, New York 2008.
- 4. Huseyin Arslan,Zhi Ning Chen,Maria-Gabriella Di Benedetto "Ultra Wideband Wireless communication" Wiley-Interscience; 1st edition 2006.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's)
(1/2/3 indicates the strength of correlation) 3 – Strong, 2 – Medium, 1 – Weak

			PO's						
COs	PO1	PO2	PO3	PO4	PO5	PO6			
CO1	2	1	2	2	2	2			
CO2	2	1	2	2	2	2			
CO3	2	1	2	2	2	2			
CO4	2	1	2	2	2	2			
CO5	2	1	2	2	2	2			



		REAL TIME EMBEDDED SYSTEMS		-		
COU	RSE OB	JECTIVES				
To en	able the s	students to				
1.	unders	stand the basics of embedded system and ARM architecture.				
2.		stand the RTOS concepts like scheduling and memory management	t re	lated	d to	th
3.	learn a	about the programming aspects of RTOS.				
4.	learn t	the different protocols of embedded wireless application.				-
5.	study o	concepts involved in the design of hardware and software components for a component of the	or a	an en	nbed	de
UNI	ГІ	INTRODUCTION		T		9
Real	Time Sys	stem – Embedded Systems – Architecture of Embedded System – Simple	Pro	ograi	nmii	19
Micro	controlle					••
UNIT Opera	гп	EMBEDDED/REAL TIME OPERATING SYSTEM stem Concepts: Processes, Threads, Interrupts, Events - Real Time	ne s	Sche	dulir	9 ng
Opera Algor Hand	TII ating Sys rithms - I held De	stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline	ed,	Real	Tin	9 ng
Opera Algor Hand	r II ating Sys rithms - I held De- ocontrolle	stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management – Overview of Operating Systems for Embedde	ed,	Real	Tin	g ne s,
Opera Algor Hand Micro	rII nting Sys rithms - I held De- ocontrolle	EMBEDDED/REAL TIME OPERATING SYSTEM stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline or Operating System Overview. CONNECTIVITY	ed, ux,	Real Vx	Tin work	9 ng ne s,
Opera Algor Hand Micro UNIT	rithms - I held Decontroller III	EMBEDDED/REAL TIME OPERATING SYSTEM stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline er Operating System Overview. CONNECTIVITY nectivity - Bluetooth - Other Short Range Protocols - Wireless	ed, ux,	Real Vx	Tin work	9 ng ne s,
Opera Algor Hand Micro UNIT	rithms - I held Derocontrolle TIII ess Controlle controlle	EMBEDDED/REAL TIME OPERATING SYSTEM stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline or Operating System Overview. CONNECTIVITY	ed, ux,	Real Vx	Tin work	9 ne s,
Opera Algor Hand Micro UNIT Wirel Envir	rithms - I held Decontrolle rIII ess Controlle onment -	EMBEDDED/REAL TIME OPERATING SYSTEM stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline or Operating System Overview. CONNECTIVITY mectivity - Bluetooth - Other Short Range Protocols - Wireless-Service Discovery - Middleware. REAL TIME UML	ed, ux, s A	Real Vx:	Tin	9 ne s, 9
Opera Algor Hand Micro UNIT Wirel Envir UNIT	rithms - I held Der pocontrolle III ess Comment -	stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline or Operating System Overview. CONNECTIVITY nectivity - Bluetooth - Other Short Range Protocols - Wirelesses-Service Discovery - Middleware. REAL TIME UML ject-Oriented Process for Embedded Systems (ROPES) Process. MDA	ed, uux,	Real Vx: Appli	Tin	9 ne s.
Opera Algor Hand Micro UNIT Wirel Envir UNIT The H	rithms - I held Der controller III ess Comment - TIV Rapid Objeendent M	Stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline or Operating System Overview. CONNECTIVITY The process of the Short Range Protocols - Wireless - Service Discovery - Middleware. REAL TIME UML Spect-Oriented Process for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principals	ed, ux, s A	Real Vx	Tin work icatio	99 mm
Opera Algor Hand Micro UNIT Wirel Envir UNIT The H	rithms - I held Der controlle rIII ess Control ronment - rIV Rapid Objected Model-Ba	stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline or Operating System Overview. CONNECTIVITY mectivity - Bluetooth - Other Short Range Protocols - Wireless - Service Discovery - Middleware. REAL TIME UML ject-Oriented Process for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principles and Projects - Object Orientation with UML 2.0-Structural Aspects-Objects-Objects - Object Orientation with UML 2.0-Structural Aspects-Obje	an an eet	Real Vx	Timwork	g g g m m n
Opera Algor Hand Micro UNIT Wirel Envir UNIT The I Indep with	rithms - I held Der pocontrolle rill ess Comment - IV Rapid Objected Model-Ba	Stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtlimeter Operating System Overview. CONNECTIVITY nectivity - Bluetooth - Other Short Range Protocols - Wirelesses - Service Discovery - Middleware. REAL TIME UML iject-Oriented Process for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principated Projects - Object Orientation with UML 2.0-Structural Aspects-Object-Openanic Aspects-UML Profile for Schedulability, Performance	an an iple	Real Vx	Timwork atfor atfor rination	99 mm mng
Opera Algor Hand Micro UNIT Wirel Envir UNIT The I Indep with	rithms - I held Der controller III ess Comment - IV Rapid Objected Model-Ba UML 2 irements	stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline or Operating System Overview. CONNECTIVITY mectivity - Bluetooth - Other Short Range Protocols - Wireless - Service Discovery - Middleware. REAL TIME UML ject-Oriented Process for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principles and Projects - Object Orientation with UML 2.0-Structural Aspects-Objects-Objects - Object Orientation with UML 2.0-Structural Aspects-Obje	an an iple	Real Vx	Timwork atfor atfor rination	9 m ng or ne
Opera Algor Hand Micro UNIT Wirel Envir UNIT The H Indep with with Requi	rithms - I held Derocontrolle riii ess Conment - riv Rapid Object Model-Bau UML 2 irements rns.	Stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtlimeter Operating System Overview. CONNECTIVITY nectivity - Bluetooth - Other Short Range Protocols - Wirelesses - Service Discovery - Middleware. REAL TIME UML iject-Oriented Process for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principated Projects - Object Orientation with UML 2.0-Structural Aspects-Object-Openanic Aspects-UML Profile for Schedulability, Performance	an an iple	Real Vx	Timwork atfor atfor rination	9 9 9 9 mng or or ne gr
Opera Algor Hand Micro UNIT Wirel Envir UNIT The H Indep with with Required	rithms - I held Dericontroller III ess Comment - IV Rapid Objected Model-Baumball UML 2 irements ins.	Stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtline er Operating System Overview. CONNECTIVITY The process of Process of Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principals and Projects - Object Orientation with UML 2.0-Structural Aspects-Object-Operation Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principals and Projects - Object Orientation with UML 2.0-Structural Aspects-Object-Operation Profile for Schedulability, Performance Analysis - Object Identification Strategies - Object Behaviour - Real Time Memory Management - Overview of Operating Systems for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principals of Projects - Object Operation Strategies - Object Behaviour - Real Memory Management - Overview of Operating Systems for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principals of Projects - Object Operation Strategies - Object Behaviour - Real Time Memory Management - Overview of Operating Systems for Embedded Systems (ROPES) Process.	an an iple eet ee,	Real Vx	Tim work dication atfor /orki entati Tim Desi	9 mg sene ss, 9 mm mg mng gr
Opera Algor Hand Micro UNIT Wirel Envir UNIT The H Indep with with Requir Patter UNIT	rithms - I held Der pocontrolle rill ess Comment - IV Rapid Objected Model-Bauman Language Literature Language Literature Language Literature Language Literature Language Literature Liter	EMBEDDED/REAL TIME OPERATING SYSTEM stem Concepts: Processes, Threads, Interrupts, Events - Real Time Memory Management - Overview of Operating Systems for Embedded vices - Target Image Creation - Programming In Linux, Rtlime er Operating System Overview. CONNECTIVITY nectivity - Bluetooth - Other Short Range Protocols - Wireless - Service Discovery - Middleware. REAL TIME UML ject-Oriented Process for Embedded Systems (ROPES) Process. MDA Models- Scheduling Model-Based Projects- Model Organization Principated Projects - Object Orientation with UML 2.0-Structural Aspects-Object. O-Dynamic Aspects-UML Profile for Schedulability, Performance Analysis - Object Identification Strategies - Object Behaviour - Real SOFTWARE DEVELOPMENT AND APPLICATION	an an iple eet	Real Vx	Timwork dication atfor /orki entati Tim Desi	9 ng

	RSE OUTCOMES	BT MAPPED
At the	end of this course, the students will be able to	(Highest Level)
CO1	make a choice of suitable embedded processor for a given application.	Understanding (K2)
CO2	design the hardware and software for the embedded system.	Applying (K3)
CO3	design and develop the real time kernel/operating system functions, task control block structure and analyze different task states.	Analyzing (K4)
CO4	implement different types of inter task communication and synchronization techniques.	Applying (K3)
CO5	know about the aspects embedded connectivity in real time systems.	Understanding (K2)

- R.J.a.Buhr, D.L.Bailey, "An Introduction To Real-Time Systems", Prentice-Hall International, 1999.
- 2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
- 3. C.M.Krishna, Kang G.Shin, "Real Time Systems", Mc-Graw Hill, 2010.
- 4. B.P.Douglass, "Real Time Uml Advances In the UML for Real-Time Systems, 3rd Edition Addison-Wesley, 2004.

CO-PO MAPPING:

 $\label{eq:conseq} Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) \\ (1/2/3 indicates the strength of correlation) \ 3-Strong \ , \ 2-Medium \ , \ 1-Weak$

COs _			PC	PO's						
Cos	PO1	PO2	PO3	PO4	PO5	PO6				
CO1	2	1	1	1	2	2				
CO2	2	1	I	1	2	2				
CO3	2	1	1	1	2	2				
CO4	2	1	1	1	2	2				
CO5	2	1	1	1	2	2				



1 052	3168	WAVELETS AND SUB-BAND CODING	3	0 0	3
COU	RSE OBJ	ECTIVES			
	A STANFACTOR STANFACTOR	audents to			
1. 1.		the fundamentals concepts of wavelet transforms.			
		100 m			
2.	34-472801(122-0004)	ultiresolution concept and Discrete Wavelet Transform.			
3.		rstem design using Wavelets.			
4.		e different wavelet families & their applications.			
5.	SALINOSE DE VARAGO	gnal compression and sub-band coding.			
UNIT	ľ	INTRODUCTION TO WAVELETS			9
chara	cteristics,	Vavelet transform, Time frequency representation, Wavelet Sy Orthogonal and Orthonormal functions and function space	ysten	ı and	
UNIT	П	MULTIRESOLUTION CONCEPT AND DISCRETE			9
		WAVELET TRANSFORM			
		formulation of wavelet systems- signal spaces, scaling function, wave Multiresolution analysis, Haar scaling and wavelet function, Filter bank			
its pr Synth	operties, I esis, 1D	l n formulation of wavelet systems- signal spaces, scaling function, wave	cs- A	nalysis	and
its pr Synth	operties, I esis, 1D channel f	In formulation of wavelet systems- signal spaces, scaling function, wave Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structu	cs- A	nalysis	and
its pr Synth Multi UNIT Refin	operties, ID channel f	In formulation of wavelet systems- signal spaces, scaling function, wave Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structuraliter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Ilation for orthogonal wavelet systems, Restrictions on filter coefficients.	red	nalysis filter ba	and ank,
its pro Synth Multi UNIT Refin Daub	operties, ID lesis, ID channel f TIII ement re echies ort	In formulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structuraliter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Ilation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelet wavelet systems.	red	nalysis filter ba	and ank,
Synth Multi UNIT Refin Daub	poperties, ID channel f III ement re echies ort	In formulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structural ilter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Itation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelet wavelet FAMILIES	red ients	nalysis filter ba	and ank,
its properties of Synth Multi- UNIT Refin Daub UNIT	poperties, ID channel f TIII ement re echies ort TIV nuous W	In formulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structuraliter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Ilation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets-	ients	nalysis filter ba	and ank, 9 n of 9 ets.
Synth Multi- UNIT Refin Daub UNIT Conti-	channel f THI ement re echies ort TIV nuous W nuous W	In formulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structuraliter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Ilation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets- Properties of Haar wavelets, Daubechies wavelets, Symlet	ients relets	nalysis filter ba	and ank, 9 n of 9 ets.
Synth Multi UNIT Refin Daub UNIT Conticorthology	channel f TIII ement re echies ort TIV nuous W egonal was ete Meyer	In formulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structural liter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Interpolation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Mayelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets. Properties of Biorthogonal wavelets, Applications of wavelets wavelets. Properties of Biorthogonal wavelets, Applications of wavelets.	ients relets	nalysis filter ba	and nnk, 9 n of 9 ets.
Synth Multi UNIT Refin Daub UNIT Conti Ortho Discr	channel for III ement rechies ortenuous Wegonal water Meyer	In formulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structural ilter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Ilation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and May avelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets. Properties of Biorthogonal wavelets, Applications of wavelets and Signal Compression and Signal Compression and Signal Compression and Sub-Band Coding	red sients. Meye	nalysis filter ba	and ank, 9 n of 9 ets. 9
Synth Multi UNIT Refin Daub UNIT Conti Ortho Discr UNIT Comp	channel f THI ement re echies ort TIV nuous W ogonal wa ete Meyer	Informulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structural ilter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Ilation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets. Properties of Biorthogonal wavelets, Applications of wavelets avelets. Properties of Biorthogonal wavelets, Applications of wavelets and Signal Compression and Systems Based on Linear Transforms - Speech and Audio Compressions Based on Linear Transforms - Speech and Audio Compressions.	red sients. Meye	nalysis filter ba	and ank, 9 n of 9 ets. 9
Synth Multi UNIT Refin Daub UNIT Conti Ortho Discr UNIT Comp	channel f THI ement re echies ort TIV nuous W ogonal wa ete Meyer	Informulation of wavelet systems- signal spaces, scaling function, wave of Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structural filter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Ilation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets. Properties of Biorthogonal wavelets, Applications of wavelets avelets. Properties of Biorthogonal wavelets, Applications of wavelets SIGNAL COMPRESSION AND SUB-BAND CODING Systems Based on Linear Transforms - Speech and Audio Compression - Joint Source-Channel Coding	ients ients Meye	nalysis filter ba	9 ets.
Synth Multi UNIT Refin Daub UNIT Conti Orthor Discr UNIT Comp	channel f III ement re echies ort IV nuous W egonal wa ete Meyer V pression f	In formulation of wavelet systems- signal spaces, scaling function, wave in formulation of wavelet systems- signal spaces, scaling function, wave in formulation analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structural idea bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Interpolation for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets. Properties of Biorthogonal wavelets, Applications of wavelets wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets. Signal Compression - Joint Source-Channel Coding TOTAL PERIODS	ients elets Meye	nalysis filter ba Desig wavel oiflets filies.	and ank, 9 n of 9 ets. and 45
Synth Multi UNIT Refin Daub UNIT Conti Ortho Discr UNIT Comp	channel for III ement reschies orter IV nuous Wegonal water Meyer TV pression for IV	A formulation of wavelet systems- signal spaces, scaling function, wave and formulation analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structural liter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Indian for orthogonal wavelet systems, Restrictions on filter coefficients hogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Mavelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets. Properties of Biorthogonal wavelets, Applications of wavelets wavelets. Properties of Biorthogonal w	ients ients relets Aeye fam	nalysis filter ba Desig wavel oiflets filies. APPED	9 ets. 9 nage
Synth Multi UNIT Refin Daub UNIT Conti Orthor Discr UNIT Comp	channel f THI ement re echies ort TIV nuous W ogonal wa ete Meyer TV pression -	Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structuraliter bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Interpolation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets- Properties of Biorthogonal wavelets, Applications of wavelets wavelets. Properties of Biorthogonal wavelets, Applications of wavelets SIGNAL COMPRESSION AND SUB-BAND CODING Systems Based on Linear Transforms - Speech and Audio Company Video Compression - Joint Source-Channel Coding TOTAL PERIODS TCOMES is course, the students will be able to (H	ients ients Meye s, C t fam ressio	nalysis filter ba filter ba property nalysis filter ba property nalysis filter ba property nalysis filter ba property nalysis	9 ets. and 9 hage
Synth Multi UNIT Refin Daub UNIT Conti Ortho Discr UNIT Comp	channel f THI ement re echies ort TIV nuous W egonal wa ete Meyer TV pression - RSE OUT	Multiresolution analysis, Haar scaling and wavelet function, Filter bank and 2D Discrete wavelet transform, Wavelet Packets, Tree structurated bank, Undecimated wavelet transform. WAVELET SYSTEM DESIGN Interpretation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Coiflet and Symlet wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Navelets- Properties of Haar wavelets, Daubechies wavelets, Symlet wavelets. Properties of Biorthogonal wavelets, Applications of wavelets wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets. Properties of Biorthogonal wavelets, Applications of wavelets are wavelets, Applications of wavel	ients ients Meye s, C t fam T M. iigherstand	nalysis filter ba Desig wavel oiflets filies. APPED	and ank, 9 n of 9 ets. and 9 nage

REFE	RENCES C.Sidney Burrus, Ramesh Gopinath & Haito Guo, "Intro-	duction to wavelets and wavel
CO5	analyze signal compression and sub-band coding.	Analyzing (K4)
CO4	compare different wavelet families.	Understanding (K2)
CO3	understand system design using wavelets.	Understanding (K2)

- C.Sidney Burrus, Ramesh Gopinath & Haito Guo, "Introduction to wavelets and wavelet transform", Prentice Hall, 1998.
- 2. G.Strang and T.Nguyen, "Wavelet and filter banks", Wesley and Cambridge Press, 1996.
- Metin Akay, "Time frequency and wavelets in biomedical signal processing", Wiley-IEEE Press, October 1997.
- 4. M. Vetterli and J. Kovacevic, "Wavelets and sub band coding", Prentice Hall, 1995.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) (1/2/3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak

			PC	PO's					
COs _	PO1	PO2	PO3	PO4	PO5	PO6			
CO1	2	1	1	2	2	2			
CO2	2	1	1	2	2	2			
CO3	2	1	1	2	2	2			
CO4	2	1	1	2	2	2			
CO5	2	1	1	2	2	2			



PCS	23169	SPEECH PROCESSING	3	0	0	3
COU	RSE OB	JECTIVES			_	
To en	able the s	tudents to				
1.	introd	uce speech production and related parameters of speech.				
2.	illustr	ate the concepts of speech signal representations and coding.				
3.	under	stand different speech modeling procedures such Markov an	d their in	nplen	enta	tio
4.	gain k	nowledge about text analysis.				
5.	learn a	about speech synthesis.				
UNI	ГІ	FUNDAMENTALS OF SPEECH PROCESSING				9
and S	Semantic	Spoken Language Structure - Phonetics and Phonology - Syllab s - Probability, Statistics and Information Theory - Probability ficance Testing - Information Theory.				
UNIT	750 STA	SPEECH SIGNAL REPRESENTATIONS AND COD	ING	-		9
		Digital Signal Processing - Speech Signal Representations - Shor			malı	
UNIT	ГШ	SPEECH RECOGNITION				9
		ov Models - Definition - Continuous and Discontinuous HMI coustic Modeling - Variability in the Speech Signal - Extract				
Mode	eling - Ad	aptive Techniques - Confidence Measures - Other Techniques.				
UNIT	ΓIV	TEXT ANALYSIS				9
Disar	nbiguatio	rument Structure Detection - Text Normalization - Linguistic n - Morphological Analysis - Letter-to-sound Conversion - eaking Style - Symbolic Prosody - Duration Assignment - Pitch	Prosody	- Ge	_	
UNIT	ΓV	SPEECH SYNTHESIS				9
Attrib	outes - Fo	ormant Speech Synthesis - Concatenative Speech Synthesis - Pr	rosodic M	odific	ation	1 0
Speed	ch - Sourc	e-filter Models for Prosody Modification - Evaluation of TTS Sy	stems.			
		TOTAL PE	RIODS			45
COU	RSE OU'	TCOMES	BT	MAPI	PED	
At the	end of th	is course, the students will be able to	(High	est L	evel)	
COI	model speech.	speech production system and describe the fundamentals of	Rememb	ering	(K1))
CO2		and compare different speech parameters.	Understa	nding	(K2)
CUL		THE REPORT OF THE PROPERTY OF	The second secon	Contract of the Contract of th	CONTRACTOR OF THE PARTY OF THE	

CO3	choose an appropriate statistical speech model for a given application.	Understanding (K2)
CO4	design a speech recognition system.	Applying (K3)
CO5	use different text analysis and speech synthesis techniques.	Analyzing (K4)
	RENCES	
1.	Ben Gold and Nelson Morgan, "Speech and Audio Signal Proc Perception of Speech and Music", Wiley-India Edition, 2006	essing, Processing ar
	Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition",	John Wiley and Son

2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.

 Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.

Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) $(1/2/3 \ indicates \ the \ strength \ of \ correlation) \ 3-Strong \ , 2-Medium \ , 1-Weak$

			PC)'s		
COs _	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	2	1	2
CO2	2	1	2	2	1	2
CO3	2	1	2	2	1	2
CO4	2	1	2	2	1	2
CO5	2	1	2	2	1	2



	23170	TELECON	MMUNICATION SYSTEM MODELING ANI SIMULATION	D 3		0 0	3
cou	RSE OBJ	ECTIVES					
To er	able the st	udents to					
1.	underst	and the various	s aspects of simulation methodology and perform	rmance.			
2.	appreci	ate the significa	ance of selecting sampling frequency and mod	leling dif	fere	nt type	s of
	signals	and processing	them.				
3.	learn th	e Monte Carlo S	Simulation.		П		
4.	learn di	fferent simulation	on techniques, their pros and cons.				
5.	underst	and and interpre	et results using case studies.				
UNI	LI	SIMULATI	ON METHODOLOGY				9
varying systems, Post processing – Basic graphical techniques and estimations UNIT II RANDOM SIGNAL GENERATION & PROCESSING							9
Uniform random number generation, Mapping uniform r							9 Low ime- 9 pdf, ation, 9 with delay dels, 9 of a 45
Corr	elated an	d Uncorrelated	Gaussian random number generation, PN				
Corr	elated an Iom signal	d Uncorrelated processing, Tes	Gaussian random number generation, PN sting of random number generators.				ion,
Corr	elated an Iom signal T III	d Uncorrelated processing, Tes	Gaussian random number generation, PN sting of random number generators. CARLO SIMULATION	l sequen	ce	genera	ion,
Corr Rand UNI Fund	elated an Iom signal T III Iamental o	d Uncorrelated processing, Tes MONTE concepts, Appli	Gaussian random number generation, PN sting of random number generators. CARLO SIMULATION station to communication systems, Monte Carlo	l sequen	ce	genera	ion,
Corr Rand UNI Fundanal	elated an lom signal T III lamental ovic technic	d Uncorrelated processing, Tes MONTE concepts, Appliques, Case study	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Ication to communication systems, Monte Carlo Sy: Performance estimation of a wireless system	l sequen	ce	genera	on, 9 ni -
Corr Rand UNI Fund anal	elated an lom signal T III lamental out to technic	MONTE concepts, Appli	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Cation to communication systems, Monte Carly: Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUE	I sequen	ratio	genera'	9 ni -
Corr Rand UNI Fund analy UNI Mod	elated and lom signal T III lamental of the control	MONTE concepts, Appli ques, Case study ADVANCE	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Cation to communication systems, Monte Caty: Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUE on-linearities: Types, Memoryless non-linearities	rlo integ	ratio	genera on, Ser	9 ni - 9 vith
Corr Rand UNI Fund analy UNI Mod mem	elated and lom signal T III lamental of the control	MONTE concepts, Appliques, Case study ADVANCE simulation of no	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Ication to communication systems, Monte Carlo Simulation of a wireless system D MODELS & SIMULATION TECHNIQUE Con-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random process	rlo integ S es, Non-ls models.	ratio	genera on, Ser urities v	9 ni - 9 vith elay
Corr Rand UNI Fundanal; UNI Mod mem line	elated and lom signal T III lamental of the la	MONTE concepts, Appli ques, Case study ADVANCE simulation of no	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Cation to communication systems, Monte Caty: Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUE on-linearities: Types, Memoryless non-linearities	rlo integ S es, Non-ls models.	ratio	genera on, Ser urities v	9 ni - 9 vith elay
Corr Rand UNI Fundanal; UNI Mod mem line Mar	elated an lom signal T III lamental of the lamental of the ling and lory, Model model, Model work model of the lamental of the	MONTE concepts, Appli ques, Case study ADVANCE simulation of no	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Cation to communication systems, Monte Carlo Simulation of a wireless system D MODELS & SIMULATION TECHNIQUE Con-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random processes and a system of the s	rlo integ S es, Non-ls models.	ratio	genera on, Ser urities v	9 vith elay els,
Corr Rand UNI Fundanal; UNI Mod mem line Mari	elated and lom signal T III lamental of the la	MONTE concepts, Appliques, Case study ADVANCE simulation of no	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Cation to communication systems, Monte Carly: Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUE con-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random process mulation of waveform channels, Discrete memory.	rlo integ S es, Non-ls s models, oryless ch	rationea, Ta	genera on, Ser urities v	9 ni - 9 with elay els,
Corr Rand UNI Fundanal; UNI Mod men line Mar UNI Tail	elated and lom signal T III lamental of the la	MONTE concepts, Appliques, Case study ADVANCE simulation of neeling and simulated odeling and simulated for discrete characteristics, pdf estimation, pdf estimation, pdf estimation.	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Ication to communication systems, Monte Carly: Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUES on-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random process nulation of waveform channels, Discrete memory. T SIMULATION TECHNIQUES	rlo integ S es, Non-ls s models, oryless ch	rationea, Ta	genera on, Ser urities v	9 ni - 9 with elay els,
Corr Rand UNI Fundanal; UNI Mod men line Mar UNI Tail	elated and lom signal T III lamental of the la	MONTE concepts, Appliques, Case study ADVANCE simulation of neeling and simulated odeling and simulated for discrete characteristics, pdf estimation, pdf estimation, pdf estimation.	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Ication to communication systems, Monte Carly: Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUES on-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random process nulation of waveform channels, Discrete memory. T SIMULATION TECHNIQUES	rlo integ S es, Non-l s models. oryless ch	rationea, Ta	genera on, Ser urities v	oion, 9 ni - 9 vith elay els, 9 of a
Corr Rand UNI Fundanal; UNI Mod men line Mar UNI Tail Cell	elated an lom signal T III lamental of the lamental of the ling and lamental, M key model, M key model T V extrapola lar Radio	MONTE concepts, Appliques, Case study ADVANCE simulation of neeling and simulated odeling and simulated for discrete characteristics, pdf estimation, pdf estimation, pdf estimation.	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Ideation to communication systems, Monte Carlos Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUE con-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random process mulation of waveform channels, Discrete memory. T SIMULATION TECHNIQUES TRANSPORTED TECHNIQUES	rlo integ S es, Non-ls models. oryless chestudy: Si RIODS BT	linea, Ta	pon, Ser	on, 9 ni - 9 vith elay els, 9 of a
Corr Rand UNI Fundanal; UNI Mod men line Mar UNI Tail Cell	elated and lom signal T III lamental of the vice technic T IV leling and lar Model, Model, Model T V extrapola lar Radio IRSE OUT	MONTE MONTE concepts, Appliques, Case study ADVANCE simulation of noteling and simulated and sim	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Ideation to communication systems, Monte Carlos Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUE con-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random process mulation of waveform channels, Discrete memory. T SIMULATION TECHNIQUES TRANSPORTED TECHNIQUES	rlo integ S es, Non-ls models. oryless chestudy: Si RIODS BT	linea, Ta	general printing of the printi	on, 9 ni - 9 vith elay els, 9 of a
CORT Rand UNI Fund analy UNI Mod men line Mar UNI Tail Cell	elated and lom signal T III lamental of the la	MONTE moncepts, Appliques, Case study ADVANCE simulation of neeling and simulated an	Gaussian random number generation, PN sting of random number generators. CCARLO SIMULATION Ideation to communication systems, Monte Carly: Performance estimation of a wireless system D MODELS & SIMULATION TECHNIQUE on-linearities: Types, Memoryless non-linearities ation of Time varying systems: Random process nullation of waveform channels, Discrete memory. T SIMULATION TECHNIQUES nators, Importance Sampling methods, Case states.	rlo integ S es, Non-ls models. oryless chestudy: Si RIODS BT	linea, Ta	pon, Ser	oion, 9 ni - 9 vith elay els, 9 of a 45

CO3	simulate a phenomena so as to depict the characteristics that may be observed in a real experiment.	Applying (K3)
CO4	apply knowledge of the different simulation techniques for designing a communication system or channel.	Applying (K3)
CO5	validate a simulated system performance so as to match a realistic scenario.	Applying (K3)

REFERENCES

- William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation, Pearson Education (Singapore) Pvt. Ltd, 2004.
- M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, Simulation of Communication Systems: Modeling, Methodology and Techniques, Plenum Press, New York, 2001.
- Averill.M.Law and W. David Kelton, Simulation Modeling and Analysis, McGraw Hill Inc., 2000.
- 4. Geoffrey Gorden, System Simulation, Prentice Hall of India, 2nd Edition, 1992.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) (1/2/3 indicates the strength of correlation) 3 – Strong, 2 – Medium, 1 – Weak

			PC)'s		
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	1
CO2	2	2	2	2	2	2
CO3	2	2	2	2	2	2
CO4	1	1	1	1	1	1
CO5	2	2	2	2	2	2



MENTS 3 0	DESIGN OF DIGITAL ELEMENT
	OBJECTIVES
	the students to
ic functions.	ovide an understanding of Boolean algebra and logic fund
cuits for digital systems.	sign and model the Verilog HDL and data path circuits for
ial logic circuit design.	velop the knowledge of combinational and sequential log
logic circuit design.	able the student to design and model of sequential logic c
e logic and design and model the	tablish a strong understanding of programmable logic
	cuits using Verilog HDL.
	Boolean Algebra
of Boolean Algebra, Basic Theorem	lgebra: Basic definitions, Axiomatic definition of Boo
eal and Standard Forms, Simplificat	of Boolean Algebra, Boolean Functions, Canonical and
hod (K-map up to 4 variable), Prod	nctions. Gate-Level Minimization: The Map Method (k
l Implementation. Logic Families: Γ	Sum of Products Simplification, NAND and NOR Imple
	s, TTL and CMOS logic families
its	Verilog HDL & Design of data path circuits
ventions, Ports and Modules, Oper	DL: Introduction to Verilog HDL, Lexical Convention
odeling, Test Bench. Design of data	DL: Introduction to Verilog HDL, Lexical Convention Modelling, Gate Level Modelling, Behavioural Modelin bit Parallel Adder/Subtractor, Carry Look Ahead Adder
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier,	Modelling, Gate Level Modelling, Behavioural Modelin
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier,	Modelling, Gate Level Modelling, Behavioural Modelin- bit Parallel Adder/Subtractor, Carry Look Ahead Adder
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL.	Modelling, Gate Level Modelling, Behavioural Modelin- bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco	Modelling, Gate Level Modelling, Behavioural Modelin bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Encoders, Encoders, Multiplexe	Modelling, Gate Level Modelling, Behavioural Modeling-bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Fu
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Encoders, Encoders, Multiplexe	Modelling, Gate Level Modelling, Behavioural Modeling-bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furst, De-multiplexers, Parity generator and checker, Applied
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Encoders, Encoders, Multiplexeding Verilog HDL.	Modelling, Gate Level Modelling, Behavioural Modeling-bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits Decedure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applied exer. Modeling of Combinational logic circuits using Venezue.
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco Applications of Decoder, Multiplexe ing Verilog HDL. ift Registers - SISO, SIPO, PISO,	Modelling, Gate Level Modelling, Behavioural Modeling-bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applications of Combinational logic circuits using Venezign of Sequential Logic Circuits
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco Applications of Decoder, Multiplexe ing Verilog HDL. ift Registers - SISO, SIPO, PISO, te diagrams, Design of counters: Mo	Modelling, Gate Level Modelling, Behavioural Modeling-bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applicator. Modeling of Combinational logic circuits using Verenze Modeling of Sequential Logic Circuits Design of Sequential Logic Circuits lip-Flops - SR, D, JK & T, Buffer Registers, Shift Registers
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco Applications of Decoder, Multiplexe ing Verilog HDL. ift Registers - SISO, SIPO, PISO, te diagrams, Design of counters: Mo	Modelling, Gate Level Modelling, Behavioural Modeling bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applicator. Modeling of Combinational logic circuits using Very Design of Sequential Logic Circuits Design of Sequential Logic Circuits Design of Sequential Logic Circuits
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco Applications of Decoder, Multiplexe ing Verilog HDL. ift Registers - SISO, SIPO, PISO, te diagrams, Design of counters: Mo deling of sequential logic circuits	Modelling, Gate Level Modelling, Behavioural Modeling-bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applied exer. Modeling of Combinational logic circuits using Very Design of Sequential Logic Circuits Ilip-Flops - SR, D, JK & T, Buffer Registers, Shift Registers and State diagrams, Ring, Up/Down, Asynchronous counter. Modeling
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco Applications of Decoder, Multiplexe ing Verilog HDL. ift Registers - SISO, SIPO, PISO, te diagrams, Design of counters: Mo deling of sequential logic circuits evices	Modelling, Gate Level Modelling, Behavioural Modeling-bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applicator. Modeling of Combinational logic circuits using Very Design of Sequential Logic Circuits Ilip-Flops - SR, D, JK & T, Buffer Registers, Shift Registers and state diagon, Ring, Up/Down, Asynchronous counter. Modeling DL.
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco Applications of Decoder, Multiplexe ing Verilog HDL. ift Registers - SISO, SIPO, PISO, te diagrams, Design of counters: Mo deling of sequential logic circuits evices Moore FSM, Design Example : Seq	Modelling, Gate Level Modelling, Behavioural Modeling bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applicator. Modeling of Combinational logic circuits using Very Design of Sequential Logic Circuits Sip-Flops - SR, D, JK & T, Buffer Registers, Shift Registers and State diagon, Ring, Up/Down, Asynchronous counter. Modeling DL. Design of FSM & Programmable Logic Devices
odeling, Test Bench. Design of data Adder, Unsigned Array Multiplier, th circuits using Verilog HDL. or, Full Subtractor, Decoders, Enco Applications of Decoder, Multiplexe ing Verilog HDL. ift Registers - SISO, SIPO, PISO, te diagrams, Design of counters: Modeling of sequential logic circuits evices Moore FSM, Design Example: Seq grammable Logic Devices: Typ	Modelling, Gate Level Modelling, Behavioural Modeling bit Parallel Adder/Subtractor, Carry Look Ahead Adder 4-Bit Magnitude comparator. Modeling of data path circ Design of Combinational Logic Circuits occdure, Half Adder, Full Adder, Half Subtractor, Furs, De-multiplexers, Parity generator and checker, Applicator. Modeling of Combinational logic circuits using Very Design of Sequential Logic Circuits Sip-Flops - SR, D, JK & T, Buffer Registers, Shift Registers and State diagon, Ring, Up/Down, Asynchronous counter. Modeling DL. Design of FSM & Programmable Logic Devices FSM: Finite state Machine(FSM):Mealy FSM and Moore

COUR	SE OUTCOMES	BT MAPPED
At the	end of this course, the students will be able to	(Highest Level)
CO1	optimize the logic functions using and Boolean principles and K-map.	Understanding (K1)
CO2	design the Verilog VHDL and data path circuits.	Applying (K3)
CO3	model and design the Combinational logic circuits using Verilog HDL.	Applying (K3)
CO4	analyze and apply the design aspects of sequential logic circuits.	Applying (K3)
CO5	explore the design aspects of Finite state machines and examine the basic architectures of programmable logic devices.	Applying (K3)
REFE	RENCES	
1.	M. Morris Mano and Michael D. Ciletti, Digital Design: With an Intr HDL and System Verilog, 2018,6 th Edition, Pearson Pvt. Ltd.	oduction to the Verile
2.	Ming-Bo Lin, Digital Systems Design and Practice: Using Verilog HD Edition, Create Space Independent Publishing Platform.	L and FPGAs,2015, 2

 Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2009, 2nd edition, Prentice Hall of India Pvt. Ltd.

 Stephen Brown and ZvonkoVranesic," Fundamentals of Digital Logic with Verilog Design", 2013, 3rd Edition, McGraw-Hill Higher Education.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's)
(1/2/3 indicates the strength of correlation) 3 – Strong, 2 – Medium, 1 – Weak

			PC)'s		
COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	=	-
CO2	3	3	2	2	-	-
CO3	3	3	3	1 1-	-	121
CO4	3	3	2	2		•
CO5	3	3	3	2		7

