



VISION

The Department of Electronics & Communication Engineering shall strive to create engineering technocrats for addressing the global challenges in relevant areas to cater the ever changing needs of society at National and International level.

MISSION

- 1. To ensure dissemination of knowledge through effective teaching and learning in Electronics and Communication Engineering.
- 2. To excel in Research and Development activities in emerging areas.
- 3. To promote industry-institute and institute-institute linkages for sustainable development of academic, research, training and placement activities.
- 4. To establish center of excellence in thrust areas to nurture the spirit of innovation and creativity among faculty and students.

PG Syllabus for M.Tech. Programme (applicable to 2018 batch onwards)



Programme Educational Objectives (PEOs)

The M. Tech. (Electronics & Communication Engineering) program shall produce professionals:

- 1. To provide in-depth knowledge of modern design tools to solve real-life problems in the field of Electronics and Communication Engineering.
- 2. To develop employability skills to meet dynamic educational and industrial needs for betterment of society.
- 3. To impart research skills with professional and ethical attributes.
- 4. To attain professional leadership qualities for effective delivery in multi-disciplinary domains.

Programme Outcomes (POs)

After successful completion of M.Tech. (Electronics & Communication Engineering) program, the student will be able to:

- 1. Use mathematics, science and engineering knowledge for solving complex problems in the field of Electronics and Communication Engineering.
- 2. Identify and analyze engineering problems to formulate appropriate solutions proficiently.
- 3. Design and develop real-time system to meet desired needs in the field of Electronics and Communication Engineering.
- 4. Compile, interpret and present research data in an appropriate format, taking into consideration scientific principles and methodology.
- 5. Use effectively modern tools and techniques for modeling complex problems to provide alternative solutions.
- 6. Design engineering systems to address societal, legal, cultural, security, health and safety issues.
- 7. Use techniques, skills, and modern engineering tools required for environmental and sustainable development.
- 8. Adopt and exhibit professional knowledge with ethical responsibilities.
- 9. Function effectively as an individual as well as team-member for achieving desired goals.
- 10. Communicate in both verbal and written forms to compete globally.
- 11. Exhibit confidence, leadership qualities and remain engaged in life-long learning.
- 12. Take up administrative responsibilities involving both project and financial management, confidently.



M.TECH. (ELECTRONICS AND COMMUNICATION ENGINEERING)

		Semester-I					
Sr. No.	Subject Code	Subject Name	L	Т	Р	Hrs.	Credits
1	PCEC 811	Optical Communication Systems	3	0	0	3	3
2	PCEC 812	Advanced Communication Systems	3	0	0	3	3
3	PEEC 811	Core Elective-I	3	0	0	3	3
4	PEEC 812	Core Elective-II	3	0	0	3	3
6	RMAL-811	Research Methodology and IPR	2	0	0	2	2
7	ACMH-811	English Research Paper Writing and Professional Communication	2	0	0	2	0
8	PEEC 813	Core Elective-1 Lab	0	0	4	4	2
9	PCEC-814	Optical Communication System Lab	0	0	4	4	2
		Total	16	0	8	24	18
		Semester-II (A)					-
Sr. No.	Subject Code	Subject Name	L	Т	Р	Hrs.	Credits
1	PCEC 821	Microwave Integrated Circuits	3	1	0	4	4
2	PCEC 822	VLSI Design	3	0	0	3	3
3	PEEC 821	Core Elective-III	3	0	0	3	3
4	PEEC 822	Core Elective-IV	3	0	0	3	3
5	ACMH-821	Constitution of India	2	0	0	2	0
6	PCEC 823	VLSI Design Lab	0	0	4	4	2
7	PEEC 824	Core Elective - II Lab	0	0	4	4	2
8	PCEC 824	Seminar	0	0	2	2	1
		Total	14	1	10	25	18
		Semester-II (B)				-	
	Four weeks tra Institutions of r CSIO etc.	aining in reputed industry/laboratory repute such as IITs, NITs, CSIR, DRI	DO,			40	S/US
		Semester-III	Ŧ	m	F	**	a
Sr. No.	Subject Code	Subject Name	L	T	P	Hrs.	Credits
1	PEEC 911	Core Elective -5	3	0	0	3	3
2	OEEC 911	Open Elective	3	0	0	3	3
3	PCEC 911	Dissertation (Part-1)	0	0	20	20	10
		Total	6	0	20	26	16
		Semester-IV					
Sr. No	Subject Code	Subject Name	T.	Т	Р	Hrs	Credite
1	PCEC 921	Dissertation (Part-2)	0	0	32	32	16
	1020721	Total	0	0	32	32	16
	I	i otai	v	v			10



Total Credits: 68

List of Program Specific/ Core Elective Courses

		CORE ELECTIVE-I (PEEC811)								
Sr. No.	Subject Code	Subject Name								
1	PEEC-811A	Micro & Nano-photonics								
2	PEEC-811B	RF Circuit Design								
3	PEEC-811C	Statistical Information Processing								
		CORE ELECTIVE-II (PEEC 812)								
Sr. No.	Subject Code	Subject Name								
1	PEEC 812A	Antenna and Radiating System								
2	PEEC 812B	Internet of Things								
3	PEEC 812C	Remote Sensing								
	CORE ELECTIVE-III (PEEC 821)									
Sr. No.	Subject Code	Subject Name								
1	PEEC 821A	Advanced Digital Signal Processing								
2	PEEC 821B	Soft Computing								
3	PEEC 821C	Digital Image Processing								
4	PEEC 821D	Artificial Intelligence and Deep Learning								
		CORE ELECTIVE-IV (PEEC 822)								
Sr. No.	Subject Code	Subject Name								
1	PEEC 822A	Electronic Product Design								
2	PEEC 822B	Satellite Communication								
3	PEEC 822C	Digital Circuit Logic Design								
		COREELECTIVE-V (PEEC 911)								
Sr. No.	Subject Code	Subject Name								
1	PEEC 911A	Wireless Sensor Networks								
2	PEEC 911B	Network Security and Cryptography								
3	PEEC 911C	Advanced Computer Networks								
		CORE ELECTIVE-I LAB								
Sr. No	Subject Code	Subject Name								
1	PEEC 813A	Communication Systems Lab								
2	PEEC 813B	Wireless Communication Lab								
		CORE ELECTIVE-II LAB								
Sr. No	Subject Code	Subject Name								
1	PEEC 824A	Microwave Engg. Lab								
2	PEEC 824B	Computer-Aided Design Lab								

List of Open Elective Courses

Sr. No.	Subject Code	Subject Name
1	OEEC 911A	Electronic Product Design
2	OEEC 911B	Soft Computing
3	OEEC 911C	Optical Communication Systems



					Р	CEC-8	11						
				Optic	cal Com	munic	ation Sy	stems					
				L			Т]	P		Credit	S	
				3			0	(0		4		
		S	essiona	l Marks	s						50		
		F	and Sem	lester E	Examina	ntion M	arks				50		
Cours	<u>se</u>	Г	'he aim	of this	s course	e is to	train st	udents	in met	hods of	f analy	sis and	
<u>Objec</u>	tives:	iı	nstallatio	on of	optical	fiber-	based	commu	nicatior	is syst	ems; s	systems	
		p	lanning	to use	differen	t photo	nic tech	nologies	s as we	ll as ad	vanced	optical	
		S	ignal pr	rocessin	g mode	els. Fur	ther, fo	cuses o	on diffe	rent no	nlinear	ities in	
		0	ptical fi	ber and	d their	mitigati	on in r	nodern	optical	fiber c	ommur	nication	
	system; design and evaluation of modern optical fiber communication												
		S	ystems.										
Cours	se	1	. To ur	Iderstan	d the ba	sic con	cept of o	optical f	iber cor	nmunic	ation sy	ystem.	
Outco	omes:	2	. To u	nderstai	nd the	various	dispers	sion no	nlineari	ties eff	ect in	optical	
			comn	nunicati	on syste	em							
		3	. Abili	ty to des	sign hig	h bit-ra	te fiber o	optic co	mmunic	cation sy	ystems.		
		4	. Abili	ty to	analyz	ze, mo	odel a	nd im	plemen	t adva	inced	optical	
			comn	nunicati	on syste	ems.				. 1			
		5	. Capa	ble to i	use opti	cal con	nmunica	tions si	imulatio	on tools	to ass	sess the	
			result	s obtain	ied from	theore	tical stu	dies.					
		1 	lapping	g of cou	irse out	<u>comes</u>	with pro	ogram (es DO1	DO1		
	DO1	PO2	DO3	DO1	DO5	DO6	DO7	DOS	DOO			DO12	
C01	M	102 W	103 N	104 N	103 N	W	107 N	100 N	109 W	N N	I N	N	
CO1	M	N	N	S	N	N	N	N	M	N	N	N	
CO3	W	M	M	N	N	S	N	N	N	N	M	M	
CO4	Μ	S	S	N	Μ	S	Μ	N	N	N	W	Μ	
CO5	Ν	Ν	Μ	S	Μ	Μ	Μ	Ν	Ν	Ν	Ν	Ν	
			•	Un	it-I						1	16 hrs	
Overv	view of	optical	fiber c	ommui	nication	: Evolu	tion of	basic	fiber	optic c	ommui	nication	
system	n, bene	fits an	d disad	lvantage	es of f	iber o	otics, tra	nsmissi	ion win	dows, t	ransmis	ssion of	
light t	hrough	optical	fiber, nu	imerical	l apertui	e (NA), optica	l fiber n	nodes &	config	uration	s, types	
of fibe	er, wave	propag	gation ir	step in	idex & g	graded i	ndex fil	ber, MF	D, prop	agation	modes	in step	
index	fibers, a	attenuat	ion in o	ptical fi	bers, fit	ber optio	c loss ca	lculatio	ns, ben	ding los	es, abs	orption,	
scatter	ring, fib	er disp	ersion,	dispers	sion sh	ifted f	iber, D-	flattene	d fiber	, polari	zation,	cut-off	
condit	ion and	V-para	meter, c	onnecto	ors & sp	lices.							
Dispe	rsion a	nd nor	linearit	ies: Dis	spersion	in sin	gle mod	le and 1	nultime	de fibe	rs, atte	nuation	
and di	spersion	n limits	in fibers	s, disper	rsion ma	anagem	ent, Ker	r nonlin	earity, s	self-pha	se mod	ulation,	
cross j	phase m	odulati	on, FWI	M									
				Un	it_II							12 hrs	



Optical sources: Direct and indirect band gap materials, semiconductor light-emitting diodes and laser diodes, LED power & efficiency, double hetero-junction LED, planner & dome LED, surface-emitting LEDs, edge-emitting LEDs, super luminescent LED, characteristic of LED, modulation, laser diodes: basic concepts for emission of radiation, threshold condition for laser oscillation, quantum well laser, distributed feedback laser, laser characteristics.

Optical detectors: Principles of photodiodes, PIN & avalanche photodiodes, photodetector noise, detector response time, avalanche multiplication noise, temperature effect on avalanche gain, receiver SNR and BER calculations.

Unit-III10 hrsOptical amplifiers: Semiconductor amplifiers, Erbium-doped fiber amplifiers (EDFAs) and
Raman amplifiers, analytical modeling of gain saturation, gain equalization, ASE noise,
amplifier cascades.

Optical sensors: Advantages, generic optical fiber sensor, fiber selection for sensor, wavelength modulated sensors - pH, humidity, temperature, carbon dioxide sensors, fiber Bragg grating based sensors - principle, strain, pressure sensors, chemical sensors.

Unit-IV10 hrsOptical networks design: Fiber optic system design considerations -power budget, bandwidth and rise time budgets, electrical and optical bandwidth etc.

Advanced multiplexing strategies: Optical TDM, subscriber multiplexing (SCM), WDM and hybrid multiplexing methods, optical networking - optical network topologies, network architecture- SONET/TDH, optical burst switching, OADM, wavelength conversion, optical filters, MZI.

RECOMM	ENDED BOOKS					
Title	Author	Publisher				
1. Fiber-optic communication Systems	G. P. Aggarwal	2nd Ed., J. Wiley & Sons, 1997				
2. Optic Communication Systems	Mynbaev	Pearson education, 2001				
3. Optical Fiber Communication	Gerd Keiser	5th edition, McGraw Hill, 2013				
4. Optical Fiber Communication	J. Senior	PHI				



						PCEO	C-812					
				Adva	anced	Comm	unicatio	on Syst	ems			
				L		r	Г	ľ ľ	2		Credits	
				3			0	()		4	
			Session	nal Mar	rks	-					50	
			End Se	emester	· Exam	inatior	n Mark	S			50	
Cour	se		Aim of	the co	ourse is	to stud	dy the t	fundam	entals	of fading	channel	s. It also
Objec	ctives:		gives o	leep in	sight in	nto the	basics	of GS	SM and	CDMA	. It discu	isses the
			differei	nt types	s of di	versity	technic	jues an	d equa	lization a	algorithm	used in
			commu	inicatio	n syste	ms. Fin	ally, it	introdu	ces the	concept	of 3G, 40	G and 5G
			wireles	s comm	nunicat	ion star	dards.					
<u>Cour</u>	se		1. Des	sign app	propriat	te mobi	le com	nunica	tion sys	stems.		
Outco	omes:		2. Apj	ply fre	quency	reuse	conce	pt in	mobile	commu	nications	and to
			ana	lyze it	s effe	cts on	interfe	erence,	syster	n capaci	ty, and	handoff
			tecl	iniques	•		1				c	1 *1
			3. Dis	tinguisi	n vai	nous	multip		CDM	technique	es ior	mobile
			con	nnunica dvonto	ations (e.g., fl	JMA, I	DMA,	CDMA	A and the	ir advant	ages and
			$\frac{1}{4}$ And	alvze a	ges. nd dee	aion Cl		wetem	functio	oning wi	th know	ledge of
			+. Alla forv	ward ar	nd reve	erse cha	annel d	etails	advant	ages and	disadvar	itages of
				ng the te	echnolo	ngv	unier u	etans,	uu vunu	ages and	uisuuvui	114505 01
			5. Un	derstand	ding un	coming	techno	ologies	like 3G	4G etc.		
		I		ng of c	ourse (outcom	es with	progr	am out	comes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	Μ	Μ	S	S	Μ	W	W	W	W	W
CO2	S	S	S	Μ	S	Μ	Μ	Μ	W	W	W	XX/
	\sim									••	• •	••
CO3	S	S	S	S	Μ	W	W	M	W	W	W	M
CO3 CO4	S S	S S	S S	S M	M S	W W	W M	M S	W W	W W	W W	M M
CO3 CO4 CO5	S S M	S S M	S S W	S M M	M S M	W W M	W M S	M S S	W W W	W W W	W W W	M M M
CO3 CO4 CO5	S S M	S S M	S S W	S M M Un	M S M it-I	W W M	W M S	M S S	W W W	W W W	W W W W	M M M 12 hrs
CO3 CO4 CO5 Cellu	S S M lar con	S S M nmunio	S S W	S M M <u>Un</u> undam	M S M it-I entals	W W M	W M S ar syste	M S S em desi	W W W gn, free	W W W quency re	W W W use, cell	M M M 12 hrs splitting,
CO3 CO4 CO5 Cellu hando	S S M lar con	S S M nmunic	S S W cation f	S M <u>M</u> <u>Un</u> undam hannel	M S M it-I entals and a	W W M : Cellul	W M S ar syste	M S S em desi nel inte	W W W gn, free erferend	W W W quency re ce, interf	W W W use, cell čerence r	M M 12 hrs splitting, eduction
CO3 CO4 CO5 Cellu hando techni	S S M lar con	S S M nmunic oncepts, and me	S W cation f co ci ethods	S M M Uni fundam hannel to imp	M S M it-I entals and a prove	W W M Cellul djacent cell co	W M S ar syste chanr verage,	M S S mel into frequ	W W W gn, free erference	W W W quency re ce, interf managem	W W W use, cell čerence r ent and	M M M 12 hrs splitting, eduction channel
CO3 CO4 CO5 Cellu hando techni assign	S S M lar con over co iques a ment.	S S M munic oncepts, and me	S W cation f co ci ethods	S M Un undam hannel to imp	M S M it-I entals and a prove	W W M Cellul adjacent cell co	W M S ar syste chanr overage,	M S S em desi nel into , frequ	W W W gn, free erference	W W W quency re ce, interf managem	W W W use, cell čerence r ent and	M M 12 hrs splitting, eduction channel
CO3 CO4 CO5 Cellu hando techni assign	S S M lar con over co iques a ment.	S S M munic oncepts, and mo	S W cation f co ci ethods	S M Uni Fundam hannel to imp	M S M it-I entals and a prove	W W M Cellul idjacent cell co	W M S ar syste chanr overage,	M S S em desi nel inte , frequ	W W W gn, fred erferend ency	W W W quency re ce, interf managem	W W W use, cell čerence r ent and	M M 12 hrs splitting, eduction channel
CO3 CO4 CO5 Cellu hando techni assigr	S S M lar con over co iques a ment.	S S M munic oncepts, and me	S S W cation f co ci ethods	S M Uni iundam hannel to imp <u>Uni</u> n: Larg	M S M it-I entals and a prove t-II e scale	W W M Cellul adjacent cell co	W M S ar syste chanr overage,	M S S em desi nel into , frequ	W W W gn, free erference ency f	W W Quency re ce, interf managem	W W W use, cell čerence r ent and	M M 12 hrs splitting, eduction channel 12 hrs lio wave
CO3 CO4 CO5 Cellu hando techni assign Mobi	S S M lar con over co iques a ment. le radi gation	S S M munic oncepts, and mo o prop mechai	S W cation f co ci ethods	S M Uni Fundam hannel to imp <u>Uni</u> n: Larg ground	M S M it-I entals and a prove t-II e scale reflect	W W M Cellul djacent cell co	W M S ar syste chanr overage, oss, fre	M S S mel inte frequ ee spac model	W W W gn, free erference ency f e propa	W W Quency re ce, interf managem	W W W use, cell cerence r ent and nodel, rac	M M 12 hrs splitting, eduction channel 12 hrs lio wave all scale
CO3 CO4 CO5 Cellu handc techni assign Mobi propa fading	S S M lar con over co iques a ment. le radi gation g and	S S M munic oncepts, and me o prop mechai multipa	S S W cation f co ci ethods agation nisms, ath pro	S M M Uni undam hannel to imp to imp to imp n: Larg ground pagatio	M S M it-I nentals and a prove t-II re scale reflect on, typ	W W M Cellul adjacent cell co e path 1 tion (tw bes of	W M S ar syste chanr overage, oss, fre vo ray) small	M S S em desi nel into , frequ ee spac model scale f	W W W gn, free erference ency f e propa , outag	W W Quency re ce, interf managem agation m ge probab diversity	W W W use, cell čerence r ent and nodel, rac pility, sm v techniq	M M M 12 hrs splitting, eduction channel 12 hrs lio wave all scale ues and
CO3 CO4 CO5 Cellu handc techni assign Mobi propa fading algori	S S M lar con over co iques a ment. le radi gation g and thms fo	S S M munic oncepts, and me o prop mechai multipa or adapt	S W cation f co cl ethods agation nisms, ath pro- ive equ	S M M Uni rundam hannel to imp <u>Uni</u> n: Larg ground opagatio alizatio	M S M it-I entals and a prove t-II reflect on, typ on.	W W M : Cellul djacent cell co e path 1 tion (tw bes of	W M S ar syste chanr overage, oss, fre vo ray) small	M S S mel inte frequ ee spac model scale f	W W W gn, free erference ency f e propa , outag	W W W quency re ce, interf managem agation m ge probab diversity	W W W use, cell ference r ent and nodel, rac pility, sm	M M 12 hrs splitting, eduction channel 12 hrs lio wave all scale ues and
CO3 CO4 CO5 Cellu handc techni assigr Mobi propa fading algori	S S M lar con over co iques a ment. le radi gation g and thms fo	S S M munic oncepts, and mo oncepts, and mo mechai multipa or adapt	S W cation f co ci ethods bagation nisms, ath pro- ive equ	S M M Uni fundam hannel to imp to imp <u>Uni</u> n: Larg ground pagatio alizatio <u>Uni</u>	M S M it-I nentals and a prove t-II reflect on, typ on. t-III	W W M Cellul adjacent cell co e path 1 tion (tw bes of	W M S ar syste chanr overage, overage, oss, fre vo ray) small	M S S em desi nel into frequ ee spac model scale f	W W W gn, free erferend ency f e propa , outag fading,	W W W quency re ce, interf managem agation m ge probab diversity	W W W use, cell Serence r ent and nodel, rac pility, sm r techniq	M M M 12 hrs splitting, eduction channel 12 hrs dio wave all scale ues and 12 hrs
CO3 CO4 CO5 Cellu handc techni assign Mobi propa fading algori	S S M lar con over co iques a ment. le radi gation g and thms fo and C	S S M munic oncepts, and me oncepts, and me multipa or adapt	S W cation f co cl ethods agation nisms, ath pro- ive equ vision	S M M Uni undam hannel to imp to imp mit Larg ground opagatio alizatio Unit multip	M S M it-I entals and a prove t-II reflect on, typ on. t-III le acce	W W M : Cellul idjacent cell co e path 1 tion (tw bes of	W M S ar syste chanr overage, oss, fre vo ray) small M arch	M S S em desi nel into frequ ee spac model scale f	W W W gn, free erference ency e propa , outag	W W W quency re ce, interf managem agation m ge probat diversity	W W W use, cell cerence r ent and nodel, rac pility, sm v techniq	M M 12 hrs splitting, eduction channel 12 hrs lio wave all scale ues and 12 hrs 1 logical
CO3 CO4 CO5 Cellu handc techni assigr Mobi propa fading algori GSM chann	S S M lar con over co iques a ment. le radi gation g and thms fo and C els, dat	S S M munic oncepts, and me oncepts, and me mechai multipa or adapt	S W cation f co c ethods pagation nisms, ath pro- ive equ vision	S M M Uni fundam hannel to imp to imp ground opagatio alizatio Unit multipl in GSM	M S M it-I entals and a prove t-II reflect on, typ on. t-III le acce 1, mob	W W M Cellul djacent cell co e path 1 tion (tw es of ss: GS] ility ma	W M S ar syste chanr overage, oss, fre vo ray) small M arch anagem	M S S em desi nel inta frequ ee spac model scale f	W W W gn, free erference ency f e propa , outag fading, e, GSM Il flow	W W W quency re ce, interf managem agation m ge probab diversity	W W W use, cell cerence r ent and nodel, rac pility, sm r techniq	M M M 12 hrs splitting, eduction channel 12 hrs lio wave all scale ues and 12 hrs 1 logical uction to
CO3 CO4 CO5 Cellu handc techni assigr Mobi propa fading algori GSM chann CDM	S S M lar con over co iques a ment. le radi gation g and thms fo and C els, dat A techn	S S M munic oncepts, and me oncepts, and me oncepts, and me oncepts, and me oncepts, and me oncepts, and me	S S W cation f co ci ethods agation nisms, ath pro- ive equi vision S-95 s	S M M Uni undam hannel to imp to imp ground pagatic alizatio Unit multipl in GSM system	M S M it-I nentals and a prove t-II reflect on, typ on. t-III le acce 1, mob archite	W W M Cellul adjacent cell co e path 1 tion (tw bes of ess: GSI ility ma cture, a	W M S ar syste chanr overage, oss, fre vo ray) small M arch anagem ir interf	M S S em desi nel into frequ ee spac model scale f itecture ent, ca face, ph	W W W gn, free erference ency f e propa , outag ading, c, GSM Il flow hysical	W W Quency re ce, interf managem agation m ge probab diversity s in GSN and logic	W W W use, cell cerence r ent and nodel, rac pility, sm techniq ems, GSN 1. Introdu	M M 12 hrs splitting, eduction channel 12 hrs dio wave all scale ues and 12 hrs A logical action to els of IS-
CO3 CO4 CO5 Cellu handc techni assigr Mobi propa fading algori GSM chann CDM 95, fo	S S M lar con over co iques a ment. le radi gation g and thms for and C els, dat A techn orward	S S M munic oncepts, and me oncepts, and me or prop mechar multipa or adapt code di ta encry nology, link an	S W cation f co cl ethods pagation nisms, ath pro- ive equ vision yption IS-95 s d rever	S M M Uni fundam hannel to imp to imp mit Larg ground opagatio alizatio Unit multipl in GSM system se link	M S M it-I eentals and a prove t-II e scale reflect on, typ on. t-III le acce 1, mob archite operat	W W M : Cellul idjacent cell co e path 1 tion (tw bes of ess: GS] ility ma cture, a ion, cal	W M S ar syste chanr overage, oss, fre vo ray) small M arch anagem ir interf l proce	M S S mel inte freque ee spac model scale f itecture ent, ca face, ph ssing i	W W W gn, free erferend ency 1 e propa f, outag fading, c, GSM ll flow hysical n IS-95	W W W quency re ce, interf managem agation m ge probat diversity subsyste s in GSN and logic 5, call pro	W W W Use, cell Ference r ent and odel, rac podel, rac	M M 12 hrs splitting, eduction channel 12 hrs lio wave all scale ues and 12 hrs A logical action to els of IS- in IS-95,



<u>Unit-IV</u>		12 hrs									
Higher generation cellular standards: E	volved EDGE, 4G	standards and its architecture, call									
flow for LTE, VOLTE and UMTS, introdu	ction to 5G.										
RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Mobile Cellular Telecommunications	William C.Y.	2 nd edition, TMH									
Analog and Digital systems	Lee.	Publication,1995									
2. Wireless Communications Principles	T.S. Rappaport	2 nd edition, PHI,2002									
and Practice											
3. V.K. Garg	IS-95 CDMA	Pearson education ,4 th									
	and CDMA-	edition,2009									
	2000										
4. A GSM system Engineering	Asha Mehrotra	Artech House Publishers, Boston,									
		London,1997									



PEEC-811A												
L				\mathbf{N}	ficro ai	nd Nan	o- Phot	onics				
				L		1	Т]	P		Credits	5
				3			0	(0		3	
			Sessional Marks								50	
			End Se	emester	[•] Exami	nation	Marks				50	
Cours	se		The m	otivatio	n for t	he cou	rse is t	o mak	e the s	tudents	understa	nds the
<u>Objec</u>	ctives:		fundam	entals of	of photo	onics wi	ith focu	s on mi	cro-pho	otonic ar	nd nano-p	ohotonic
			devices	and ph	ysics.							
Cours	se		1. To u	indersta	nd the f	fundame	entals of	f photo	nics.			
<u>Outco</u>	omes:		2. To u	understa	and the	fundan	nentals	of surf	ace pla	smon p	olaritons	both at
			sing	le, flat i	nterface	es and in	n metal	/dielect	ric mult	ilayer st	ructures.	
			3. Able	e to desi	gn diffe	erent ty	pes of p	lasmon	ic sense	ors and s	olar cells	3.
			4. Able	to desi	ign nand	o-photo	nic devi	ices.	nhoton	ia davia	og uging	finito
			J. Auto diffe	rence ti	ime- do	nain m	yze ine ethod	t nano-	photom	ic devic	es using	; mine-
			Mannir	ng of co	nine doi	itcome	s with r	rogran	n outco	mes		
										PO1		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	PO11	PO12
CO1	S	S	M	S	M	M	M	N	S	M	N	N
CO2	S	S	M	M	M	N	M	N	M	M	N	N
CO3	S	M	S	S	S	S	S	M	S	S	N	N
CO4	S	S	S	S	S	M	M	N	S	S	N	N
CO5	S	S	M	– M	M	N	Μ	N	M	M	N	N
				Un	it-I	I		I				14 hrs
Ray o	ptics:	ntrodu	ction. p	ostulate	s of ray	optics	. Hero's	s princi	pal. Sne	ell's Lay	v. simple	optical
compo	onents,	graded	l-index	optics,	ray ec	quation	(Parax	ial ray	equati	on) ma	trix opti	cs, ray-
transfe	er matr	ix, mat	rix of s	simple	optical	compo	nents (1	free-spa	ice proj	pagation	, refracti	ion at a
planar	bound	ary, ref	raction	at a spl	herical	bounda	ry, trans	smissio	n throu	gh a thi	n lens, re	eflection
from	a plan	ar mir	ror, ref	flection	from	a sphe	erical n	nirror),	matric	es of c	cascaded	optical
compo	onents.	_										
Wave	optics	: Postu	lates of	wave	optics,	intensit	y, powe	er, and	energy,	monoc	hromatic	waves:
compl	lex repi	esentat	ion and	1 Helm	holtz ec	juation,	, wave	fronts	(plane)	waves,	spherical	waves,
ring re	erence,	annaci	so resor	araxiai	waves,	beam (optics, I	radry r	erot ca	ivity, m	icro reso	nators -
Electi	romagn	etic or	stics. T	M and	TF no	larized	light k	oundar	w cond	itions t	rancmice	ion and
reflect	tion of	P-pola	ized an	id S-po	larized	light fr	om a p	lanar b	oundary	z. single	and mu	lti-laver
proble	em pola	rization	of light	t; matri	x repres	sentation	n (The J	lones ve	ector).	,		101 100 01
			<u> </u>	Un	it-II				,			12 hrs
Revie	w of el	ectrom	agnetic	: (EM)	theory	: Boun	dary co	ndition	s, some	relevar	nt EM pr	oblems,
FDTD) and	FEM	mode	lling,	electron	nagneti	cs of	metals	s- Max	xwell's	equation	ns and
electro	omagne	tic wav	e propa	gation,	the die	lectric 1	functior	n of the	free el	ectron g	as, dispe	raion of
	1										-	
the fre	e electi	on gas	and vol	ume pla	asmon,	real me	tals and	l inter b	and trai	nsitions,	fundame	entals of
the fre	onics,	on gas surface	and vol plasm	ume pla on reso	asmon, onance,	real me surfac	tals and e plasr	l inter b non po	and tran	nsitions, s at a	fundame single ir	entals of nterface,



without considering damping, Drude model considering damping, Lorentz model, Lorentz Drude model.

Unit-	III		12 hrs						
Excitation of surface plasmon pol	aritons at planar interfaces:	Cou	pling mechanism, prism						
coupling, Kretschmann configurati	ons, Otto configurations, an	gular	interrogation, spectral						
interrogation, reflectivity, transmittivity, complete resonance condition, grating coupling, wave									
guide coupling: 1-D coupling, 2-	D coupling, plasmonic grati	ngs,	models describing the						
refractive index of metals, localized	surface plasmon resonance, pl	asmo	nic sensors and devices,						
surface-enhanced Raman scattering.									
Unit-IV 10 hrs									
Plasmonic waveguides and interc	onnects: Metal dielectric inte	rface,	, MI wave guide, MIM						
wave guide, IMI wave guide, sym	metric and anti-symmetric m	ode,	propagation length and						
penetration depth of MIM and IMI w	ave guide, photonic crystals an	d dev	vices.						
RE	COMMENDED BOOKS								
Title	Author		Publisher						
1. Principles of Nano-optics	L. Novotny and B. Hecht	Can	nbridge University						
2. S. Maier	Plasmonics - Fundamentals	Spri	nger						
	and Applications								



					Pl	EEC-81	1B					
					RF C	Circuit I	Design					
			L	,		Т			P		Credits	
			3			0			0		3	
			Session	nal Ma	rks						50	
			End So	emester	• Exami	ination	Marks				50	
Cours	se		The co	urse air	ns to de	sign and	d analyz	e basic	resonat	ors, RF	filters, a	und RF
<u>Objec</u>	<u>etives:</u>		transis	tor amp	olifier; s	tudy th	e operat	tion and	d charac	cteristic	s of RF	active
Course			compo	nents, o	scillator	rs and n	nixers u	sed in R	F desig	n.		
<u>Cours</u>	<u>se</u> mos:		1. 10 2 To	unders	, design	and and	alysis of	inters	and amp	oliners.	mnonan	te and
Oute	<u>/////////////////////////////////////</u>		2. 10	bedance	matchi	ng	ing com	cepts 0			mponen	its and
			3. To	study th	ne opera	tion of	mixers a	and osci	llators.			
		Ι	Apping	g of cou	irse out	comes	with pr	ogram	outcom	es		
										PO1		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	PO11	PO12
CO1	S	S	S	S	Ν	S	Ν	Ν	Μ	N	Μ	W
CO2	S	M	N	N	N	M	M	N	N	N	M	N
CO3	M	Ν	Ν			Μ	Ν	Ν	M	N	Ν	
RF n scatter impler	etwork ring par mentatio	and ameters on, coup	filter: , basic bled filte	<u>Un</u> Intercor resonate er. Uni	it-II nnecting or and f	g netwo filter co	orks, ne onfigurat	etwork tions, sj	propert pecial fi	ies and lter rea	l applic lizations	12 hrs ations, , filter 12 hrs
Activ	e RF c	ompon	ents an	d mod	eling:	Semico	nductor	basics.	RF di	odes b	ipolar-ir	inction
transis	stor. RF	field ef	fect trar	nsistors.	diode n	nodels,	transisto	or mode	ls.	0405, 0	ipoiui je	metion
Matcl	hing an	d biasi	ng netv	vorks: 🧵	[mpedar	nce mat	ching u	sing dis	screte c	ompone	nts, mic	rostrip
line m	atching	networ	ks, amp	lifier cla	asses of	operati	on and b	biasing	network	<u>(S.</u>		-
				Uni	t-IV:							12 hrs
RF tr relation broadl	ansisto ons, stał band, h	r ampli pility co igh po ^r	fier, oso onsidera [:] wer, an	c illators tions, c d multi	s and m onstant istage a	i xers: (gain, n amplifie	Characte loise fig rs, basi	eristics (gure cire c oscil	of ampl cles, co lator m	ifiers, a nstant V odel, h	mplifier VSWR o igh freo	power circles, quency
oscilla	ator con	figurati	on, basic	c charac	teristics	s of mix	ers.					
-	T. • 4 T			RE	COMN	AENDE	ED BOC)KS		_		
1 DE	L itle	Decier				D	Autho)r	Deser	ł 	Publishe	r
1. KF	Circuit	Design	L			Rell Pav	al Broto	lawig,	India	on Edu n Penri	2001	st
2. De Circui	sign of . ts	Analog	CMOS	Integrat	ted	BR	azavi		Mc C	Braw Hil	ll, 2001.	
3. RF	Microe	lectron	ics			Beh	zadRaza	avi	2nd e Educ	dition, lation, 19	Pearson 997.	



4. RF Circuit Design: Theory & Applications	Reinhold Ludwig,	2nd edition, Pearson, 2008.
	Gene Bdgdanov	



				PE	EC-81	1C					
			Statisti	ical Inf	ormati	on Proc	essing				
			L			Т		P		Credit	s
			3			0	(0		3	
	S	essiona	l Mark	S			1			50	
	F	Ind Sen	iester I	Examin	ation N	larks				50	
Course Objectives: Course Outcomes:	1 1 1 2 3 4	The mai continuc statistica How dis continuc and aud and con coding, . To C system opera . To d such . Comp applie . To d	n objections ous ran al decisions screte constructions io-visuations BCH constructions haracteristics models parative cations	tive of dom va sion the channels ns; com al infor codes & constant rize and th as inf trate ma ely evo to signa	the council the council and r aplexity mation aplexity mation apply ormatic athematic athematic athematic athematic athematic athematic athematic	rse is to and paramete neasures , comparator coding man, S , Reed- probabion system ical more sy resu ssing, c	o under rocesse r estim s of in ression, schem Shannor Solom ilistic te ms, reco odeling lts dev ommun	stand th s, rand nation a formation and ef nes; incl n-Fano, on code echniqu eivers, f and p veloped nications	le basics om sign and specton gener ficient of luding of arithm <u>s & dec</u> es in m "iltering roblem in th s system	s of dis nal mo ectral a eralize t coding error de etic, a oder. oder. odern d , and sta solving is counts.	crete & delling, nalysis. to their of text, etecting daptive lecision atistical g using rse for themes
		for m	odeling	σ and a_1	nalvsis	of varic	probac	tems in	volving	functio	nalities
		in de	cision n	naking.	statistic	cal infer	ence. e	stimatic	on and d	etection	1.
	M	apping	of cou	rse outc	comes v	vith pro	ogram (outcom	es		
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 M	W	Ν	S	N	W	Ν	Μ	W	Ν	Ν	Ν
CO2 M	N	Ν	S	S	Ν	Ν	Ν	Μ	Ν	Ν	Ν
CO3 W	Μ	Μ	Ν	Μ	S	Ν	S	Ν	S	Μ	Μ
CO4 M	S	S	Ν	Μ	Ν	Μ	Ν	Ν	Ν	W	Μ
"	<u>.</u>	-	Uni	t-I				-			14hrs
Review of moments, in representation	random ndependen n of ran	variat ent, un idom v	oles: P correla ariables	robabili ited an s, vecto	ty con d orth or quar	cepts, nogonal itization	distribu rando , Tche	ition ar om va bayche:	nd dens riables; f inequ	sity fur vecto ality th	nctions, or-space neorem,
central limit t	heorem,	discrete	e & con	tinuous	randon	ı varıab	les.				
Random pr	ocess:	Expecta	tions,	momer	nts, erg	godicity	, disci	rete-tim	e rand	om pr	ocesses
stationary pr	ocess, a	utocorre	lation	and aut	o cova	riance f	function	ns, spec	tral rep	oresenta	ation of
random signa	ls, prope	erties of	power	spectral	density	, Gauss	sian pro	cess and	d white	noise p	rocess.
.		114	Unit	t-11	1.0.2.5						12 hrs
Random signapplications, Durbin algori	hal mod linear s thm.	ystem v	MA(q), vith rar	, AR(p) ndom in	, ARM put, fo	A(p,q) 1 rward a	models, and bac	, hidder kward	Marko predicti	ov mode lons, Le	el & its evinson



Unit-III	12 hrs
Parameter estimation theory: Maximum likelihood estimation, gene	ralized likelihood ratio
test, some criteria for good estimators, Bayes' estimation minimum mea	n-square error estimate,
minimum, mean absolute value of error estimate maximum, a-poste	riori estimate, multiple
parameter estimation best linear unbiased estimator, least-square esti	mation recursive least-
square estimator.	
Spectral analysis: Estimated autocorrelation function, periodogram, ave	raging the periodogram
(Bartlett method), Welch modification, parametric method, AR(p) s	pectral estimation and
detection of harmonic signals.	
<u>Unit-IV</u>	14hrs
Information theory and source coding: Review of information and	entropy, source coding
theorem, Huffman, Shannon-Fano, arithmetic, adaptive coding ,	RLE , LZW, data
compaction,LZ-77, LZ-78. discrete memory less channels, mutual	information, channel
capacity, channel coding theorem, differential entropy and mutual info	rmation for continuous
ensembles.	
Application of information theory: Group, ring & field, vector, GF	addition, multiplication
rules, introduction to BCH codes, primitive elements, minimal	polynomials, generator
polynomials in terms of minimal polynomials, some examples of BC	CH codes and decoder,
Reed- Solomon codes & decoder, implementation of Reed Solomon enco	oders and decoders.
RECOMMENDED BOOKS	
Title Author	Publisher
1.Probability, Random Variables andPapoulis and S.U.4th	n Edition, McGraw-
Stochastic Processes Pillai Hi	ll, 2002.
2. Statistical and Adaptive Signal D.G. Manolakis, M	cGraw Hill, 2000.
Processing V.K. Ingle and S.M.	
Kogon	
3. Signal Detection and Estimation Mourad Barkat A	tech House, 2nd
Ec	ition, 2005
4. Information theory and reliable R G. Gallager W	iley, 1st edition, 1968
communication	
5. Elementary Number Theory Rosen K.H, Ad	ldison-Wesley, 6th
ed	ition, 2010.
6. The Theory of Error-Correcting Codes F. J. Mac Williams No	w York, North-
and N. J. A. Sloane Ho	olland, 1977.



					P	PEEC-8	312A						
				Ant	enna A	nd Rad	liating	System					
				L		,	T	Ī			Credit	S	
		Ī		3			0	()		3		
			Sessior	nal Ma	rks			•			50		
			End Se	emester	• Exami	ination	Marks				50		
Cours	se		The ob	jective	of this	course	is to ir	ntroduce	e the fu	undame	ntal prin	ciples of	
<u>Objec</u>	<u>tives:</u>		antenna	a Diffe	erent ty	pes of	f anten	inas ar	d the	ir appli	cations	will be	
			introdu	ced, w	vith foc	cus on	loop	antenna	s, ape	rture a	ntenna,	reflector	
			antenna	a, micr	ostrip_a	ntenna,	broadl	band ar	itenna	and and	enna ari	ays; the	
			charact	erizatio	on and	design	conside	erations	of usi	ng ante	nnas in	wireless	
C			commu	<u>inicatio</u>	n syster	$\frac{\text{ns.}}{1}$		1				· 1	
Cours	<u>se</u>		I. Fan	1111ariza	tion w	ith rad	lation	mechar	usm, a	antenna	parame	ters and	
Outco	omes:		2 Port	ses of a	niennas	s. orticulo	r ologo	of optor	no for	aivon a	anificati	one	
			2. De a	able to	on pring	articula	design	on antenn	as and	antenna	arrays	ons.	
			J. App 4 Fam	ny uesi niliarize	with so	me adv	vanced s	antenna	types	antenna	allays.		
	Mapping of course outcomes with program outcomes												
PO1 PO2 PO4 PO5 POC PO5 PO2 PO3 A PO1 PO12													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	9	0	PO11	PO12	
CO1	S	Μ	Μ	Μ	Ν	Μ	N	Μ	N	Ν	W	N	
CO2	N	S	Μ	Ν	N	Μ	Ν	Ν	Μ	N	Μ	Μ	
CO3	S	Μ	S N M S M N N M M										
CO4	Ν	Ν	Μ	Ν	Ν	Μ	Ν	Ν	Μ	Ν	Μ	Μ	
				Un	it-I							12 hrs	
Funda	amenta	l conc	epts: Pl	hysical	concep	t of ra	diation,	radiati	on pat	tern, ne	ar- and	far-field	
region	is, recij	procity,	directi	vity ar	nd gain	, effect	tive ape	erture,	polariz	ation, i	nput im	pedance,	
efficie	ncy, Fr	iis tran	smissior	1 equati	on, radi	ation in	tegrals	and aux	kiliary j	potentia	l functio	ns.	
Radia	tion fr	om wir	es and	loops:	Infinites	simal di	pole, fi	nite-len	gth dip	ole, line	ear eleme	ents near	
condu	ctors, d	ipoles f	for mobi	le com	municat	tion, sm	all circ	ular loo	р.	1		101	
				<u>Uni</u>	<u>t-II</u>							12 hrs	
Anten	ina arr	ays: Ai	nalysis (of unifo	ormly sp	aced ar	rays wi	th unifo	orm an	d non-u	niform e	xcitation	
	tudes, e	xtensio	n to plai	nar arra	ys. mahalia			7					
Kelled	ctor and	lennas:	Prime	tocus pa		reflect	or and C	assegr	ain anu	ennas, d	esign co	$12 \mathrm{hrs}$	
A 4		4		Uni	[-]]]		C				1	12 111 5	
Apert	ure an	loration	: Huyg	ens pr	incipie,	radiati	on from	n recta	ngular	and ci	rcular a	pertures,	
concer	t CONSIC	leration	is, daoi	net s p	meiple	, radiat	ion froi	n scrou	ai and	pyramic	iai norns	s, design	
Micro	pis. strin A	ntenn	ac. Basi	ic chara	octoristi	rs of m	icrostri	n anten	nas fe	eding n	ethods	methods	
of ana	lvsis de	esion o	f rectand	oular ar	d circul	lar natel	h anteni	p anten nas	11as, 10	cuing in	ictitous,	methous	
or and	19515, a	001511 0	r ree tung	Uni	t-IV	ui pute	ii uiiteiii	ilus.				12 hrs	
Broad	lband a	ntenna	as: Broa	dband of	concept	log-pe	riodic a	Intennas	s, freau	encv in	depender	nt	
antenr	nas.				<u>-</u> P*	, or			, 10	- ,	- r		
Basic	concep	ts of sı	nart an	tennas	: Conce	ept and	benefit	s of sm	art ante	ennas, fi	xed weig	ght beam	
1						-						-	



	RECO	MMENDED BOOKS	
	Title	Author	Publisher
1.	Antenna	K D Parsad	Parkash Publications
2.	Antennas	John D. Karans	Tata McGraw Hill
3.	Antenna Theory and Design	Balanis, C.A.	3rd Ed., John Wiley &Sons
4.	Electromagnetic Waves and Radiating Systems	Jordan, E.C. and Balmain, K.G	2nd Ed, Pearson Education
5.	Antenna Theory and Design	Stutzman, W.L. and Thiele, H.A.,	2nd Ed, John Wiley & Sons
6.	Antenna Theory and Design, Revised edition	Elliot, R.S.	Wiley-IEEE Press
7.	Microstrip Antenna Design Handbook,	Garg. R. Bhartia, P. Bahl, I. and Ittipiboon.	Artech House



					PE	EC-81	2B						
Internet of Things													
				L			<u> </u>			Р		Credits	
				3			0			0		3	
			Sessio	nal Ma	arks							50	
			End S	emeste	er Exa	minati	ion Ma	arks				50	
Course			The ai	m of t	his cou	arse is	to fan	niliariz	e with	IoT tec	hnolog	ies and its	
Objectives:			require	ement	in cert	ain sc	enarios	s, utiliz	zation	of lates	t techn	ologies to	
	_		implen	nent I	oT so	lutions	s in d	lifferen	nt scer	narios a	nd exp	perimental	
			platfor	m for	imple	mentir	ng pro	totypes	s and	testing	them a	s running	
			applica	ations.									
Course			1. To ι	underst	and th	e appli	cation	areas o	of IoT.				
Outcomes:			2. To 1	realize	the re-	volutic	on of I	nternet	in sm	art cities	s, cloud	& sensor	
			netv	vorks.									
			3. To	under	stand	build	ing b	locks	of i	nternet	of th	ings and	
			chai	racteris	stics.								
			4. To u	unders	tand th	e vari	ous op	erating	g syster	ms and s	security	/ issues in	
101. Mapping of Course Outcomes with Program Outcomes													
Mapping of Course Outcomes with Program OutcomesPO1PO2PO3PO4PO5PO6PO7PO8PO9PO10PO11PO12													
CO1	POI	PO2	PO3	PO4	PUS	PUO	P0/	PUð	P09	POIO	POII	. POI2	
	S	M	W	N	N	N N	N N	N N	N	N N	N	S	
CO_2				IN N	IN N	IN N	IN N	IN N	IN N	IN N	W NV	S W	
CO3	VV S	5 5	VV N/	IN N	IN N	IN N	IN N	IN N	IN N	IN N	VV NI		
04	3	3	IVI	IN	IN Unit		IN	IN	IN	IN		14 hrs	
IoT Archit	tocturo	Sma	rt obie	acte ae	build	ling h	locks	for Io'	T one	an source	e hard	It IIIS	
embedded s	vstems	nlatfoi	rms for	LIS as	doe/oa	nng U iteway	I/O d	rivers	C proc	n sourc	σ mult	ithreading	
concepts	ystems	plation	1115 101	101, 0	uge/ge	ucway	, 1/O u	110013,	C prog	51 annin	g, mun	nincading	
Application	ı doma	ins of	IoT:	Smart	cities	and Io	T revo	olution	. fracta	al cities.	from	IT to IoT.	
M2M and p	eer netv	vorkin	g conce	epts. II	V4 an	d IPV	6. softy	ware de	efined	network	s SDN.		
			0	- I ,	Unit-	II	- ,					12 hrs	
Fog compu	ting: F	rom c	loud to	fog a	nd MI	ST net	workir	ng for]	IoT co	mmunic	ations,	principles	
of edge/P2	P netw	orking	g, prote	ocols	to sur	port]	loT co	ommur	nication	ns, mod	ular d	esign and	
abstraction,	security	y and p	orivacy	in fog	. 1	1						C	
IoT technol	logy fui	ndame	entals:	Introdu	uction	to WS	N and	IoT ne	tworks	(PAN,	LAN a	nd WAN),	
edge resour	ce pooli	ng and	d cachii	ng, clie	ent side	e contr	ol and	config	uratior	ı.			
					Unit-	III						10 hrs	
Operating	system	s in I	oT: Re	equirer	nent o	of oper	ating a	system	in Io	T enviro	onment	, study of	
Mbed, RIoT	and Co	ontiki	operati	ng syst	ems.								
					Unit-	IV						12 hrs	
Application	ı of Io'l	C: Con	nected	cars I	oT trar	nsporta	tion, s	mart g	rid and	l healthc	are sec	tors using	
IoT, introdu	ictory co	oncept	s of big	g data f	for IoT	applic	ations	•			-		
Security in	IoT: Se	ecurity	and le	gal coi	nsidera	tions,	IT Act	2000 a	and sco	ope for I	oT legi	slation.	



RECOMMEN	DED BOOKS	
Title	Author	Publisher
1. Internet of Things- Hands on approach	Arshdeep Bahga and Vijay K. Madisetti	VPT publisher
2. Designing the Internet of Things	Adrian McEwen and Hakim Cassimally	Wiley
3.Getting started with Internet of Things	Cuno Pfister	Maker Media
4. Internet of things	Samuel Greenguard	MIT Press



					P	EEC-8	12C							
					Rei	mote Se	ensing							
			L	1		Т]	Р		Credits	5		
			3			0			0		3			
			Session	nal Ma	rks						50			
			End S	emeste	r Exam	ination	Marks	5			50			
Cours	se		The co	ourse a	ims to	provide	e an ur	nderstan	ding a	bout ba	sic con	cepts of		
<u>Objec</u>	tives:		remote	e sensi	ng, dif	ferent	types	of space	cecrafts	and	remote	sensing		
			platfor sensors	ms, pl s used i	hotograj n RAD/	ohic pi ARs and	oducts Altime	and o eter-LiE	optome DAR	chanica	l electr	ooptical		
Cours	se		1. To	unders	stand ba	sic con	cepts, 1	orinciple	es, and	applica	tions of	remote		
Outco	mes:		ser	nsing, p	articula	rly the g	geometr	ic and r	adiome	tric prin	ciples.			
			2. To	apply	princip	les of	variety	of topi	cs of	remote	sensing	to data		
			col	lection,	radiatio	on, reso	lution, a	and sam	pling.					
			3. To	under	rstand	various	therm	al dat	a anal	ysis, ii	nterpreti	ng and		
processing techniques. Mapping of course outcomes with program outcomes														
Mapping of course outcomes with program outcomes PO1														
	DO1	DOJ	DO2		DO5	DOC	D07	DOP		POI	DO11	DO12		
<u>CO1</u>	POI	PO2	PO3	P04	PU5	PU0 M	PU/	P08	P09	U	POII	PO12		
CO1	5	5 5	M S M M S W W M W W											
C02	S	S	S	S	S	M	M	M	W	W	W	W		
	D	0	0	Un	it-I				••	••	••	12 hrs		
Physic	cs of re	emote	sensing	: Electi	romagne	etic spe	ctrum,	physics	of ren	note ser	nsing, ef	fects of		
atmos	phere s	scatteri	ng, diff	ferent	types of	of atmo	sphere	scatter	ring, a	bsorptic	on, atmo	ospheric		
windo	w, enei	gy inte	eraction	with s	urface t	features	, spectr	al refle	ctance	of vege	etation, s	soil and		
water	atmospl	heric in	fluence	on spec	ctral res	ponse p	atterns,	multi c	oncept	in remo	te sensir	ıg.		
				Un	<u>it-II</u>							12 hrs		
Data	acquisi	ition:	Гуреs о	of platf	orms, d	lifferent	types	of airc	rafts, 1	nanned	and un	manned		
spaced	crafts, si	un sync	hronous	s and ge	eosynch	ronous	satellite	s, types	and ch	aracteri	stics of a	lifferent		
platfor	rms: L	ANDSA	AT, SP	OT, IF	RS, INS	SAT, II	KONOS	S, QUI	CK BI	RD etc	., photo	ographic		
produ	ets, B/V	V, colo	r, color	IR filn	n and th	eir chai	acterist	tics, res	olving	power c	of lens a	nd film,		
optom	echanic	al elec	tro opti	ical ser	nsors –a	cross ti	rack an	d along	g track	scanner	rs, multi	spectral		
scanne	ers and	therm	al scanı	ners, ge	eometric	c chara	cteristic	es of sc	anner	imagery	, calibra	ation of		
therma	al scann	ers.										101		
				<u>Uni</u>	<u>t-III</u>							12 hrs		
Scatte	ering sy	stem:	Microw	ave sca	atterome	etry, typ	es of \overline{R}	RADAR	, SLAF	R: resolu	ution, ra	nge and		
azimu	th, real	apertu	ire and	synthe	tic aper	rture R	ADAR,	charac	eteristic	s of m	icrowave	e image		
topogi	aphic e	effect,	differen	t types	s of rer	note se	nsing p	olatform	ns, airb	orne ar	nd space	borne,		
sensor	s, ERS	, JERS	, RAD	ARSAT	r, RISA	T, scat	teromet	ter, alti	meter-I	LiDAR	remote	sensing,		
l princi	ples, ap	plicatio	ns.											

Unit-IV:	12 hrs
Thermal and hyper spectral remote sensing: Sensors characteristics, pr	rinciple of spectroscopy,
imaging spectroscopy, field conditions, compound spectral curve, sp	ectral library, radiative
models, processing procedures, derivative spectrometry, thermal remote s	sensing, thermal sensors,
principles, thermal data processing, applications, data analysis, span	tial resolution, spectral
resolution, radiometric and temporal resolution, signal to noise ratio,	data products and their
characteristics, visual and digital interpretation, basic principles of data	processing, radiometric
correction, image enhancement, image classification, principles of LiD	OAR, aerial laser terrain
mapping.	
DECOMMENDED DOOVS	

RECOMME	NDED BOOKS	
Title	Author	Publisher
1. Remote Sensing and Image interpretation	T.M. Lilles and R.	6th Edition,
	W. Kiefer	John Wiley & Sons, 2000
2. Introductory Digital Image Processing: A	John R. Jensen	2nd Edition, Prentice
Remote Sensing Perspective		Hall,1995.
3. Remote Sensing Digital Image Analysis	Richards, John A.,	5th Edition, Springer-
	Jia, Xiuping	Verlag Berlin Heidelberg,
		2013
4. Principles of Remote Sensing	P.J.Paul Curran	1st Edition, Longman
		Publishing Group,
		1984
5. Introduction to The Physics and	Charles Elachi,	2nd Edition, Wiley Series,
Techniques of Remote Sensing	Jakob J. van Zyl	2006
6. Remote Sensing Principles and Image	F.F.Jr, Sabins	3rd Edition, W.H. Freeman
Interpretation		& Co, 1978



					P	EEC-81	3 A							
					Core 2	Elective	e -1 Lal	b						
				(Co	mmuni	ication	System	Lab)						
			L			Т			Р		Credi	its		
			0			0			4		2			
		Inte	rnal As	sessme	nt Mar	ks					50			
		End	Semes	ter Mai	rks						50			
Cours	<u>se</u>	The	aim of	this cou	irse is t	o study	and un	derstand	d the as	pects of	differe	nt types		
Objec	Objectives: of signals, their operation, the spectrum in time and frequency domain,													
	generation, and demodulation of AM signals. Thorough knowledge would													
	enable students to understand characterization and design considerations in													
	communication systems.													
<u>Course</u> 1. To familiarize the use of MATLAB for solving communication														
Outco	omes:		engi	neering	problei	ns.								
			2. To l	Learn th	ne basic	s of sig	gnals ar	nd its op	peration	is as use	ed in A	nalogue		
			and	Digital	Commu	inicatio	n.							
			3. To a	ınalyze	the spe	ctrum,	in time	and fre	quency	domair	n, of An	ıplitude		
			Moc	lulation										
		4	4. To f	amiliari	ze with	generat	tion and	l demod	lulation	of ASK	, PSK a	nd FSK		
			sign	als usin	g MAT	LAB.								
		Ν	Aappin	g of cou	irse ou	tcomes	with p	rogram	outcon	nes				
							_	_		PO1				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	PO11	PO12		
CO1	Μ	Μ	Ν	S	Ν	Μ	Ν	Μ	Ν	S	Μ	Ν		
CO2	Ν	Ν	S	Ν	Ν	S	Μ	Ν	Ν	S	S	Μ		
CO3	Ν	Μ	Μ	Ν	S	Μ	Ν	Ν	Μ	S	Μ	Μ		
CO4	S	Ν	S	Ν	Ν	S	Μ	Ν	Μ	S	S	S		

List of Experiments:

- 1. To the use of MATLAB for generation of different signals important in communication theory.
- 2. To learn the use of MATLAB for different operations on signals.
- 3. To identify the spectrum analyzer as used in frequency domain analysis using SIMULINK.
- 4. To identify various types of linear modulated waveforms in time and frequency domain representation using SIMULINK.
- 5. To analyze the spectrum, in time and frequency domain, of Amplitude Modulation using MATLAB.
- 6. To generate and demodulate amplitude shift keyed (ASK) signal using MATLAB.
- 7. To generate and demodulate phase shift keyed (PSK) signal using MATLAB.
- 8. To generate and demodulate frequency shift keyed (FSK) signal using MATLAB.
- 9. To generate a scatter plot for QPSK and BPSK using MATLAB.



					DE	EC 01) D								
					PE Core I	EC-81. Floctivo) D _1 I ah								
				(Wir	eless co	mmini	-1 Lau	Lab)							
			L	(, , , , , , , , , , , , , , , , , , ,		T			P		Credi	ts			
			0			0			4		2				
		Iı	nternal	Assessn	nent Ma	arks					50				
		Ε	nd Sem	ester M	larks						50				
Cours	e	Т	The aim of this course is to study and understand the practical aspects of												
<u>Objec</u>	tives:	W	vireless	commu	nication	n syste	m with	focus	on ba	sic dig	ital ba	seband			
		C	ommuni	cation,	wavefor	rm analy	ysis wit	h MATI	LAB, cl	nannel i	mpact c	on path			
		lo	loss model using MATLAB, various filter application and multi-dimensional												
		si	gnal ar	nalysis	in com	imunica	tion sy	stem. 7	Thoroug	gh knov	vledge	would			
		e	nable st	udents	to unde	rstand	characte	rization	and p	aramete	rs in w	vireless			
		С	ommuni	cation s	ystems.										
Cours	<u>e</u>	1	. To fa	miliariz	e with s	ome adv	vanced o	commur	nication	system.					
Outco	mes:	2	. To fai	miliariz	e with the	he diffe	rent way	veform f	features	via sim	ulation.				
		3	. To av	vare abo	ut the lo	osses in	the con	nmunica	tion cha	annel.					
		4	. To fa	miliariz	e about	the usef	ulness o	of the fil	lters in t	the com	municat	tion.			
		N	/apping	g of cou	rse out	comes v	vith pro	ogram o	outcom	es					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
CO1	Ν	Μ	Ν	Μ	Ν	Ν	Ν	Μ	Ν	S	Ν	Ν			
CO2	Μ	Μ	W	Μ	Ν	Μ	Ν	Ν	Ν	S	Ν	Ν			
CO3	W	Μ	Ν	Ν	Ν	Μ	Ν	Ν	Μ	S	Μ	Ν			

Μ List of Experiments:

CO4

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1. To study the baseband communication using Trainer KIT.

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- 2. To study the CDMA for both multipath and multiuser on Trainer KIT.
- 3. To study the spread spectrum- DSSS modulation and demodulation using Trainer KIT.
- 4. To study and familiarize with MATLAB and its function widely used in wireless communication simulation and plot using MATLAB simulation

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- 5. To study and Develop an QPSK detector and understand the relation between BER and SNR.
- 6. To study and understand the various waveforms, their properties and process to capture transmitted waveforms and their processing using MATLAB simulation.
- 7. To Study the Propagation Path loss Models for Free Space Propagation using MATLAB.
- 8. To Study the Propagation Path loss Models for Link Budget Equation in Satellite Communication using MATLAB.
- 9. To Study the Propagation Path loss Models for Carrier to Noise Ratio in Satellite Communication using MATLAB.
- 10. To Study the various pulse shaping filters widely used in wireless communication system
- 11. To study and understand the features of matched filter.
- 12. To study the importance of coarse and fine synchronization, effect of frequency offset and its correction.
- 13. To Study tools to find out several unknown parameters of wireless communication system through multi-dimensional signal analysis

Department of Electronics & Communication Engineering

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					I	PCEC-8	814								
				Optical	Comm	nunicat	tion Sys	stem La	ıb						
			L			Т			Р		Cred	its			
			0			0			4		2				
		Inte	rnal As	ssessmei	nt Mar	:ks					50				
		End	Semes	ter Mar	ks						50				
Cou	rse	The	aim of	this co	ourse i	s to stu	idy and	d unders	stand th	e pract	ical asj	pects of			
<u>Obj</u>	ectives:	adva	anced co	ommunic	cation	system	and opt	tical fibe	er. It als	o gives	the insi	ght into			
		varie	ous opt	ical non	lineari	ties in	optical	commu	nication	n and th	neir mit	tigation.			
		Fina	lly, it v	will prov	vide pl	atform	for the	e studen	t to des	sign and	ł evalu	ation of			
		mod	lern opt	tical cor	nmuni	cation	networl	ks, wire	eless co	mmunio	cation	network			
		and	OFDM.												
Cou	rse	1. <i>I</i>	Able to	understa	and vai	tious lo	sses oc	curs in o	optical o	commur	nication	system			
<u>Out</u>	comes:	8	and their	r mitigat	ion.										
		2. I	. Ability to model and analyze the optical communication system for higher												
		3. Adding to model and analyze the optical communication system for higher data rate													
	data rate.														
	4. Capable to integrate wireless technology with optical communication														
			<i>Jannin</i>	ngy. g of cou	rse out	tcomes	with n	rogram	outcon	nes					
	PO1					PO6		PO8			PO11	PO12			
CO		102 M	103 N	S 104	<u>105</u> N	100 M	107 N	100 M	N	S	<u>1011</u> M	N			
	$\frac{1}{2}$ N	N	S	N	N	S	M	N	N	S	S	M			
CO	3 N	M	M	N	S	M	N	N	M	S	M	M			
CO	1 S	N	S	N	Ň	S	M	N	Μ	S	S	S			
List	of Exper	iments	:	II											
1.	To study	the effe	ect chara	acteristic	cs of M	Iach-Ze	nder m	odulator	r in Opti	i-systen	1.				
2.	Designing	g of an	intensi	ty modu	ulator 1	using L	ithium	Niobate	e Mach-	Zehnde	r modu	ilator in			
	Opti-syst	em.													
3.	To establ	ish a po	oint-to-p	oint opt	ical co	mmuni	cation l	ink on (Opti-Sys	stem and	d optica	ıl kit.			
4.	Character	rization	of lase	r diode a	ind pho	otodetec	tor usin	ng simu	lator/lig	ht runne	er.				
5.	Character	rization	of the e	electrical	l paran	neter of	the inte	ensity m	odulato	or using	Opti-S	ystem.			
6.	Measurer	nent of	attenua	tion in c	ptical	fiber us	ing Op	ti-Syster	m simul	ator and	l light r	unner.			
7.	Measurer	nent of	dispers	ion in op	ptical f	iber usi	ng Opti	i-Systen	n simula	ator and	light ru	inner.			
8.	Minimiza	ation of	the effe	ect of dis	spersio	n in opt	ical con	mmunic	ation lir	ık.					
9.	Evaluatio	on of po	ower bu	dget of a	an opti	cal fibe	er link u	using O	pti-Syst	em sim	ulator a	nd light			
	runner.														

- 10. Designing of a DWDM point-to-point link using Opti-system.
- 11. To study the effect of channel spacing and operating bit rate in DWDM optical network.
- 12. To study the effect of four-wave mixing in DWDM network in Opti-system.
- 13. To study the effect of cross-phase modulation in DWDM network in Opti-system.
- 14. Designing of an all-optical wavelength convertor using Opti-system.
- 15. Experimental study of SMF cutting and splicing.
- 16. Demonstration of SMF connection.
- 17. Designing of external metal deposition-based PCF-SPR sensor model.
- 18. Modelling of spectroscopy-based sensing setup for liquid analytes.

Dr. J. S. Ubhi



Course Objectives: Th Course Objectives: Th Inn va act act Course Outcomes: 1. 2. 3. 3. 4. Mapp	Micro L 3 ssional Mar d Semester	owave In	ntegrat T	ed Circ	uits I								
Course Objectives:The lin va actCourse Outcomes:1.2.3.4.4.	L 3 ssional Mar d Semester		T	1	I								
Course Objectives:Th lin va actCourse Outcomes:1.2.3.4.4.	3 ssional Mar d Semester		1		1			Credits	1				
SeeEnCourse Objectives:ThlinvaactCourse Outcomes:1.2.3.4.Mapp	d Semester	Jea			()		4					
Course Objectives:The lin va acciCourse Outcomes:1.2.3.4.4.	Objectives: The objective of this course is to analyze and design of various strip												
Course Objectives.IIIlinvaactactCourse Outcomes:1.2.3.4.4.Mapp	a objective	of this		$\frac{1}{1}$	alvza a	ad dasi	m of w		trin				
Course Outcomes: 1. 2. 3. 4. Mapp	les launchin	or uns og techni	iques a	nd micr	owave i	lu uesig	filters a	nalvze	the				
ac Course Outcomes: 1. 2. 3. 4. Марр	rious couply	er for r	ietwork	design	: study	the di	fferent	devices	of				
Course Outcomes:1.2.3.4.Mapp	tive microw	ave circi	uits and	nonline	ear RF c	ircuits.							
2. 3. 4. Mapp	To gain kn	owledge	e about t	he desi	gn of va	rious st	riplines	launch	ing				
2. 3. 4. Mapp	and lumped	l, eleme	nts.		-		-		-				
3. 4. Mapp	Ability to d	lesign ar	nd fabrio	cate var	ious mie	crowave	e planar	filters.					
4. Mapp	Ability to	analyz	e and	model	networl	c desig	n based	d on v	arious				
4. Mapp	couplers.						•		6 1				
Mapp	Select vari	ious co	mponen	its to o	characte	rize ci	rcuit ar	id veri	fy the				
	performance	es.	mes wi	ith proc	rom or	itcomes							
				un pros	gi ann Ut		,		PO1				
PO1 PO2 P	O3 PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	2				
CO1 M M Y	W N	Ν	S	Ν	Ν	Ν	Ν	W	Ν				
CO2 S M J	M N	Ν	S	Ν	Ν	Μ	Ν	Μ	Μ				
CO3 M S	N N M S N N N N N												
CO4 N M S N M M N M M													
	Uni	<u>t-I</u>							12 hrs				
Introduction: Review of	transmission	n lines,	founda	tions of	f micro	strip lii	nes, stri	plines,	higher				
modes in microstrips and	strip lines,	slot line	es, copla	anar wa	veguide	s, copl	anar str	ips, lau	nching				
microstrip to slot line tra	o microstrip	rostrin	to conl	angular	waveg	unde to (CPW)	micros	rip tran	isition,				
components - capacitors in	ductors and	resistor	to copi	allal wa	avegulu		v) trans	ition, i	umpeu				
	Unit	-II	3.						12 hrs				
Microwave planar filters:	Periodic st	tructures	s, filter o	design b	y the in	nage pa	rameter	method	l, filter				
design by the insertion	loss metho	d, filter	transf	ormatio	ns, filte	er impl	ementat	ion, st	epped-				
impedance low-pass filters,	coupled line	e filters,	filters u	using co	upled re	esonator	s.						
	<u>Unit-</u>	·III							12 hrs				
4-Port network design:	Review of	network	design	, even	and od	d-mode	analysi	s, bran	ch-line				
couple, branch-line coupl	er with im	proved	couplin	ng perf	ormance	e, bran	ch-line	couple	r with				
multiple sections, introduc	ction to hy	brid-rin	g coup	lers, qu	alitativ	e desci	ription	and co	mplete				
to parallel coupled lines an	plers, nyoric	1-ring couple	ouplers	with me	dd anal	ing imp	arallel	s, introc	luction				
coupled-line parameters m	ultiple-section	on direct	tional co	n and o	uu-anar	515 01]	Jaraner-	couplet	i iiies,				
coupled file parameters, in	Unit.	-IV		Jupicis.					12 hrs				
Nonlinear RF circuits:	Review of	non-lin	near cir	cuits, 1	ower s	gain re	lations.	simult	aneous				
conjugate matching, stabi	lity conside	erations,	power	gain 1	for mat	ched, i	ınmatch	ed, un	ilateral				
conditions, noise characteri	zation and d	lesign of	otions, s	witches	- PIN d	liode sw	vitches,	FET sw	vitches,				
mems switch, variable atte		-											
Nonlinear RF circuits: conjugate matching, stabi conditions, noise characteri	Unit- Review of lity conside zation and d	-IV non-lin erations, lesign op	near cir power potions, s	cuits, j gain t witches	oower g for mat - PIN c	gain re ched, u liode sw	lations, inmatch	simult ed, un FET sw	12 hrs aneous ilateral vitches,				



amplifiers, low noise amplifiers, power amplifiers, oscillators.

	RECOM	MENDED BOOKS			
	Title	Author	Publisher		
1.	Microwave Engineering	D.M. Pozar	3 rd Ed., John Wiley &		
			Sons, 2004		
2.	Microwave Engineering Using	E.H. Fooks and	Prentice-Hall, 1990		
	Microstrip Circuits	Zakarevicius			
3.	Networks and Devices using Planar	Franco di Paolo	CRC Press, 2000		
	Transmission Lines				
4.	RF Circuit Design	R. Ludwig and	Pearson Education,		
	-	P. Bretchko	2000		
5.	Microwave and RF Engineering	Roberto Sorrentino	John Wiley & Sons,		
		and Giovanni	2010		
		Bianchi			



VLSI Design L T P Credits 3 0 0 3 Sessional Marks 50 End Semester Examination Marks 50 Objectives: The objective of VLSI Design is to help the students to get brief knowledge of MOS, PMOS, NMOS, CMOS &Bi-CMOS technologies. It also aims at introducing the fundamental principles of VLSI circuit design and to examine the basic building blocks of gate level design and subsystem design. Course 1. Model the behaviour of MOS transistor and understand the switching characteristics of inverter. 2. Design combinational and sequential circuits using CMOS gates. 3. Identify the sources of dynamic, leakage power components in a given VLSI circuit and analyze the performances of VLSI circuits. 4. Analyze and design VLSI subsystem structures. Mapping of course outcomes with program outcomes PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO1 PO12 CO2 S M N N N N M M M M M M M M M M M M M M M M						I	PCEC-8	822					
L T P Credits 3 0 0 3 Sessional Marks 50 End Semester Examination Marks 50 Objectives: The objective of VLSI Design is to help the students to get brief Objectives: knowledge of MOS, PMOS, NMOS, CMOS & & CMOS technologies. It also aims at introducing the fundamental principles of VLSI circuit design and to examine the basic building blocks of gate level design and subsystem design. Course 1. Model the behaviour of MOS transistor and understand the switching characteristics of inverter. 2. Design combinational and sequential circuits using CMOS gates. 3. Identify the sources of dynamic, leakage power components in a given VLSI circuit and analyze the performances of VLSI circuits. 4. Analyze and design VLSI subsystem structures. Mapping of course outcomes with program outcomes VLO2 S M M N N CO2 S M M N N W N CO2 S M N N N M M M CO2 S M N N N N M M M <t< td=""><td></td><td></td><td></td><td></td><td></td><td>V</td><td>LSI De</td><td>sign</td><td>_</td><td></td><td></td><td></td><td></td></t<>						V	LSI De	sign	_				
Sessional Marks 50 End Semester Examination Marks 50 Course Objectives: The objective of VLSI Design is to help the students to get brief knowledge of MOS, PMOS, NMOS, CMOS & &Bi-CMOS technologies. It also aims at introducing the fundamental principles of VLSI circuit design and to examine the basic building blocks of gate level design and subsystem design. Course Outcomes: 1. Model the behaviour of MOS transistor and understand the switching characteristics of inverter. 2. Design combinational and sequential circuits using CMOS gates. 3. Identify the sources of dynamic, leakage power components in a given VLSI circuit and analyze the performances of VLSI circuits. 4. Analyze and design VLSI subsystem structures. - Mapping of course outcomes with program outcomes PO1 PO1 PO2 PO3 PO4 PO5 CO1 N N N N N CO2 S M N N N M CO3 S M N N N M CO1 N N N N N M CO1 N N N N M N <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><u>T</u></td><td>I</td><td></td><td></td><td>Credit</td><td>S</td></td<>								<u>T</u>	I			Credit	S
Eastonal Marks 50 End Semester Examination Marks 50 Objectives: The objective of VLSI Design is to help the students to get brief knowledge of MOS, PMOS, NMOS, CMOS &Bi-CMOS technologies. It also aims at introducing the fundamental principles of VLSI circuit design and subsystem design. Course 0.1 Nodel the behaviour of MOS transistor and understand the switching characteristics of inverter. 2. Design combinational and sequential circuits using CMOS gates. 3. Identify the sources of dynamic, leakage power components in a given VLSI circuit and analyze the performances of VLSI circuits. 4. Analyze and design VLSI subsystem structures. Mapping of course outcomes with program outcomes PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO11 PO12 CO1 N N N N N M M M CO2 S M N N N N M M CO3 S M N N N N M M CO4 N S M N N N M M				C	<u> </u>	-1		0	()		<u> </u>	
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CO3 S M N N N N W N M M CO4 N S M N N S W N N M M CO4 N S M N N S W N N M M CO4 N S M N N S W N N M M Device physics: Review of MOS transistor theory, MOS device equations- basic dc equations, concept of threshold voltage, second order effects and small signal ac characteristics. Interter analysis: Complementary CMOS inverter, DC characteristics, ratio, noise margin, CMOS inverter, as an amplifier, static load CMOS inverters, pseudo NMOS inverter, saturated load inverters, cascode inverter, TTL interface inverter, differential inverter, transmission gate, tri-state inverter and Bi-CMOS inverter. I4 hrs Fabrication process: Basic MOS technology, NMOS and CMOS process flow, stick diagrams, design rules, layout design and tools and latch up in CMOS. It hrs Circuit characterization and performance estimation: Resistances and capacitance estimation, SPICE modeling, switching characteristics, delay models, rise and fall times, propagation delays, body effect, CMOS gate transistor sizing, power dissipation, design margining and scaling principles. I0 h	CO2	S	Μ	M	N	N	S	Μ	N	Μ	N	Μ	Μ
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Image: Second structures, clocking structures, low power clock logic structures, clip input and output (I/O) structures. Image: Ima	gates		logic s	tructure	sign: Clock	ing stra	tegies	low por	i, Dasić j ver CM	$OS \log$	ic struct	tures ch	vin input
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Subsystem structures: Antimetic logic unit (ALO), siniters, memory elements, mgn density	Subsy	stem st	tructur	es: Arit	hmetic	logic u	nit (AL	LU), shi	fters, m	nemory	elemen	ts, high	density



memory structures, finite state machines (FSM) and programmable logic arrays (PLA)

REC	OMMENDED BOOKS	
Title	Author	Publisher
1. CMOS Digital Integrated Circuits	Sung- Mo Kang, Yusuf	ТМН, 2003
	Leblebici	
2. Basic VLSI Design, Systems And	Pucknell DA and Eshraghian	PHI, 1988
Circuits	K	
3. Integrated Circuits	KR Botkar	Khanna Publishers,
		2015



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			$(\Gamma\Gamma\Gamma) a$	nu now realized	ГІК ан Thon	the cour	se will	study th		eu, allu i		diction										
			and esti	mation	equaliz	vation al	lgorithm	study u is and fl		ent of m	ultirate	signal										
			process	ing and	sample	rate coi	versior			opt of h	iuitiiute	Signai										
Cours	se		1. Mas	ter the	represe	entation	of dis	crete-tir	ne sigi	nals in	the free	nuency										
Outco	mes:		dom	ain, us	sing z-t	transform	m, disc	rete Fo	ourier t	ransform	n (DFT	T) and										
			disc	rete cos	ine tran	sform.																
			2. Und	erstand	the imp	plement	ation of	the DF	Γ in ter	ms of th	e FFT, a	as well										
			as so	ome of i	its appli	cations.																
			3. Lean	rn the b	asic for	ms of F	FIR and	IIR filt	ers, and	how to	o design	filters										
			with	desired	d freque	ncy resp	onses.															
			4. Abi	lity to i	mpleme	ent adar	ptive sig	gnal pro	cessing	g algorit	hms bas	sed on										
	second order statistics.																					
		N	5. Ana	lyze val	rious m	ulti-rate	process	ing tecr	iniques													
			apping				with pro	lgrain (Γ	Mapping of course outcomes with program outcomes										
	PO1	DO3																				
		F (<i>J</i> 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	PO11	PO12										
CO1	S	<u>102</u> M	PO3 N	PO4 N	PO5 N	PO6 N	PO7 M	PO8 N	PO9 N	0 N	PO11 M	PO12 N										
CO1 CO2	S M	M N	PO3NN	PO4 N N	PO5 N N	PO6 N M	PO7 M M	PO8 N N	PO9 N N	0 N N	PO11 M W	PO12 N N										
CO1 CO2 CO3	S M S	M N M	PO3NNM	PO4 N N M	PO5 N N N	PO6 N M S	PO7 M M N	PO8 N N N	PO9 N N N	0 N N N	PO11 M W M	PO12 N N M										
CO1 CO2 CO3 CO4	S M S N	I O2MNMS	PO3NMN	PO4 N N M N	PO5 N N N M	PO6 N M S N	PO7 M M N M	PO8 N N N N	PO9 N N N M	0 N N N N	PO11 M W M M	PO12 N N M N										
CO1 CO2 CO3 CO4 CO5	S M S N M	N M M S N	PO3 N M M N N	PO4 N M N N N	PO5 N N M S	PO6 N S N M	PO7 M M N M S	PO8 N N N N	PO9 N N M N	0 N N N N	PO11 M W M M N	PO12 N N M N N										
CO1 CO2 CO3 CO4 CO5	S M S N M	M M M S N	PO3NMMNN	PO4 N M N N Un	PO5 N N M S it-I	PO6 N S N M	PO7 M M N M S	PO8 N N N N	PO9 N N M N	0 N N N N N	PO11 M W M M N	PO12 N N N N 12 hrs										
CO1 CO2 CO3 CO4 CO5 Discret	S M S N M ete time	M N M S N	PO3 N M N S and s	PO4 N N N N Un systems	PO5 N N M S it-I : Adva	PO6 N M S N M antages	PO7 M M N S and lim	PO8 N N N N	PO9 N N M N of dig	0 N N N N ital sign	PO11 M W M M N al proce	PO12 N M N 12 hrs essing,										
CO1 CO2 CO3 CO4 CO5 Discro	S M S N M ete time	M N M S N e signal crete tin	PO3 N N M N s and s me sign	PO4 N N N N Systems als and	PO5 N N M S it-I : Adva system	PO6 N M S N M M antages analys	PO7 M M N S and lim is using	PO8 N N N N n itations z trans	PO9 N N M N of dig	0 N N N N ital sign	PO11 M W M M N al proce	PO12 N N M N 12 hrs essing, asform,										
CO1 CO2 CO3 CO4 CO5 Discro review proper	S M S N M ete time v of dis rties and	M N M S N e signal crete tin t applica	PO3 N N M N s and s me sign ations of	PO4 N N N V Un Systems als and f DFT, 1	PO5 N N S it-I FFT and	PO6 N M S N M antages analys d decima	PO7 M M N S and lim is using ation alg	PO8 N N N N nitations z trans gorithm	PO9 N N M M of dig sform a s, DCT	0 N N N N ital sign and its a	PO11 M M M N al proce	PO12 N M N 12 hrs essing, sform, ions in										
CO1 CO2 CO3 CO4 CO5 Discro review proper multir	S M S N M ete time v of dis rties and nedia co	M N S N e signal crete tin t applica	PO3 N N M N s and s me sign ations of	PO4 N N N N Systems als and f DFT, 1	PO5 N N M S it-I : Adva system FFT and	PO6 N M S N M antages analys d decima	PO7 M M M S and lim is using ation alg	PO8 N N N nitations z trans gorithms	PO9 N N M N of dig sform a s, DCT	0 N N N ital sign and its a	PO11 M W M M N al proce	PO12 N N M N 12 hrs essing, asform, ions in										
CO1 CO2 CO3 CO4 CO5 Discrete review proper multir	S M S N M ete time v of dis rties and nedia co	M M S N e signal crete tin l applica oding.	PO3 N N M N s and s me sign ations of	PO4 N N N V Systems als and f DFT, 1 Uni	PO5 N N S it-I : Adva system FFT and	PO6 N M S N M antages analys d decima	PO7 M M N M S and lim is using ation alg	PO8 N N N N nitations gorithms	PO9 N N M M of dig sform a s, DCT	0 N N N N ital sign and its a	PO11 M W M M N al proce	PO12 N N M N 12 hrs essing, sform, ions in 12 hrs										
CO1 CO2 CO3 CO4 CO5 Discro review proper multir Design	S M S M M ete time v of dis rties and nedia co n of dig D filtered	M N S N e signal crete tin applica oding.	PO3 N N M N s and s me sign ations of cers: Re	PO4 N N M N vystems als and f DFT, l Uni view of	PO5 N N M S it-I : Adva system FFT and t-II f structu	PO6 N M S N M antages analys d decima	PO7 M M N S and lim is using ation alg	PO8 N N N N nitations g z trans gorithms	PO9 N N M M of dig sform a s, DCT	0 N N N ital sign and its a design	PO11 M W M M N al proce rier tran applicati	PO12 N N M N 12 hrs essing, asform, ions in 12 hrs al FIR										
CO1 CO2 CO3 CO4 CO5 Discrete review proper multir Design and II Page	S M S M M ete time v of dis rties and n of dig R filters time	M M S N e signal crete tin applica oding.	PO3 N N M N s and s me sign ations of	PO4 N N M N V Un Systems als and f DFT, 1 Uni view of	PO5 N N N S it-I : Adva system FFT and it-II f structu	PO6 N M S N M M antages analys d decima	PO7 M M N M S and lim is using ation alg discrete	PO8 N N N N nitations z trans gorithms	PO9 N N M N of dig sform a s, DCT ystems,	0 N N N N ital sign ital sign and its a design	PO11 M W M M N al proce rier tran application	PO12 N N M N 12 hrs essing, sform, ions in 12 hrs al FIR										
CO1 CO2 CO3 CO4 CO5 Discro review proper multir Design and II Real process	S M S M M ete time v of dis rties and nedia co n of dig R filters time D ssing using	M N S S S S S S S S S S S S S S S S S S	PO3 N N M N s and s me sign ations of cers: Re eneral a S320 fai	PO4 N N M N vistems als and f DFT, l Uni view of und spe	PO5 N N M S it-I : Adva system FFT and t-II f structu	PO6 N M S N M M antages analys d decimation rpose h	PO7 M M N M S and lim is using ation alg discrete	PO8 N N N N nitations gorithms e time s e for D	PO9 N N M M of dig sform a s, DCT ystems, eSP, rea	0 N N N ital sign ital sign and its a design al time	PO11 M W M M N nal proce rier tran applicati	PO12 N N M N 12 hrs essing, sform, ions in 12 hrs al FIR signal										
CO1 CO2 CO3 CO4 CO5 Discro review proper multir Design and II Real proces	S M S M M ete time v of dis rties and n of dig R filters time D ssing using	M M S N e signal crete tin applica oding. sital filt	PO3 N N M N s and s me sign ations of cers: Re eneral a S320 fai	PO4 N N M N V v v v v v v v v v v v v v v v v v v	PO5 N N S it-I : Adva system FFT and it-II f structu	PO6 N M S N M M antages analys d decima ures for rpose h ttation o	PO7 M M N S and lim is using ation alg discrete hardware f DSP a	PO8 N N N N nitations z trans gorithms e time s e for D lgorithm	PO9 N N N M N of dig sform a s, DCT ystems, pSP, rea n on dig	0 N N N N ital sign ital sign and its a design al time gital sign	PO11 M W M M N al proce rier tran application of digital hal proce	PO12 N N M N 12 hrs essing, sform, ions in 12 hrs al FIR signal essors. 12 hrs										
CO1 CO2 CO3 CO4 CO5 Discro review proper multir Design and II Real proces	S M S M M M ete time v of dis rties and n of dig R filters time D ssing using	M N S N e signal crete tin applica oding. SP: Ge	PO3 N N M N s and s ne sign ations of cers: Re eneral a S320 fai	PO4 N N M N Systems als and f DFT, l Uni view of and spe mily, im Unit	PO5 N N N S it-I : Adva system FFT and t-III cial pu plemen t-III	PO6 N M S N M antages analys d decimation ures for rpose h ttation o	PO7 M M N S and lim is using ation alg discrete ardware f DSP a	PO8 N N N N nitations gorithms e time s e for D lgorithm	PO9 N N N M N of dig sform a s, DCT ystems, pSP, rea n on dig	0 N N N ital sign ital sign and its a design al time gital sign forwar	PO11 M W M M N nal proce rier tran applicati of digital nal proce	PO12 N N M N 12 hrs essing, sform, ions in 12 hrs cal FIR signal essors. 12 hrs										
CO1 CO2 CO3 CO4 CO5 Discre review proper multir Design and II Real proces Estim linear	S M S M M M M ete time v of dis rties and n of dig R filters time D ssing using	M M S N e signal crete tin applica oding. sP: Ge ing TM:	PO3 N N M N s and s ations of cers: Re eneral a S320 fai diction: vinson-I	PO4 N N M N V v v v v v v v v v v v v v v v v v v	PO5 N N N S it-I : Adva system FFT and t-II f structu cial pu plemen t-III predict:	PO6 N M S N M M antages a analys d decima ures for rpose h ttation o	PO7 M M N S and lim is using ation alg discrete ardware f DSP a	PO8 N N N N N nitations z trans gorithms e time s e for D lgorithm m lineau	PO9 N N N M N of dig sform a s, DCT ystems, pSP, re- n on dig	0 N N N ital sign ital sign and its a design al time gital sign , forwar	PO11 M W M M N al proce rier tran applicati of digital digital nal proce	PO12 N N M N 12 hrs essing, isform, ions in 12 hrs al FIR signal essors. 12 hrs ckward diction										
CO1 CO2 CO3 CO4 CO5 Discro review proper multir Design and II Real proces Estim linear error f	S M S M M ete time v of dis rties and nedia co n of dig R filters time D ssing usi ation a predict: Tilter. W	M N S S S signal crete tin applica oding. sital filt SP: Ge ing TM: nd pree	PO3 N N M N s and s me sign ations of cers: Re eneral a S320 fai diction: vinson-I ters for	PO4 N N M N V view of and spe mily, im Linear Durbin filtering	PO5 N N N S it-I : Adva system FFT and f structu cial pu plemen t-III predict: algorith g and ov	PO6 N M S N M M antages analys d decimation rpose h tation o ion and m, Schiver same	PO7 M M N S and lim is using ation alg discrete ardware f DSP a optimu ur algon	PO8 N N N N nitations z trans gorithms e time s e for D lgorithm m linear rithm, p	PO9 N N M M N of dig sform a s, DCT ystems, pSP, rea n on dig	0 N N N ital sign ital sign and its a design al time gital sign , forwar es of lin	PO11 M W M M N al proce rier tran application of digital digital nal proce d & back hear prece	PO12 N N M N 12 hrs essing, sform, ions in 12 hrs cal FIR signal essors. 12 hrs ckward diction										
CO1 CO2 CO3 CO4 CO5 Discro review proper multir Design and II Real process Estim linear error f Equal	S M S M S M M ete time v of dis rties and nedia co n of dig R filters time D ssing usi ation a predictt filter, W lization	M M N S signal crete tin applica oding. sital filt SP: Ge ing TM: algorit	PO3 N N M N s and s me sign ations of cers: Re eneral a S320 fai diction: vinson-I ters for thms: A	PO4 N N M N Systems als and f DFT, l Uni view of und spe mily, im Linear Durbin filtering	PO5 N N N M S it-I : Adva system FFT and t-II f structu cial pu plemen t-III predict algorith g and ove e equali	PO6 N M S N M M antages a analys d decima ures for rpose h atation o ion and m, Schu ver samp	PO7 M M N S and lim is using ation alg discrete ardware f DSP a optimu ur algor pling. e zero-f	PO8 N N N N nitations z trans gorithms e time s e for D lgorithm m lineau	PO9 N N N M Of dig sform a s, DCT ystems, pSP, rea n on dig r filters ropertie	0 N N N ital sign ital sign and its a design al time gital sign , forwar es of lin	PO11 M W M M N al proce rier tran applicati of digital digital nal proce sion fee	PO12 N N M N 12 hrs essing, isform, ions in 12 hrs cal FIR signal essors. 12 hrs ckward diction										



equalizer, block decision feedback equalizer, LMS algorithm convergence properties of LMS algorithm, recursive least squares algorithm, Kalman filtering, blind equalization.

Unit-IV			1	2 hrs							
Multi-rate signal processing: Introd	luction, decimation and	d interp	olation, sample	rate							
conversion, efficient poly-phase structu	res, design of phase sh	ifters, fil	lter banks, quadi	ature							
mirror filters, applications of digital signation	al processing.										
RECOMMENDED BOOKS											
Title Author Publisher											
1. Digital Signal Processing	John G.Prokis	Pre	ntice Hall of Indi	а							
2. Digital Signal Processing	Oppenheuim	Pre	ntice Hall of Indi	a							
3. Digital Signal Processing: A	Sanjit K. Mitra	Tat	a McGraw Hill								
Computer-Based Approach	-										



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		1				Soft-Co	omputii	ng				
							<u>T</u>		<u>}</u>		Credi	ts
		G	•	<u> </u>	L		U	(J		5	
		56	essiona	al Mari	KS E	- 4° N	<u>/l</u>				50	
C	_		na Sei	nester		ation N	larks	4 C	C - C - C		50	
Course Object	<u>e</u> tivogi		ie cou	irse ann	is to lea	irn ine i	key asp	ects of	Solt Co	mpuing	g. The C	ourse will
Object	11765.	Su	uuy no	ring nr	oblems:	unders	tand th	zasonniş De featu	g to hai	neural	networ	and its
		an	nlicati	ions ki	now ab	out the	compo	nents a	nd huil	ding bl	ock hvr	othesis of
		ge	enetic	algorith	m. Nex	st focus	to gain	n insigh	nt onto	neuro f	uzzv m	odeling &
			ontrol	and ga	ain kno	wledge	in ma	chine l	earning	throug	h Supp	ort vector
		m	achine	es.		0			6	6	- TI	
Cours	e	1.	Anal	yze the	genetic	algorith	nms and	l their a	pplicati	ons		
Outco	mes:	2.	Gain	knowl	edge to	develop	o geneti	c algori	thm an	d suppo	rt vector	r machine-
	based machine learning system.											
		3.	Writ	e geneti	ic algori	thm to s	solve th	e optimi	ization	problem	l.	
		4.	Anal	lyze var	ious neu	iral netv	work are	chitectu	res.			
		5.	Unde	erstand	fuzzy c	concepts	s and d	evelop	a fuzzy	y expert	system	to derive
			decis	sions.		C		C 1 /	1 /		1	
		6.	Able	to moc	iel neuro	o fuzzy	system	for data	cluster	ing and	classific	cation.
		п	Map	ping o	course		nes wit	n progr	am ou	comes	[
		r C								PO1		
	PO1	2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	PO11	PO12
CO1	S	N	Ν	N	N	Μ	N	Μ	W	N	N	N
CO2	S	N	Μ	Ν	Μ	Μ	S	Ν	Ν	Ν	Μ	Μ
CO3	Ν	N	Ν	Ν	Ν	Μ	Μ	Ν	Ν	S	Μ	Μ
CO4	Ν	N	Ν	Ν	Ν	W	Ν	Μ	Μ	Ν	Μ	W
CO5	S	N	S	Ν	Ν	S	S	Ν	Ν	Ν	Μ	Μ
CO6	S	Ν	W	Ν	S	W	Μ	Ν	Ν	Ν	Ν	Ν
				<u> </u>	Unit-I							12 hrs
Neura	l netwo	ork i	funda	mental	s: Basic	concep	ots, hun	nan brai	n, artifi	icial neu	Iron mo	del, neural
networ	k archi	tecti	ıres-R	osenbla	itt's per	ceptron,	, ADAI	LINE an	id MAI	JALINE	1 netwo	rks, neural
networ	K chara		istics,	learnir	ng meth	ods, ard	chitectu	re taxoi	nomy,	back-pro	opagatio	n network
(BPN)	, BPN 8	irchi	tectur	e, perce	ptron m	odel, si	ngle lay	er netw	ork, mu	litilayer	percepti	ron model,
back-p	on ann	icat	ion of	A NN t	c-propag	ation a	igorium	n, tuning	g paran	leters er	lect and	parameter
selection	on, app	icai			Init_II	erequar	Ization.					12 hrs
Fuzzy	logic	fun	damer	ntal· C	risn set	s fuzz	v sets	membe	ershin	function	basic	fuzzy set
operati	ions. fr		set r	properti	es, cris	b relation	ons. fi	zzy rel:	ations	fuzzv (Cartesia	n product
operati	ion on f	uzzv	y relat	ions, fu	zzy svst	ems. cr	isp logi	c, predi	cate los	gic, fuzz	y logic.	fuzzy rule
based s	system	and	defuzz	zificatio	n metho	ods.		-, F		5,	J 8,	j
based system and defuzzification methods.												
	Unit-III 12 hrs											
Geneti	ic algo	rithr	n fun	<u>U</u> dament	' nit-III t als: Ba	sic cond	cepts, b	iologica	l backg	ground,	working	12 hrs principle,



selection, tournament selection, rank selection and steady state selection, design of rapid nickel cadmium battery charger and rule base generation from numerical data using GA.

Unit-IV:		12 hrs								
Genetic modeling: Inheritance operators, cross-over-single site crossover, two-point crossover,										
multipoint crossover, uniform crossover, matrix crossover, crossover rate, inversion, deletion										
and duplication, mutation operator, generation cycle, convergence of genetic algorithms.										
RECON	IMENDED BOOKS									
Title	Author	Publisher								
1. Neural Networks, Fuzzy Logic and	S. Rajasekaran and G.A.	PHI								
Genetic Algorithms	Vijayalakshmi Pai									
2. Artificial Neural Networks	B. Yegnarayana	PHI								
3. Introduction to Applied Fuzzy	Ahmad M. Ibrahim	PHI								
Electronics										
4. Fuzzy Logic with Engineering	J T Ross	McGraw-Hill								
Applications										



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Digital Image Processing												
				L	8	T		P		C	redits	
				3		0		0			3	
			Session	al Marl	KS						50	
			End Se	mester	Examir	nation N	Iarks				50	
Cours	e		Aim of	the cour	rse is to	study t	he fund	amental	s of dig	ital ima	ge proc	essing.
<u>Objec</u>	tives:		It also g	ives dee	ep insig	ht in to	the basi	c of ima	age proo	cessing of	operatio	ns like
			filtering	of nois	se and i	mage e	nhancen	nent; de	esign, a	nalyze a	ind imp	lement
			algorith	ms for	advanc	ed imag	ge analy	ysis like	e image	e compr	ession,	image
			reconstr	uction,	image s	egment	ation an	d edge o	letectio	n techni	ques.	
Cours	se .		1. Exai	nine va	rious ty	pes of ir	nages, i	ntensity	transfc	rmation	s and	
Outco	mes:		appl	ying vai	rious fil	tering te	echnique	es.				
			2. Show	w how	higher	-level	image	concept	ts such	as ec	lge det	ection,
			segn	nentatio	n, repre	sentatio	n can be	e impler	nented	and used	1.	
			3. To	manipu	late bo	oth bin	ary and	d gray	scale o	ligital	images	using
			mor	ohologia	cal filter	rs and o	perators	to achie	eve a de	esired re	sult.	-
4. Apply image processing algorithms in practical applications.												
Mapping of course outcomes with program outcomes												
											PO1	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	1	PO12
CO1	S	Μ	Ν	S	Μ	Μ	Μ	Ν	Ν	Ν	Ν	Ν
CO2	S	Μ	Μ	S	Ν	Μ	Μ	Ν	Ν	Ν	Μ	Ν
CO3	Ν	Ν	Μ	S	Ν	Μ	Μ	Ν	S	Ν	W	Ν
CO4	Μ	S	Μ	Ν	Ν	S	Μ	Ν	Μ	Ν	Μ	Μ
				Unit	t -I							12 hrs
Digita	l imag	e fund	amenta	ls: Scer	nes and	images	, differ	ent stag	ges of i	mage p	rocessir	ng and
analys	is, com	ponen	s of ima	age pro	cessing	system	, visual	prelimi	naries,	brightn	ess ada	ptation
and c	ontrast,	acuity	and co	ontour,	texture	and p	attern o	liscrimi	nation,	shape	detectio	n and
recogr	nition, c	olor p	erception	, image	format	ion, geo	ometric	and pho	otometri	c mode	ls, digit	ization
includ	ing sam	pling,	quantiza	tion and	digital	image v	visual de	etails.			-	
				<u>Unit</u>	-II							12 hrs
Image	e enhan	cemen	t and re	estorati	on: Cor	ntrast in	tensifica	ation co	mprisin	g of lin	ear stre	tching,
non-li	near stre	etching	, fuzzy p	oroperty	modifi	cation, l	nistogra	m specit	fication	, modify	ving gre	y level
co-occ	urrence	matri	x and loc	cal contr	rast stre	tching,	smoothi	ing inclu	uding ii	nage av	eraging	, mean
filter,	ordered	statist	c filter, o	edge-pro	eserving	g smootl	ning and	l low pa	ss filter	ing, ima	ige shar	pening
includ	ing hig	h-pass	filterin	g and	homom	orphic	filtering	g, imag	ge resto	oration	fundam	entals,
minim	um me	an squ	are erro	r restor	ation l	east squ	are err	or resto	oration	and cor	nstrained	d least
square	error re	estorati	on.									
				<u>Unit-</u>	III							12 hrs
Image	e compi	ressior	: Funda	mentals	of ima	nge com	pression	n, error	criterio	on, lossy	y compi	ression
includ	ing tra	nsforr	n comp	pression	, bloc	k trun	cation	compre	ession,	vector	quant	ization
compr	ession a	nd los	sless con	npressic	n inclu	ding Hu	ffman c	oding m	nethod.			

Unit-IV 12 hrs										
Image segmentation and edge detection: Region extraction, pixel based approach including										
feature thresholding, optimum thresholding and threshold selection methods, edge detection										
fundamentals, derivative operators including Roberts, 4-neighbour, Prewitt and Sobel operators,										
Canny edge detector, Laplacian edge detector, Laplacian of Gaussian edge detector.										
RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Digital Image Processing	Rafael C. Gonzalez	Pearson								
2. Digital Image Processing and Analysis	Chanda and Majmuder	PHI								
3. Computer Vision and Image	S Nagabhushana	New Age International								
Processing										



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			Ar	<u>tificial</u>	Intellig	gence ar	nd Deep) Learr	ing			
		-		<u>L</u> 2		<u> </u>		P 0		<u> </u>		
		-	Socion	4 al Marl	70	1		U			50	
		_	Fnd So	al Ivial i mostor	və Fvamiı	nation N	Iorke				50	
Cours	20		The ava		v of a	huge v		of Ima	te and	Video	data or	ver the
<u>Cours</u> <u>Objec</u>	<u>se</u> omes:		internet Learning Vision t This co approact then mo Neural I will acq various 1. Und 2. App over 3. Ana meri	has ma g has ma g has p asks. ourse p hes, e.g ove to Network uire the real-life reciate p fitting a lyze and its and c	de data proved provide g., Baye modern cs, Auto knowl proble the diff the opti and regu d different lemerits	analysi itself to s introd esian Cl n Deep oencode edge of ms. ference l mization ularization ularization s.	duction assifica Learni rs etc. U applyin between n techni on. arious o	to final terpreta possible to tra tion, M ng arch Jpon co ng Deep classifi ques and deep lea	dition a c solutional ditional ditional dultilaye mitecture ompletin Learnin cation a d different rning ar	hallengi ballengi on to su Mach r Percej es like g the co ng techn und regro entiate b chitectu	ing task ing task ich Con ptron et Convol ourse, st iques to ession. etween res and	their
			4. Acq	uire the	know	ledge of	latest	trends	n deep	learnin	g doma	in and
			vario	ous othe	er techn	iques.			400-			
	P01	PO2	PO3	2 01 COU PO4	PO5	PO6	P07	PO8		PO10	P011	P012
C01	3	3	3	1	2	1 1	1	1	1	0	2	2
CO2	3	3	2	1	1	1	2	1	1	0	3	2
CO3	3	3	3	3	2	2	2	1	1	0	3	2
CO4	3	3	3	1	3	2	2	1	1	0	3	2
				<u>Unit</u>	t-I							12 hrs
Introd Decisi Techn Prop,	Introduction: Introduction to Deep Learning, History of Deep Learning, Bayesian Learning, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss. Optimization Techniques, Gradient Descent, Stochastic GD, Batch Optimization, Momentum Optimizer, RMS Prop, Adam.											
NT.	1 17 /	• •	1.4	Unit	<u>-11</u>		3.7	1 37				12 hrs
Neura Netwo CNN Transf Regul augme	I Networks, Mu Operat former arization	vork A ultilaye ions, H on: Bi	rchitec r Percep Building as Var	tures: otron, B blocks iance ' <u>Unit-</u>	Introdu ack Pro s of C Trade-c	ction to pagatio CNN, T off, L2	o Neur n Learr ransfer regula	al Netv ning, Co Learni arizatior	vork, F onvolutiong, Go n, Earl	eed Fo onal Ne oogle N y stop	rward ural Ne let, Rea archit ping, I	Neural etwork, s Net. ecture. Dataset 12 hrs
Norm	alizatio	n in N	eural N	letwork	Revi	siting G	radient	Descen	t, Effec	tive tra	ining ir	Deep
Net- Norma	early alizatior	stoppin 1.	ig, Dro	opout,	Batch	Norma	lization	, Insta	nce N	ormaliz	ation,	Group



Unsupervised Learning with Deep Network, Autoencoders, Denoising
auto encoders, Sparse auto encoders, Variational Autoencoder, Encoder Decoder Models,
Attention Mechanism, Attention over images.Unit -IV12 hrsDeep Learning Architectures: Recent Trends in Deep Learning Architectures, Residual
Network, Skip Connection Network, Classical Supervised Tasks with Deep Learning, Image

Network, Skip Connection Network, Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, LSTM Networks. Generative Modeling with DL, Generative Adversarial Network.

Recommended Books		
Title	Author	Publisher
1. Deep Learning	Ian Goodfellow and Yoshua Bengio	An MIT Press book. (2019).
2. Deep Learning for Coders with Fastai and PyTorch	Jeremy Howard and Sylvain Gugger	O'Reilly (2020).
3. Deep Learning From Scratch	Seth Weidman	O'Reilly (2020).
4. Deep Learning with PyTorch	Eli Stevens, Luca Antiga, Thomas Viehmann	Manning Publications. (2019).



Electronic Product Design L T P Credits 3 0 0 3 Sessional Marks 50 End Semester Examination Marks 50 Course The objective of this course is to provide adequate knowledge about the reliability, control panel design, thermal consideration and packaging required for electronic industry. Course 1. Explain reliability and methods of solving complex problems. 2. Explain the importance of aesthetics and ergonomics in electronics product design. 3. Explain in the types of interconnections for packaging. Mapping of course outcomes with program outcomes Mapping of course outcomes with program outcomes PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 0 1 PO12 CO1 W N N M N N M M N N M M N N N N N N N N N N N N N N N						PF	EC-82	2A							
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3 0 0 3 Sessional Marks 50 End Semester Examination Marks 50 Course The objective of this course is to provide adequate knowledge about the reliability, control panel design, thermal consideration and packaging required for electronic industry. Course 1 Explain reliability and methods of solving complex problems. Outcomes: 2 Explain need of control panel design and thermal consideration in electronic industry. Apapting of course outcomes with program outcomes Mapping of course outcomes with program outcomes Vol PO1 PO1 <th <="" colspan="2" td=""><td></td><td></td><td></td><td></td><td>L</td><td></td><td>Т</td><td></td><td><u> </u></td><td>P 9</td><td></td><td>Credits</td><td>5</td></th>	<td></td> <td></td> <td></td> <td></td> <td>L</td> <td></td> <td>Т</td> <td></td> <td><u> </u></td> <td>P 9</td> <td></td> <td>Credits</td> <td>5</td>						L		Т		<u> </u>	P 9		Credits	5
Sessional Marks 50 End Semester Examination Marks 50 Course The objective of this course is to provide adequate knowledge about the reliability, control panel design, thermal consideration and packaging required for electronic industry. Course 1. Explain reliability and methods of solving complex problems. Outcomes: 2. Explain the importance of aesthetics and ergonomics in electronics product design. 3. Explain need of control panel design and thermal consideration in electronic industry. 4. Explain the types of interconnections for packaging. Mapping of course outcomes with program outcomes PO1 PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 0 1 PO12 CO1 W N N M M N N N CO2 M M S M N N M CO3 M N S M N N M CO1 W N N M N N N CO2 M M S					3			0)		3			
End Semester Examination Marks50Course Objectives:The objective of this course is to provide adequate knowledge about the reliability, control panel design, thermal consideration and packaging required for electronic industry.Course Outcomes:1. Explain reliability and methods of solving complex problems.Qutcomes:1. Explain reliability and methods of solving complex problems.Qutcomes:1. Explain reliability and methods of solving complex problems.Qutcomes:2. Explain the importance of aesthetics and ergonomics in electronics product design.3. Explain need of control panel design and thermal consideration in electronic industry.4. Explain the types of interconnections for packaging.Mapping of course outcomes with program outcomesPO1PO2PO3PO4PO5PO6PO7PO8PO901PO12CO1WNNNMNNNNMCO2MMSNSMNNMCO3MMNNNMNMNMCO3MMNNNMNMNMSystem reliability concepts:Introduction to concepts of reliability, nature of reliability problems in electronics equipment, series configurations, parallel configuration, mixed configuration, mixed configuration, methods of solving complex systems, mean time to failure (MTTF) and mean time between failure (MTB) of systems. maintainability, availability concepts, system downtime, mean t				Sessior	nal Mar	·ks	1					50			
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4. Explain the types of interconnections for packaging. Mapping of course outcomes with program outcomes PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 0 1 PO12 CO1 W N N N M N M N Intres System Courtill				elec	ctronic i	ndustry	•		_						
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PO1PO2PO3PO4PO5PO6PO7PO8PO9PO1PO1CO1WNNNNNMNNNNNCO2MMSMNSMNNNMMCO3MMSSNSMNNNMMCO4NMMNNMNNMNMNCO4NMMNNMNMNMNMCO4NMMNMNMNMNMNCO4NMMNNMNMNMNMCO4NMMNNMNMNMNMCO4NMMNNMNMNMNMCO4NMMNNMNMNMNCo4NMMNNMNMNMNCo4NMMNNMNMMNproblemsin electronics equipment, series configurations, parallel configuration, mixedconfiguration, mixedconfiguration, mixedconstruction.Unit-IILini-IILini-II			1	Apping	g of cou	rse outo	comes v	with pro	ogram (outcom	es	DOI	1		
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CO4NMNNNIn<	<u>CO3</u>	M	M	S	S	N	<u> </u>	M	N	S	N	S	M		
Unit-IIIhrsSystem reliability concepts:Introduction to concepts of reliability, nature of reliabilityproblems in electronics equipment, series configurations, parallel configuration, mixedconfiguration, methods of solving complex systems, mean time to failure (MTTF) and meantime between failure (MTB) of systems. maintainability, availability concepts, system downtime,mean time to repair (MTTR), fault tree analysis-concepts and procedures, rules for fault treeconstruction.Unit-II12hrsErgonomics and aesthetics in electronics product design:Overview of electronics productdesign, top-down and bottom-up approach, considering power supply design as an example.	CO4	Ν	M	M	N		M	Ν	Ν	Μ	Ν	M			
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configuration, methods of solving complex systems, mean time to failure (MTTF) and mean time between failure (MTB) of systems. maintainability, availability concepts, system downtime, mean time to repair (MTTR), fault tree analysis-concepts and procedures, rules for fault tree construction.Unit-II12hrsErgonomics and aesthetics in electronics product design: Overview of electronics product design, top-down and bottom-up approach, considering power supply design as an example.	proble	ms in	electro	onics ec	quipmer	it, serie	es con	figuratio	ons, pa		configu	ration,	mixed		
time between failure (MTB) of systems. maintainability, availability concepts, system downtime, mean time to repair (MTTR), fault tree analysis-concepts and procedures, rules for fault tree construction. <u>Unit-II</u> 12hrs Ergonomics and aesthetics in electronics product design: Overview of electronics product design, top-down and bottom-up approach, considering power supply design as an example.	config	uration,	metho	OS OI SC	olving c	complex	system	is, meai		to failu	re (MI	IF) and	i mean		
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Ergonomics and aesthetics in electronics product design: Overview of electronics product design, top-down and bottom-up approach, considering power supply design as an example.	consu	uction.			Uni	t_II							12hrs		
design, top-down and bottom-up approach, considering power supply design as an example.	From	omics	and ap	sthatics	in elec	tropics	nrodu	ct dosic		ruiou	of electr	ronics r	roduct		
uosizni, tob uowin and bottonin ub abbioachi, considering nower subini design as an examine	design	ton-de	anu ac	d bottor	m_un_ar	proach	consid	lering n	ower si	upply d	esion a	s an ex	ample		
ergonomics and display writ ergonomics and aesthetics consideration.	ergono	mics ar	nd displ	av wrt	ergono	mics an	d aesthe	etics cor	isiderat	ion.	csign a		ampie,		
Unit-III 12 hrs	ergone	miles u	ia aispi	uy w.i.c.	Unit	t-III	a aostin		Istaetat	1011.			12 hrs		
Control panel design and thermal consideration : Types of controls design and organization	Contr	ol nane	el desig	n and t	hermal	conside	eration	· Types	of con	trols de	esion an	d organ	ization		
of control panel engineering consideration, layout of components, selection of materials, sheet	of con	trol par	nel eng	ineering	consid	eration	lavout	of com	ponents	selecti	on of m	aterials	sheet		
metals and plastic structural design and control cabinets fabrications, thermal management of	metals	and pl	astic s	tructural	design	and co	ntrol ca	binets f	fabricati	ions th	ermal m	anagen	nent of		
electronics equipment, thermal design consideration, component level, board level, system level,	electro	nics ea	uipmen	t. therma	al desig	n consid	leration	. compo	onent le	vel. boa	rd level	. system	n level.		
fans and system operating characteristics, heat sink design.	fans a	nd syste	m oper	ating cha	aracteris	stics, he	at sink of	design.		, ei, eoe		, 5950011	1 10 / 01,		
Unit-IV 10 hrs					Uni	t-IV							10 hrs		
Packaging: Design consideration for inter-connections, types of inter-connections, wires, cables.	Packa	ging: D	esign c	onsidera	ation for	· inter-co	onnectio	ons, typ	es of int	er-conr	ections.	wires.	cables.		
connectors, treatment of vibration, grounding	conne	ctors, tre	eatment	t of vibra	ation, gr	ounding	5	× 71			- ,	. 7	,		



RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Materials and Processes in Manufacturing	Ernest Paul De	12 th Edition, John Wiley									
	Garmo, J.T. Black,	& Sons.									
	Ronald A. Kohser										
2. Advanced Thermal of Electronics	Raiph Remsburg	Springer, 2011									
Equipment											
3. Product Design of Electronics Equipment	V.S. Bagad	4 th Edition 2009,									
		Technical Publication									



PEEC-822B											
Satellite Communication											
		L		,	Г]	P		Credits	5	
		3			0)	3			
	Sessional	l Marks	6						50		
	End Sem	ester E	xamina	tion M	arks				50		
Course	This cou	irse pro	ovides f	fundame	ental kr	nowledg	ge abou	t orbita	al theor	ry and	
Objectives:	satellite li	ink desi	gn. Stuc	lents wi	ll under	stand th	ne role c	of variou	is modu	ulation,	
	multiplex	ing and	multipl	e acces	s techni	ques us	ed in sa	tellite c	ommun	ication	
	networks	. study o	of variou	us satell	ite servi	ices also	presen	ted in th	nis cours	se.	
<u>Course</u>	1. Visual	ize the a	architect	ure of s	atellite	systems	as a me	eans of I	high spe	eed,	
Outcomes:	high ra	inge cor	nmunica	ation sy	stem.						
2. State various aspects related to satellite systems such as orbital equations,											
sub-systems in a satellite, link budget, modulation and multiple access											
schemes.											
3. Solve numerical problems related to orbital motion and design of link budget for the given peremeters and conditions											
Mapping of course outcomes with program outcomes											
	Intapping					gi ani (PO1		
PO1 PO	2 PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	1	PO12	
CO1 M W	/ N	S	N	W	N	M	W	N	N	N	
CO2 M N	N	S	S	Ν	N	Ν	Μ	N	N	N	
CO3 W M	I M	Ν	Μ	S	Ν	S	Ν	S	Μ	Μ	
• •		Un	it-I	•					•	12hrs	
Architecture of	satellite c	ommur	nication	syster	n : Prin	ciples	and arc	hitectu	re of s	atellite	
communication, b	rief history	v of sate	ellite sys	stems, a	advantag	ges, dis	advanta	ges, apj	plication	ns, and	
frequency bands us	sed for sate	ellite con	mmunic	ation ar	d their a	advanta	ges/drav	wbacks.			
Orbital analysis :	Orbital equ	uations,	Kepler	's laws	of plane	etary m	otion, a	pogee a	nd perig	gee for	
an elliptical orbit	, evaluatio	n of ve	elocity,	orbital	period,	angula	r veloc	ity etc	of a sa	atellite,	
concepts of solar d	lay and side	ereal day	у								
		Uni	<u>it-II</u>							12 hrs	
Satellite sub-syste	ems: Archi	itecture	and role	es of va	rious su	ib-syste	ms of a	satellit	e syster	m such	
as telemetry, track	ing, comm	and and	d monite	oring (1	TC & I	M), atti	tude and	d orbit (control	system	
(AUCS), commun	ication sub	-system	, power	sub-sys	stems, ai	ntenna s	ub-syst	em.			
Satellite sub-syste	ing comm	lecture	and role	es of va	TTC & N	ID-Syste	ms of a	l salemi	e syster	in such	
as telemetry, tracking, command and monitoring (TTC& M), attitude and orbit control system											
(AOCS), communication sub-system, power sub-systems, antenna sub-system.											
Satellite link budget: Flux density and received signal power equations calculation of system											
noise temperature for satellite receiver, noise power calculation, drafting of satellite link budget										system	
	tor satellite	e receiv	er, nois	e nowei	· calcula	tion dr	afting c	of satell ¹	ite link	budget	
and C/N ratio c	tor satellite	e receiv s in cl	er, nois ear air	e power and 1	calcula	ation, dr	afting c ns. case	of satella e study	ite link	budget ersonal	



4. Satellite Communication

<u>Unit-IV</u>		14hrs								
Typical phenomena in satellite communication: Solar eclipse on satellite, its effects, remedies										
for eclipse, sun transit outage phenomena, its effects and remedies, Doppler frequency shift										
phenomena and expression for Doppler shift	, modulation and multip	le access schemes used in								
satellite communication, typical case studie	es of VSAT, DBS-TV	satellites and few recent								
communication satellites launched by NASA/	ISRO, GPS.									
RECOMMENDED BOOKS										
Title	Author	Publisher								
1. Satellite Communications	Timothy Pratt and	Wiley India, 2nd edition,								
	Others	2010.								
2. Fundamentals of Satellite	S. K. Raman	Pearson Education India,								
Communication 2011										
3. Digital Satellite CommunicationsTri T. HaTata McGraw Hill, 2009										

Dennis Roddy

McGraw Hill, 4th Edition, 2008



PEEC- 822 C														
				Dig T	gital Ci	rcuit L	ogic De	sign	<u>n</u>		Credit	~		
		-		L 3		<u> </u>						5		
		F	Socion	<u>J</u> al Marl	76	U			0		<u> </u>			
		-	End So	mostor	15 Evomi	nation	Morks				50			
Carros			The eh		Examin f this s			ida a ai			Jourston	din a af		
Cours Object	<u>e</u> tivos		how loc	via airau	i uns c	ourse is	d dooig	nue a co	ified to	stod and	furthor	uning of		
Objec	<u>iives.</u>			gie circu	ng prob	allaryzet	I, UESIGI		ntial cir	sieu anu	ian are	treated		
			includir	ng finite	state :	machine	s Mea	ly and	Moore 1	cuit des models	state d	iagrams		
			and sta	to tobloc	ontin	aization	asyncl	hronous		tial circ	state u	agranis		
			and haz	arde an	alvze a	nd desig	, asynci m simpl	la system	ns com	nosed of	$\frac{2}{2}$ progra	mmable		
			logic si	uch as R	Ms I	DI De F	PG∆s a	nd CPI	ns comj De	posed of	progra	mmaule		
Cours	ρ		1 To learn different types of digital systems and to understand and deal											
Outco	<u>c</u> mes:		with various practical issues related to their design.											
Outeo	mes.		2 Able	2. Able to design, simulate, and built synchronous sequential and										
			2. riok	asynchronous sequential circuits.										
			3. Abil	lity to	analv	ze and	desig	on sim	nple sy	vstems	compo	sed of		
			prog	rammah	le logi	c. such a	as ROM	s PLDs	FPGA	s and Cl	PLDs	500 01		
			Mapping of course outcomes with program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	S	S	S	Ν	Ν	S	Ν	Ν	Μ	Ν	\mathbf{M}	Ν		
CO2	Μ	M	S	S	Ν	S	Μ	Ν	Μ	Ν	S	Μ		
CO3	Μ	S	S	M	M	S	Μ	Ν	Μ	N	S	S		
Unit-I12 hrsSynchronous FSM design: Review of digital concepts, MSI and LSI circuits and their applications, synchronous state machine design and analysis-models, latches and flip-flops, setup and hold times, tristate logic and busses, Mealy and Moore FSM design, design of iterative circuits, timing analysis of FSMs, FSM optimization, binary and one-hot encoding and pipelining.Unit-II12 hrsDealing with asynchronous inputs: Synchronizers and meta-stability, asynchronous machines analysis and design- models for asynchronous FSMs, detection and elimination of timing defects in asynchronous FSMs- cycles, races and hazards.Unit-III12 hrsClock distribution: Clock skew, low-skew clock buffers, zero delay buffers - PLL, delay-locked loops, timing analysis of synchronous, source synchronous and embedded clock bus interfaces.Unit-IV12 hrs											id their os, setup iterative elining. 12 hrs achines defects 12 hrs v-locked aces. 12 hrs e arrays			
archite	cture, v	arious	architect	ures of I	FPGA,	designi	ng with	PLDs, 1	FPGAs	and CPI	LDs.	, and the second s		
RECO	MME	NDED	BOOKS	5			-	- I -						
Title	• • •	- D'- '4		ithor	D:-		Publi	isher		1	20	00		
1. Eng	gineerin	g Digit	al Desig	n	K1C	hard F	Inder	2nd E	ed., Aca	demic P	ress, 20	000		
2. Dig practi	ital De ces	sign-pri	nciples	and	Joh	n F Wal	cerly	3rd E 1999	d., Pear	son Edu	cation A	Asia,		
3. Dig Desig	gital Lo n,	ogic an	d State	Machin	e Dav	vid J Co	mer	3rd E	d., Oxfo	ord Univ	versity F	Press		



4. An Engineering Approach to	William I Fletcher	PHI, 1980
Digital Design		



PCEC-823												
					VLS	I Desigi	n Lab					
			L	1		Т			P		Credi	ts
			0			0			4		2	
		I	nternal	Assessr	nent M	arks					50	
		E	and Sem	ester M	larks						50	
Cours	se	Г	'o introc	luce the	e fundai	mental j	principl	es of V	LSI cir	cuit des	ign in (CMOS
<u>Objec</u>	tives:	te	echnolog	gy and	to exa	amine	perform	nance p	aramete	ers of	combin	ational
	circuits; design, layout and simulation of combinational circuits and											
amplifiers.												
Cours	Course5. Ability to analyze CMOS inverter.											
Outco	Outcomes: 6. Ability to estimate and compute the resistance, capacitance, inductance											
and power consumption of a NMOS/CMOS.												
	7. Ability to design logic circuit layouts for both static CMOS and dynamic										namic	
			clocke	d CMO	S circui	its.						2
		8.	Be ab	le to co	omplete	a signi	ficant Y	VLSI de	esign pr	oject ha	aving a	set of
			object	ive crite	eria and	design	constrai	nts				
	1	1	lapping	g of cou	rse out	comes v	with pro	ogram o	outcom	es		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Ν	Μ	Ν	Μ	N	N	N	Μ	Ν	S	Ν	Ν
CO2	Μ	M	W	Μ	N	M	N	N	N	S	Ν	Ν
CO3	W	Μ	Ν	Ν	N	Μ	Ν	Ν	Μ	S	Μ	Ν
CO4	Μ	Μ	Μ	S	Ν	S	Μ	Ν	Μ	S	Μ	S
List o	f Exper	riments	:									
14. D	esign of	f NMO	S and Cl	MOS in	verters	for DC	signal.					
15. NMOS and CMOS inverters -transient characteristics and switching times.												
16. E	16. Evaluation of resistance in NMOS/CMOS.											
17. E	17. Evaluation of capacitance and inductance in CMOS.											

18. Design of multiplexers and demultiplexers.

- 19. Design of full adder and comparator.
- 20. Design of MOS capacitor for small signal.
- 21. Design and simulate common source (CS) amplifier.
- 22. Design and simulate cascode and active current mirrors.
- 23. C-V and I-V characterization of MOS capacitors.

24. Modeling and simulation of NMOS and CMOS circuits using SPICE.



	PEEC-824 A														
	Core Elective Lab -2														
	(Microwave Engineering Lab)														
			L			Т			Р		Credi	its			
			0 0 4 2												
		Inte	Internal Assessment Marks 50												
		End	End Semester Marks 50												
Cours	<u>e</u>	This	This lab aims to design and simulate various microwave circuits using software												
Object	tives:	tool	tool. After designing and simulation, students will be able to fabricate these												
Cours	0	1 1	Docion	vorious	s. miorow	0000 000	nnonon	ta naina	coftwar	a toola					
<u>Outco</u>	<u>e</u> mes:	1. 1 2. S	Simulate and can	e the ch	aracteri gate and	istics of interpr	microv et the re	vave co esults.	mponen	its using	g softwa	re tools			
		3. 1	Fabricat	e the s	imulate	ed circu	its to	provide	sustair	nable pr	oducts	in said			
		0	lomain												
		Ν	Aappin	g of cou	irse ou	tcomes	with p	rogram	outcon	nes					
										PO1					
	PO1	PO2	D2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 0 PO11 PO12												

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	PO11	PO12	
CO1	Μ	Μ	Μ	Μ	S	S	S	Ν	Μ	Ν	Ν	W	
CO2	W	S	Ν	S	S	Μ	S	Μ	Μ	S	Μ	Μ	
CO3	Μ	Μ	S	Ν	S	S	Μ	Μ	Μ	S	Μ	S	

List of Experiments:

- 1. Design of quarter wave microstrip line on an appropriate substrate, resonated at 2.54 GHz and simulate using HFSS and plot its S_{11} and VSWR performance.
- 2. Fabrication of quarter wave microstrip line mentioned in experiment No. 1.
- 3. Design of microstrip line step transformer on an appropriate substrate at $f_0 = 2.54$ GHz for impedance 50 ohms to 75 ohms, simulate using HFSS and plot its impedance plot for both ports over the span from 0.5 f_0 to 1.5 f_0 .
- 4. Fabrication of microstrip line step transformer mentioned in experiment No. 3.
- 5. Using HFSS, design and performance of equal split Wilkinson Power Divider for a 50 Ω system impedance at frequency $f_0 = 2.54$ GHz. Plot the return loss S_{11} , insertion loss $S_{21} = S_{31}$ and isolation $S_{23} = S_{32}$ verses frequency from 0.5 f_0 to 1.5 f_0 .
- 6. Fabrication of Wilkinson Power Divider mentioned in experiment No. 5.
- 7. Design of microstrip rectangular patch antenna resonated at $f_0 = 2.54$ GHz. Simulated using HFSS and plot it S₁₁ parameter and 2D radiation pattern at theta 0 degree and phi 90 degree.
- 8. Fabrication of microstrip rectangular patch antenna mentioned in experiment No. 7.
- 9. Design the microstrip line bends at 45° with matched ports at frequency 2.54 GHz. Simulate using HFSS and study the bending loss over the frequency from 0.5 f_{\circ} to 1.5 f_{\circ} .
- 10. Fabrication of microstrip line bends mentioned in experiment No. 9.
- 11. Design the microstrip line curve bends with matched ports at frequency 2.54 GHz. Simulate using HFSS and study the bending loss over the frequency from 0.5 f_0 to 1.5 f_0 .
- 12. Fabrication of microstrip line curve bends mentioned in experiment No. 11.



	PEEC-824 B													
Core Elective Lab -2														
				(Co	mpute	r Aided	Design	n Lab)						
			L			Т			P		Credi	its		
			0			0			4		2			
		Inte	rnal As	ssessme	nt Mar	ks					50			
End Semester Marks 5											50			
Cours	<u>se</u>	This	This lab aims to design and simulate various features of wireless network,											
<u>Objec</u>	ctives:	artif	artificial intelligence, microwave antenna, digital signal processing and image											
		proc	processing using the different software available which can help the students to											
	work on inter-disciplinary projects.													
Cours	se	1. I	1. Design and understand the basic of WSN using NS3 software.											
Outco	omes:	2. I	Learn a	nd unde	erstand	the bas	ic desig	gn proce	edure of	f neural	networ	k using		
		I	ython p	program	ming.		_					_		
		3 5	Simulate	e and a	nalvze	the cha	racteris	stics of	differe	nt types	of mic	rowave		
			ntenna	using s	oftware	0110 0110		01000 01	41110101	in types	01 1110	1011410		
			Indeped	using so		·	-£ МА		in diat		أمسم أمم			
		4. (Jndersta	and the	e applie	cation (DI MA	ILAB	in digi	ital sigi	hal and	image		
		I	processi	ng.										
			Jonnin	a of oor	IRCO OIL	toomos	with n	rogrom	outoon	205				
			Tappin	g or cou			with p	l ogi alli	outton					
	DO1		DOJ	DO4	DOF	DOC	DOT	DOG	DOO	POI	DO11	DO12		
001	POI	PO2	P03	P04	P05	PU6	P07	P08	P09	U	POIL	P012		
				M	S G	S N	S G	N		N	N	W		
<u>CO2</u>	W	S	S N S S M S M M S M M											
CO3	M	Μ	M S N S M M M S M S											

List of Experiments:

Μ

Μ

S

CO4

1. To understand the basic concepts about the wireless sensor network (WSNs), types and application.

S

Μ

Μ

Μ

S

Μ

S

2. To design and simulate a wireless sensor network (WSN) using NS3 simulator.

S

Ν

- 3. To study and design WSN using LEACH, a cluster-based routing protocol for WSN.
- 4. To understand and write a PYTHON programme to wrap inputs of neural network with NumPy.
- 5. To understand and write a PYTHON programme to make the prediction in neural network.
- 6. To understand and write a PYTHON programme to train a Neural Network.
- 7. To understand and write a PYTHON programme to minimize the errors.
- 8. To study and understand the Digital signal Processing using MATLAB.
- 9. To study and understand the Image Processing using MATLAB.
- 10. To design and simulate E-plane, H-plane, and Magic Tee for operation in X-band frequency range using HFSS software.
- 11. To Design and simulate Horn Antenna for operation in X-band frequency range using HFSS.



- 12. To Design and simulate rectangular and circular patch microstrip antenna for 5G application using ADS/ HFSS software.
- 13. To Design and simulate wire monopole antenna for 5G application using ADS/ HFSS software.
- 14. To Design and simulate triple-frequency microstrip-fed monopole antenna using defected ground structure using ADS/ HFSS software.



	PCEC-824												
Seminar													
				L		Т			Р		Credi	ts	
				0		0			2		1		
Cours	<u>e</u>		To car	ry out a	n presen	itation i	n one c	of the sp	pecializa	ations o	f the pr	ogram	
Objec	tives:		with substantial multidisciplinary component.										
<u>Course</u> 1. An ability to write technical documents and give oral presentation											tations		
Outcomes: related to the work completed and improves personality develop											pment		
and communication skills.													
	2. Train the students to approach ethically any multidisciplinar												
engineering challenges with economic, environmental and social												social	
contexts and to set them for future recruitment by potential employers												oyers.	
			3. Ide	ntify an	d apply	approp	priate w	ell-rehe	earsed n	ote-taki	ng inte	ractive	
			and	l time m	anagem	nent stra	tegies to	o their a	cademic	c studies	5.		
			4. Dev	velop au	idience-	-centred	present	tations r	neeting	concret	e profes	ssional	
			obj	ectives	and inte	grating	ethical a	and lega	al visual	aids.			
			5. Ide	ntify ar	nd critio	cally ev	valuate	the qua	ality of	claims	, expla	nation,	
			sup	port, a	nd deli	ivery in	n publi	c and	profess	ional d	iscourse	e, and	
			unc	lerstand	the fact	tors infl	uencing	a speak	ter's cre	dibility			
		N	/Iapping	g of cou	rse out	comes v	vith pro	ogram o	outcom	es			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
CO1	Ν	Ν	Ν	S	Ν	Ν	Ν	S	Μ	S	S	S	
CO2	Ν	Ν	Ν	Ν	Ν	Ν	Ν	S	Ν	Ν	Μ	Ν	
CO3	Ν	Ν	Ν	Ν	Ν	Ν	Ν	S	Μ	Ν	W	Μ	
CO4	Ν	Ν	Ν	S	Ν	Ν	Ν	S	Μ	S	S	S	
CO5 N N N S N N N S M S M							Μ						



PEEC-911A													
Wireless Sensor Networks													
				L			Т]	Р		Credits		
		Γ		3			0	(0	3			
		Γ	Session	al Mar	ks						50		
			End Se	mester	Examir	nation N	Marks				50		
Cours	e		This co	urse is a	imed to	study t	he sate-	of- the-	- art w	vireless s	ensor ne	etwork	
Objec	tives:		architec	ture, ro	uting pr	otocols	, perform	mance 1	netrics,	challen	ges as v	vell as	
			the appl	lications	of wire	eless sei	nsor net	works.					
Cours	e		1. Und	lerstand	the p	rinciple	es and	charac	teristics	of w	ireless	sensor	
<u>Outco</u>	mes:		netv	vorks.									
2. Identify, evaluate and analyze the problems related to wireless sensor													
network.													
3. Understand the different clustering algorithms and their usefulness.													
4. Design different protocols to solve the existing issues.													
		I I	lapping	apping of course outcomes with program outcomes									
	DO1	DOI	DO2	DO4	DO5	DOC	D07	DOQ	DOO	POI	DO11	DO12	
CO1	POI	PO2	PO3	P04	PO5	PO6	P07	P08	P09	UN	POII	PO12	
	D N	IN S	N M	IVI NI	IN N	M	IN N	NI NI	IN M	IN N	IN M	IN M	
CO_2	N S	5 M		N S	IN M	M	IN M	IN N	IVI NI	IN N	M	IVI NI	
C03	5 6			D N			IVI S			IN NI	M	IN M	
004	0	IVI	IVI		1VI 4 T	IVI	0	1	IVI	1	IVI	10 hm	
Introd	Inction	Chara	otoristio	roquiro	nonte fe	or WCN	challo	ngas for	WSNG	compo	ricon w	ith ad	
hoc wi	ireless n	etwork	s single	node a	rchitecti	n worv	ardware	compo	nents e	s, compa	onsump	tion of	
sensor	nodes	comme	s, single reially a	vailable	sensor	nodes -	– I mote	IRIS	mica m	ote EY	ES node	s BT-	
nodes	Telos-I	3	fording t	i v unuon	sensor	noues	1 mote	, 1110,	inica in	010, 11		5, D I	
noucs,	10105 1			Uni	t-II							16 hrs	
Mediu	ım acce	ss cont	trol pro	tocols:	Fundam	entals of	of MAC	protoco	ols - loc	cation di	scovery	, other	
issues	- low di	ity cyc	le and w	ake up o	concepts	s, IEEE	802.15.	4 MAC	protoc	ols, ener	gy effic	iency.	
				Unit	-III	*			•		0,	10 hrs	
Routi	ng and	data ga	athering	g protoc	ols: Rou	uting ch	allenges	s and de	esign iss	sues in v	vireless	sensor	
networ	rks, flo	oding	and gos	siping,	data ce	ntric ro	outing,	gradien	t based	routing	g, hierai	rchical	
routing, location-based routing, data aggregation operations, aggregation techniques													
Unit-IV 12 hrs													
Applications of WSN: WSN applications - home control, building automation, industrial													
automation, medical applications, reconfigurable sensor networks, highway monitoring, military													
applications, civil and environmental engineering applications, wildfire instrumentation, habitat													
monito	oring etc	2.											



RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Wireless Sensor Networks Technology,	Kazem Sohraby,	John Wiley & Sons,									
Protocols and Applications	Daniel Minoli and	2007									
	Taieb Znati										
2. Protocols and Architectures for Wireless	Holger Karl and	John Wiley & Sons Ltd,									
Sensor Networks	Andreas Willig	2005									
3. Wireless Sensor Networks: Heterogeneous	D. Kumar, T.C Aseri,	Lap Lambert Academic									
Clustered Data Aggregation and Routing	and R.B. Patel	Publishing GmbH &									
Protocols		Co., Germany, 2012									



	PFFC-911B											
				Networ	·k Secm	rity and	1D Crvnta	oranhy	7			
]	L	<u>n secu</u>	<u>T</u>	<u>orypt</u>	<u>-81 apri</u>	P		Cre	dits
			-	3		0			0			<u>,</u>
		Sessi	ional M	arks							5	0
		End	Semest	er Exan	ninatio	n Mark	8				5	0
Cours	e	The	aim of t	his cou	rse is to	o identif	v and u	tilize di	fferent	forms o	f crypto	graphy
Objec	tives:	techr	niques, i	ncorpor	ate aut	henticati	ion and	securit	y in the	networ	rk appli	cations
		and	distingu	ish amo	ong diff	erent ty	pes of	threats	to the s	ystem a	and han	dle the
		same										
<u>Course</u> 1. Understand the need of network and system security.												
<u>Outcomes:</u> 2. Understand the basics of private key and public key cryptography.												
	3. Familiarize with the concept of number theory.											
4. Understand the various authentication techniques in security.												
	DO1		Lapping	of Cou	rse Out	tcomes	with Pr	ogram	Dutcom	es DO1	DO1	DO1
	POI	PO2	P03	PO4	P05	PUO	P07	PUð	P09		POI 1	PO1 2
CO1	S	М	W	N	N	N	N	N	N	N N	I N	2 N
CO2	M	M	M	N	N	N	N	N	N	N	W	N
CO2	W	S	W	N	N	N	N	N	N	N	W	N
CO4	S	S	M	N	N	N	N	N	N	N	N	N
Unit-I 12 hrs												
Securi	i ty : Nee	d, secu	rity serv	vices, at	tacks, C	DSI secu	rity arc	hitectur	e, one-t	ime pas	swords,	model
for ne	etwork	security	, classi	cal enc	ryption	technic	ques lik	e subst	titution	ciphers	, transp	osition
cipher	s, crypta	nalysis	of class	ical enci	ryption	techniqu	les.					
System	n secur	ity: Intr	uders, i	ntrusior	n detect	ion, pas	sword 1	nanagei	nent, w	orms, v	iruses,	trojans,
virus c	ountern	neasures	s, firewa	lls, firev	vall des	ign prin	ciples, t	rusted s	ystems.			
N T N	(1	T .	1		<u>Unit</u>	<u>-II</u>	• .1		<u> </u>		10	Jhrs
Numb	er theo	ry : Inti	oductio	n, Ferm	nat's an	d Euler	's theor	em, the	chines	se rema	inder th	leorem,
Euclia	ean aige	orithm, e	extended		ean aige	orithm a	na moa	ular arit	nmetic.		1	1 hng
Drivot	o kov (symmot	ric) ers	ntogra	oby: Bl	<u>l</u> ock cipl	hare etr	aam cir	hore D	C/ strag	m ciph	+ IIIS or data
encryr	tion sta	ndard ()	DES) a	dvanced	encryr	otion sta	ndard (AES) t	rinle DF	C = S = RC5		linear
and di	fferentia	l crypta	nalvsis.	a vaneee	i eneryp	non sta	indur d	11L5), t		20, RC3	, 1011	, inicui
Public	-key (a	symmet	tric) cry	ptogra	phy: RS	SA, key	distribu	tion and	l manag	ement, l	Diffie-H	fellman
key ex	change,	elliptic	curve o	cryptogr	aphy, n	nessage	authent	ication	code, ha	sh func	tions, n	nessage
digest	digest algorithms: MD4 MD5, secure Hash algorithm, RIPEMD-160, HMAC											
Unit-IV 12 hrs												
Authentication - IP and web security digital signatures, digital signature standards, authentication												
protoc	ols, Kei	rberos,	IP secu	rity arcl	hitecture	e, encap	sulating	g securi	ty paylo	oad, key	y manag	gement,
web s	ecurity	conside	rations,	secure	socket	layer ai	nd trans	port lay	ver secu	rity, sec	cure ele	ctronic
transac	transaction.											



BECOM	RECOMMENDED BOOKS											
Title	Author	Publisher										
1. Cryptography and Network Security,	William Stallings	Pearson Education										
Principles and Practices												
2. Network Security, Private	Charlie Kaufman, Radia	Prentice Hall										
Communication in a Public World	Perlman and Mike											
	Speciner											
3. Security Architecture, Design	Christopher M. King,	RSA Press										
Deployment and Operations	Ertem Osmanoglu, Curtis											
	Dalton,											
4. Inside Network Perimeter Security	Stephen Northcutt, Leny	Pearson Education										
	Zeltser, Scott Winters,											
	Karen Kent, and Ronald											
	W. Ritchey											



PEEC-911C												
				Ad	vanced	Comp	uter N	etwork	S D		0 1	
		_		L 2					<u>P</u>			its
		_	Sessions	J al Marl	76		U		U		<u> </u>	
			End Semester Examination Marks								<u> </u>	
Cours	Se.		The aim	of this	course	is to p	ovide a	a broad	covera	ge of so	me new	advanced
Objec	ctives:		topics i	n the	field of	of con	nputer	networ	ks (wi	reless 1	networks	s, mobile
			network	s, VPN	networ	ks, etc.) and t	o give	the stuc	lent idea	as and ir	nsights on
			importar	nt desig	n issues	associ	ated wi	th com	outer ne	etworks.		
Cours	se		1. Unde	erstand	the	main	abstrac	et conc	cepts 1	related	to the	layered
Outcomes: communication architecture.												
			2. Anal	yze ar	id imp	lement	some	of the	e most	t advan	ced rou	iting and
			cong	estion (control a	algorith	im.	moutor	natwor	ka (thro	uah mat	homatical
			5. Eval mode	eling ar	d simul	lation)	5 01 00	inputer	networ	ks (uno	ugii illai	nematical
		1	Mappi	ng of co	ourse of	utcome	s with	progra	m outo	omes		
										PO1	PO1	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	1	PO12
CO1	Μ	Ν	W	Ν	Μ	W	Ν	Ν	Ν	Ν	W	Ν
CO2	M	S	M	N	N	M	M	N	M	N	M	M
<u>CO3</u>	Ν	Ν	Ν			Ν	Μ	Ν	Ν	N	M	
Intro compa	duction arison (to of TC	compute P/IP and access t	er net	works: model	Refei s, type	ence es of o	models: data tra	OSI Insmiss	model, ion, err	TCP/II for detection	P model, ction and
	,	- I -		Un	it-II							12 hrs
Netwo ring;	o rk typ star, rin	es an Ig, bu	d topolo s, other.	ogies: L networ	ANs, V rk hard etWare	VANs, ware: v and Al	others wiring,	and hy networ	brids, e k inter	ethernet, face car	token b ds, hubs	ous, token s, routers,
5,1101	100, 1111	ouuen		Uni	it-III	una m						12hrs
Intro	duction	to dis	stribute	d syster	ns: Cha	racteri	stics of	distribu	ited Sy	stems, e	xamples	, resource
sharin	ig, syst	em n	nodels,	archite	ctural f	fundam	entals:	basic	conce	pts, clie	ent-serve	er model,
coope	ration b	betwee	en client	and se	ervers,	extensi	on to t	the clie	nt serv	er mode	el: mobi	le agents,
proxy	servers	•								- [1.01
NT . 4	l. *		-4	<u>Un</u>	It-IV				D 1 1	<u> </u>	.	12hrs
encap: server	orking sulation	and 1 . IPv4 micati	• Vs. IPv	vorking v6, inte	g: Netw er proce	ork typ ss com	munica	nciples, ation: ex	IP del sternal	data rep	view, op resentati	ion, client
RECOMMENDED BOOKS												
	Ti	tle				A	uthor			Pu	blisher	
1. C	ompute	r Netv	vorks			And Tan	lrew S. enbaun	n	2n	d editio	n, PHI, 1	1988
2. C	compute rocessir	r net	work a	nd Di	stribute	d Jam	es Mar	tin	Pr	entice-H	Iall.	



3.	Data Communications and	B.A. Forouzan	4th edition, McGraw Hill
	Networking		Education, 2006



OEEC-911A															
					El	ectroni	c Produ	ict Desi	gn						
					L		Т]	P		Credits			
					3			0	()		3			
			Ses	ssional I	Marks							50			
			En	d Seme	ster Ex	aminat	ion Ma	rks				50			
Cours	e		Th	e objec	tive of	this co	urse is	to prov	vide ad	equate	knowled	dge abo	out the		
Objec	tives:		reli	iability,	control	panel d	esign, t	hermal o	conside	ration a	nd pack	aging re	quired		
			for	electro	nic indu	stry.									
Cours	<u>e</u>		1.	. Explai	n reliab	ility and	l metho	ds of so	lving co	omplex	problem	ns.			
<u>Outco</u>	mes:		2.	. Explai	n the in	nportanc	e of Ae	esthetics	and Er	gonomi	cs in ele	ectronics	\$		
product design.															
			3.	. Explai	n need	of contr	ol pane	l design	and the	ermal co	onsiderat	tion in			
				electro	onic ind	ustry.			c						
			4.	. Explai	n the ty	pes of in	nter-cor	nection	tor pac	kaging	•				
			IV	lapping	g of cou	rse outo	comes v	vith pro	ogram (Jutcom	es DO1				
	DO1	D	`	DO3		DO5	DOC	DO7	DOQ	DOO		DO11	DO12		
CO1	W		JZ N	rus N	r04 N	105 N	ruu M	FO /	ruo M	FU9	U N	ron N	ruiz N		
CO1	VV M		. Ч МГ	IN S	M	IN N	S	M	N	N	N	M	M		
C02	M		Л	S	S	N	5	M	N	S IN	N	S	M		
C03	N		<u>vi</u> М	M	N	N	M	N	N	M					
04	1	1	VI	IVI	 ∐n [:]	it_T	IVI	1	1	IVI	1	IVI	11hrs		
Syster	n relia	hili	tv d	concent	s• Intro	n <u>t-r</u> duction	to co	ncents	of reli	ability	nature	of reli	ability		
proble	ms in	ele	ectro	nics eq	uinmer	nt serie	es con	figuratic	on ren	arallel	configu	ration	mixed		
config	uration	me	etho	ds of so	olving c	complex	system	is mear	time	to failu	re (MT	ΓF) and	mean		
time b	etween	fail	ure ((MTB)	of system	ms. mai	ntainabi	ility, ava	ailabilit	v conce	pts. svst	em dow	ntime.		
mean	time to	rep	air	(MTTR), fault	tree an	alysis-c	oncepts	and pr	ocedure	es, rules	for fau	ilt tree		
constr	uction.	1			,,		5	1	1		,				
					Uni	t-II							12hrs		
Ergon	omics a	and	aes	sthetics	in elec	tronics	produ	ct desig	gn: Ove	erview	of electi	onics p	roduct		
design	, top-do	own	and	d bottor	n-up ap	proach,	consid	lering p	ower su	upply d	lesign as	s an exa	ample,		
ergono	omics ar	nd d	ispla	ay w.r.t.	ergono	mics an	d aesthe	etics cor	nsiderat	ion.					
					<u>Unit</u>	t-III							12 hrs		
Contr	ol pane	el do	esigi	n and t	hermal	conside	eration	: Types	of cont	trols, de	esign an	d organi	ization		
of con	trol pan	iel,	engi	ineering	consid	eration,	layout	of comp	ponents	, selecti	ion of m	naterials	, sheet		
metals	and pl	asti	c, st	ructural	design	and co	ntrol ca	binets f	fabricati	ions, th	ermal m	nanagem	nent of		
electronics equipment, thermal design consideration, component level, board level, system level,															
fans and system operating characteristics, heat sink design.															
					Unit	t-IV					L		<u>10 hrs</u>		
Packaging: Design consideration for inter-connections, types of inter-connections, wires, cables,															
connectors, treatment of vibration, grounding.															



RECOMMENDED BOOKS											
Title	Author	Publisher									
1. Materials and Processes in Manufacturing	Ernest Paul De	12 th Edition ,John Wiley									
	Garmo, J.T. Black,	& Sons.									
	Ronald A. Kohser										
2. Advanced Thermal of Electronics	Raiph Remsburg	Springer, 2011									
Equipment											
3. Product Design of Electronics Equipment	V.S. Bagad	4 th Edition 2009,									
		Technical Publication									



OEEC-911B												
				.	Soft	Compu	uting		D	1	<u>a</u> 14	
		-		L 2			1		<u>P</u>		Credits 2	
		-	Socion	J ol Mor	20		U		0		<u> </u>	
		-	End Se	mester	<u>ks</u> Fvamii	nation N	Marks				<u> </u>	
Cours	e		The co	urse ain	ns to le	arn the	kev asr	ects of	Soft c	omputin	og The	course
Objec	<u>-</u> tives:		will stu	dy how	to app	oly fuzz	v logic	and rea	soning	to hand	lle unce	rtainty
			and solv	ve engin	neering	problem	ns; unde	rstand t	he featu	res of n	eural ne	etwork,
			and its	applica	ations;	know a	about tl	ne com	ponent	s and b	ouilding	block
			hypothe	esis of (Genetic	algorit	hm. Ne	xt focu	s to ga	in insig	ht onto	neuro
			fuzzy m	nodeling	g & cont	trol and	gain kn	owledg	e in ma	chine lea	arning tl	hrough
C	_		Support	t vector	machin	es.	1	1 (1				
<u>Course</u> 1. Analyze the genetic algorithms and their applications									vector			
<i><u>ourcomes.</u></i> 2. Sum knowledge to develop genetic argorithm and support vector machine-based machine learning system.									vector			
	3. Write genetic algorithm to solve the optimization problem.											
	4. Analyze various neural network architectures.											
	5. Understand fuzzy concepts and develop a fuzzy expert system to derive											
	decisions.											
	6. Able to model neuro fuzzy system for data clustering and classification.											
		l	Mapping	g of cou	rse out	comes v	with pro	ogram (outcom	es		
										PO1		
<u> </u>	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	0	PO11	PO12
$\frac{\text{CO1}}{\text{CO2}}$	S	M	N	N	N	M	N	M	W	N	N	N
C02	S N	M		IN N	NI NI		S M	IN N	IN N	N S		M
C03	N	M	N	N N	N N	W	NI N	M	M	S N	M	W
C04	S	N	S	N	N	S	S	N	N	N	M	M
CO6	S	N	W	N	S	W	M	N	N	N	N	N
		1		Un	it-I		1					12 hrs
Neura	l netwo	ork fui	ndamen	tals: Ba	sic con	cepts, h	numan b	orain, ai	tificial	neuron	model,	neural
networ	rk archi	itecture	s-Rosen	blatt's p	perceptr	on, AD	ALINE	and M	IADAL	INE net	tworks,	neural
networ	rk char	acterist	ics, lear	ning m	ethods,	archite	cture ta	xonom	y, back	-propag	ation n	etwork
(BPN)	, BPN a	archited	ture, pe	rceptron	n model	, single	layer ne	etwork,	multila	yer perc	ceptron :	model,
back-p	on ann	lication	nning, d of ANN	ack-pro	pagatioi nnel equ	n algori ializatic	uiiii, tui	ing pai	ameter	senect	and par	ameter
sciecti	on, app	ncation		Uni	t-II	anzan	/11.					12 hrs
Fuzzy	logic	funda	mental:	Crisp	sets, fi	uzzy se	ets, mer	nbershi	p func	tion, ba	sic fuz	zy set
operati	ions, fi	izzy se	et prope	erties, c	risp re	lations,	fuzzy	relatior	is, fuzz	zy Carte	esian p	roduct,
operati	ion on f	fuzzy r	elations,	fuzzy s	systems,	, crisp l	ogic, pr	edicate	logic, f	uzzy log	gic, fuzz	zy rule
based system and defuzzification methods.												
0		• 4 7	0 7	Unit	t-III		1 1 1		1			12 hrs
Genetic algorithm fundamentals: Basic concepts, biological background, working principle,												
encodi	ng, fitn ment se	ess fun	ction, re	product	ion incl	uding ro	bulette-v	vneel se	election	, Boltzn	hann sel	ection,
uuuua	tournament selection, rank selection and steady state selection, design of rapid nickel cadmium											



battery charger and rule base generation from numerical data using GA.

Unit-IV:		12 hrs								
Genetic modeling: Inheritance operators,	cross-over-single site cross	over, two-point crossover,								
multipoint crossover, uniform crossover,	multipoint crossover, uniform crossover, matrix crossover, crossover rate, inversion, deletion									
and duplication, mutation operator, generation cycle, convergence of genetic algorithms.										
RECOMMENDED BOOKS										
Title Author Publisher										
1. Neural Networks, Fuzzy Logic and	S. Rajasekaran and G.A.	PHI								
Genetic Algorithms	Vijayalakshmi Pai									
2. Artificial Neural Networks	B. Yegnarayana	PHI								
3. Introduction to Applied Fuzzy	Ahmad M. Ibrahim	PHI								
Electronics										
4. Fuzzy Logic with Engineering	J T Ross	McGraw-Hill								
Applications										



					0	EEC-91	1C					
				Optic I	al Com	munica	ation Sy T	stems	D		Crodite	
				<u>L</u> 3			<u>1</u> 0		<u> </u>		3	1
		S	essional	Marks	3		U		•		50	
		E	nd Sem	ester E	, xamina	ation M	arks				50	
Cours	e	Т	he aim	of this	course	e is to	train st	udents	in met	hods of	analys	is and
Objec	tives:	in	stallatic	on of op	tical fib	ber based	d comm	unicatio	ons syste	ems; sys	tems pl	anning
		us	sing dif	ferent	ohotoni	c techno	ologies	as wel	l as ad	vanced	optical	signal
		р	rocessin	g mode	els. Fur	ther, fo	cuses o	n diffe	rent no	nlinearit	ies in	optical
		fi	ber and	their r	nitigatio	on in m	odern o	optical	fiber co	mmunic	cation s	ystem;
		de	esign an	d evalu	ation of	moderr	n optical	fiber c	ommuni	ication s	ystems.	
Cours	<u>se</u>	1	l. To ur	nderstan	d the ba	asic con	cept of o	optical f	fiber con	nmunica	ation sy	stem.
<u>Outco</u>	mes:	2	2. To u	ndersta	nd the	various	disper	sion no	onlineari	ties eff	ect in	optical
2 Ability to design high hit rate fiber ontic communication systems												
3. Ability to design high bit-rate fiber optic communication systems.												
4. Ability to analyze, model and implement advanced optical												
5 Canable to use ontical communications simulation tools to assess the												
		-	result	s obtain	ned from	n theore	tical stu	dies.	mulan	11 10015	10 4350	755 the
		N		g of cou	rse out	comes	with pro	ogram (outcom	es		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Μ	W	Ν	Ν	Ν	W	Ν	Ν	W	Ν	Ν	Ν
CO2	Μ	Ν	Ν	S	Ν	Ν	Ν	Ν	Μ	Ν	Ν	Ν
CO3	W	Μ	Μ	Ν	Ν	S	Ν	Ν	Ν	Ν	Μ	Μ
CO4	Μ	S	S	Ν	Μ	S	Μ	Ν	Ν	Ν	W	Μ
CO5	Ν	Ν	Μ	S	Μ	Μ	Μ	Ν	Ν	Ν	Ν	Ν
				Un	<u>it-I</u>							<u>16 hrs</u>
Overv	view of	optical	fiber c	ommur	nication	n: Evolu	tion of	basic	fiber	optic c	ommun	ication
system	i, bene	tits and	d disad	vantage	es of 1	tiber op	otics, tra	ansmiss	ion win	dows, tr	ansmiss	sion of
light t	nrougn	optical i	iber, nu	merical	apertu	re (NA) gradad i	, optica	I fiber f	nodes &	configu	urations	, types
index	fibers a	ttenuati	a = 10	ntical fil	uex & g bers fil	per optic	1000 m	lculatio	D, prop	agailon ting lose	noues	in step
scatter	ing fib	er disne	on n o _l ersion	dispers	ion sh	ifted fi	iber D-	flattene	d fiber	nolari	zation	cut-off
condit	ion and	V-narai	meter, c	onnecto	ors & sn	lices		inducente	u moer	, poluin	Lation,	cut on
Dispe	rsion a	nd non	linearit	ies: Dis	spersion	n in sing	gle mod	le and	multimo	de fiber	rs, atter	uation
and di	spersion	n limits	in fibers	s, disper	sion ma	anageme	ent, Ker	r nonlin	earity, s	self-phas	se modu	lation,
cross 1	ohase m	odulatio	on, FWN	И.		C			0,1	1		
				Uni	it-II							12 hrs
Optic	al sour	ces: Di	rect and	indirec	et band	gap ma	terials,	semico	nductor	light-ei	nitting	diodes
and la	ser dioc	les, LEI	D power	: & effi	ciency,	double	hetero-j	unction	LED, p	olanner d	& dome	EED,
surface-emitting LEDs, edge-emitting LEDs, super luminescent LED, characteristic of LED,												
modul	ation, la	aser dio	des: bas	sic conc	epts for	r emissi	on of ra	diation,	, thresho	old cond	lition fo	or laser
oscilla	tion, qu	antum y	well lase	er, distri	buted for	eedback	laser, la	aser cha	racteris	tics.	1.1	
Optic	Optical detectors: Principles of photodiodes, PIN & avalanche photodiodes, photodetector											
noise,	aetecto	r respon	nse time	e, avala	ncne m	ultiplica	ution no	ise, ten	peratur	e effect	on ava	lanche



gain, receiver SNR and BER calculations.

<u>Unit-III</u>		10 hrs									
Optical amplifiers: Semiconductor amplifie	ers, Eerbium-doped fiber	amplifiers (EDFAs) and									
Raman amplifiers, analytical modeling of	gain saturation, gain	equalization, ASE noise,									
amplifier cascades.											
Optical sensors: Advantages, generic optical fiber sensor, fiber selection for sensor, wavelength											
modulated sensors - pH, humidity, temperature, carbon dioxide sensors, fiber Bragg grating											
based sensors - principle, strain, pressure sensors, chemical sensors.											
Unit-IV 10 hrs											
Optical networks design: Fiber optic system design considerations -power budget, bandwidth											
and rise time budgets, electrical and optical ba	indwidth etc.										
Advanced multiplexing strategies: Optical	TDM, subscriber multip	lexing (SCM), WDM and									
hybrid multiplexing methods, optical netw	working - optical netw	vork topologies, network									
architecture- SONET/TDH, optical burst sw	vitching, OADM, wavel	ength conversion, optical									
filters, MZI.											
RECOMM	ENDED BOOKS										
Title	Author	Publisher									
1. Fiber-optic communication Systems	G. P. Aggarwal	2nd Ed., J. Wiley &									
		Sons, 1997									
2. Optic Communication Systems	Mynbaev	Pearson education, 2001									
3. Optical Fiber Communication	Gerd Keiser	5th edition, McGraw									
		Hill, 2013									
4. Optical Fiber Communication	J. Senior	PHI									



	PCEC-911															
Dissertation (Part-I)																
				L		Т			Р		Credi	its				
				0		0			20		10					
Cours	se		The ai	m of t	he cou	rse is t	hat stu	dents l	earn the	e proces	s of re	esearch				
Objectives: proposal writing, conducting research in Electronics & Communication Engineering. Students are expected to work on formulation research problem, and literature survey. By the end of the semester, the are expected to complete and present their research proposals.										ication ulation r, they						
Cours	<u>se</u>		1. Re	view of	literatu	re as per	rtains to	their di	issertati	on topic	•					
Outco	mes:		2. Design a conceptual framework, research design and data analysis													
			plan as they pertain to their dissertation topic.													
			3. Ha	ve abili	ties and	l capabi	lities ir	n develo	oping ar	nd apply	ving con	mputer				
			sof	tware a	nd hard	ware to	electron	ic desig	gn.							
		Ν	Aapping	g of cou	rse out	comes v	vith pro	ogram o	outcom	es						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12				
CO1	Μ	Μ	W	S	Μ	Μ	Ν	Ν	Μ	Μ	Μ	Ν				
CO2	Ν	Ν	Ν	S	Ν	Ν	Ν	S	S	S	Μ	S				
CO3	Ν	Ν	Μ	S	S	CO3 N N M S S M M N N M M										



	PCEC-921											
					Dissert	ation (1	 Part-II)					
				L		Т	,		Р		Credi	ts
				0		0			32		16	
Cours	e		The aim of the course is that the student will work on their research topic									
Objec	tives:		in consultation with the supervisor. Students will conduct experimental									
			and/or analytical study and analyzing results with modern mathematical /									
			scienti	fic meth	ods and	d use of	softwa	re tools	on thei	r resear	ch topic	c. The
			next fo	ocus is o	on prepa	aring the	e studer	nts for the	heir reso	earch ar	nd disse	rtation
writing. By the end of the semester, they are expected to complete and											te and	
present their research dissertation.												
<u>Course</u> 1. Apply/develop solutions or to do research in the areas of Electronics of										nics &		
Outcomes: Communication Engineering.												
			2. Des	sign and	validat	e techno	ological	solution	ns to de	fined pr	oblems.	
			3. Organize, analysis and interpret experimental results.									
			4. Describe the significance of experimental outcomes in a well-reasoned									
			discussion.									
			5. Communicate clearly and effectively for the practical application of									
			their work.									
			6. Defend the experimental approach, methods, and interpretation in an									
			ora	l defenc	e before	e the eva	aluation	commi	ttee.			
		N	Aapping	g of cou	rse out	comes v	vith pro	ogram (outcome	es		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	Μ	S	Μ	S	Μ
CO2	S	S	S	W	Μ	S	S	W	Μ	Ν	Μ	Μ
CO3	Μ	S	Μ	S	W	Μ	Μ	Μ	Μ	S	Μ	Μ
CO4	Ν	Ν	Ν	S	Ν	Ν	Ν	S	S	S	S	S
CO5	Ν	Ν	Ν	S	Ν	Ν	Ν	S	Μ	S	S	S
CO6	Ν	Ν	Ν	S	Ν	Ν	Ν	S	Μ	S	S	S