Course Code	21EE03067	Course Name	SUSTAINABLE DEVE	LOPMENT PRACTICES	Categ		0			3	OPEN I	ELECT	TIVE				1 0	P 0	3
Pre-requi Course		AK .	Co-requisite Courses	w		rogras Cours							ш	į –					-
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Course Le	aming Rationale	CLRs: The pur	pose of learning this cours	e is to:	110				Progr	am O	ittome	e iPo						rogran	
CLR-1:	gew a basic und	historia de la contracta de la	sinable development	1	1	1.2	3	4	5	0	7	0	9	10	11	12		pecific	
CLR-2	understand the y	woessity of societal	development towards syste	mativity			27	7	9.0	th.			ď			7			
CLR-3:		ingrated strategies	af austainsible development		rigneering Krewledge	Problem Analysis	Desgridevelopment of solutions	Conduct investigations complex problems	Wodem Tool Usage	the engineer and society	Environment & Sustamation	8	Included & Team Work	Communication	Project Mgt. & Finance	An Long Loaming	X	150.2	65
Course Ou	itcomes (CO):	At the	end of this course, learners	will be able to:	1	E	Hara and the	Con	3	ž	23	Ehica	2	00	E	5	PSO-1	至	PSO-3
CO-1:	familiarize the ne	ceasely of quotains	ble development by various	stalle holders		-		1 *	+	3	1	J		. +		+		+	+
CO-2:	recognize the fee	sobility, approache	s, techniques, and outcomes	of sustainable development	7.2	-	4	1.0	1	20	3	+11	-	14	**		+:	+:	+
00-8:	interpret various	patales and history	ated approaches for adaption	of austainable environment	2	+	14	100		180	J	7	(+)	-		+	+	+	+
Definition, Unit-2 - De Poverty, ur	scope and elemen evelopmental Nee	ds of Indian Socie equate housing, or	faultsinable development P Ny	legals, Government, investors, to my of energy sources and suppl	Mary Land	100	Williams.	110	Dr.	100		110		1100		100		91	House May and
		for Sustainable C	Development				_	-	-		_	_			_			9.5	House
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Learning Resources	Mat add 2. Green i	fon, 2007. F.J., Chambers, B.V		d growth", SAGE Publicutions, on in Sustainable Development ion, 2006	II Chopre, 1999 4 Hana C Marrish	B.C	oriotina.	V. 19	ntaine	nie Cle	nie/opm	nent in							

B\_Tech / M\_Tech (integrated) Programmes-Regulations 2021-Volume-20-Common Courses-Sylabi-Corne) Copy

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	Tirtel	50	0%	10	0.6	10	0.5

Course Designers	WARRING TO STATE OF THE PARTY O	
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. M. Umasankar, Bharat Electronics Ltd. Anchrage selesh	1 Dr. S. S. Dash, GCE KJR	1. Dr. V. Praceup SPMST
2 Dr. F. Kanagarei, 18WF, Chernal	2. Dr. A. Vanhadassan, N.T. Proportioner, Karndon	Dr. R. Barrier, SHACET

Course Code	21ECE22YF	Course Name	Satellitz Commu	nication and Decadeasting		giry	I		- !	Profe	100	eal	Elle	city	8			3	0	# ()	3
Provego		T	Co-requisite Courses	SIL.		Progressive Courses	NI	i.													
Course O	Reing Department	Electro Engine	nics and Communica ening	tion Data Book / Codes / Mandard	n .	XII.															
Contract	Learning Rationals	0(3,R) The	purpose of learning this coun	NATE:						Prop	THE .	Duto	in the	(PS	à .				P	QUIV	
CLR+	Study the back	ground an	d orbital mechanics o	Coatellite communication syste	cates		1	2	1	4	5	ñ	7	*	9	10	1.1	12	- A	court doors	-
CLRJ.	Investigate on	dia links	and identify areas to i	mprove link performance						ã.	П						П				
CLR-F:	Identify the va- links	nions tamb	agation effects and ac	cess techniques for satellite co	mmun	cation			cable?	and some	П	ė,	ŧ,								
CLR-4	lamapeus the a radico	pplications	of satellite communi	cation in VSAT systems, satell	inc TV,	and	(Negati	1	Ta d	ė,	Mag.	antho	1.5 cm		See 20		Filmen	E			
CL#-5	Explore the er	incope of	satellite navigation an	d packet communication			i i	ş	1	100	2	0	ì		1	Į	74	ş			
Cinima (	Outcome (CO):	Ace	terest of this course, harriers	with all is		-	ě,	3	1	報	ĝ	Da e	1	Bha	94	Į.	1	9	9	3	8
CD-1	Interpret the se	bee regan	operation of satellite	communication systems.			2	2.	-	-	~	+		+	-	-	-	*	7	-	
2,03	Analyze satellin	Samehing	, link design, link ara	lability, and interference			+	2	3.	.+.	+	+	-	+	-	+	-	+.	2	.0	+
203	Examine the m on satullite com			посрась, реправатам сібесть, а	nd then	t impact	2	*	2	-	-	-	4		-	*	-		.2	1	
C04	Illustrate the pr	actical imp	dementation of VSAT	and DHS systems	11000		3	2	-	-	-	-	-	-	+	-	+	. 7	-	10-	3
2.03	Review the sate	Dite comm	unication navigation:	and global positioning system :	applica	tions.	3	2	-		+	+	+	-	-	-	*	14	-	2	

### Unit-12 Overview of satellite communication

Principle, historical developments, frequency allocations for satellite services.

Orbital mechanics: Kepler's laws, orbital parameters, look angle determination, orbital perturbations, orbit cratted systems, gravitationary orbit, telegraphy, tracking, command and monitoring, priver systems, communication subsystems, transposeders, natellite anisonate, egapement reliability and space qualification.

Basic transmission theory, system noise temperature and G/T ratio, design of downlinks, sareflite systems using small earth stations uplink design, carrier to noise (C/N) ratio, design of satellite links for specified C/N (with and without frequency re-use), link budget, system design examples

## twest: Propagation effects and shor impact on satellise earth links.

Quantifying attenuation and depolarization, rain and ice effects, cloud attenuation, troposphesic and ionosphesic sentillation, prodiction of NPD, propagation

enumbersembled brune Multiple access techniques for satellite links: Multiple access, frequency division multiple access, time division multiple access, denund access multiple access, random secess, code decisios multiple acress

Network architectures, access control protocol, basic techniques, sat earth station engineering, calculation of link margins for VSAT star network, system design

Direct broadcast santists (DBS) TV and radio: C-band and Ku-band home satellite TV, DBS modulation, digital DBS-TV, DBS-TV system design, DBS-TV link budget, crient control in digital DBS-TV, master control station and uplicit, establishment of DBS-TV antennas, satellite radio broadcasting

the Satellite rangetion and global positioning system (CIPS):

Radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, GPS received necessary GPS society operation, case study – IRNSS/NAVIC, case study – GAGAN (GPS Aded GEO Augmented Navigation)
Satellite packet communication: Message transmission by FDMA, message transmission by TDMA, pure Aloha-satellite packet minching, slotted Aloha, packet

	1	D. Roddy, "Satellite Communications", McGraw Hill 4 G. D. Gordon and W. L. Morgan, "Communications Satellite Handbook",
	1	Education, 4th Edition, 2017. Wiley, 2010.
0.00	12.	T. Pratt, C. Bostian and J. Allmutt, "Satellite Communications", S. L. J. Ippolito Jr, "Satellite Communications Systems Engineering
Lourning		Wiley, 2nd Edition, 2013. Atmospheric Effects. Satellite Link Design and System Performance", John
accounts.	2	W. L. Princhart, H. G. Suyderhoud and R. A. Nelson, "Satellite Wiley & Sons, 2nd Edition, 2017.
		Communication Systems Engineering", Pearson Education, 2nd 6. M. Richharia, "Satellite Communication Systems: Design Principles",
	1.	Edition 2012 Marmillan 2nd Edition 2011

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Expert forcindate	Eights fon Higher Technical Institutions	Intered Equals
		t Dr. Sachin Kumur, Research Assistant Professor, Dept. of ECE SRM IST, Chennui
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Pre-requi Course			Co- requisits Courses	NIL.		Progressio e Courses	N	H .													
Course O	Mortey Department	ECE			Date Book / Codes / Sharebook	NIL.															
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QA1	ntroducing re telecommuni		cements and g	prowing t	zends in mobile		1	2	3	4	5	6	7		0	10	1	12		ECO1	
GAZ:	Figure out the r	nethods to in	grove the Data F	Ratios in mo	obile communication					Т	т	П	E		П		П		П	П	
CLA3	nferring tech	nical requir	rements for 50	i, networ	k architecture						ш		1		Ш				Н		
(254)	Acquire the kno	wledge of Ne	twork Planning a	nd Deploys	ment techniques.		0				ш	h	1		1		*		Н		
CLAS:	Analysing secur	ity lechnique	and Application	s of Advan	roed Mobile communication a	entry (matrix)				Ci	w	:	=		1		1		Н		
Course (	Outcomes (CO):	Altho	end of this course, has	orum, self les s	MAR Sc:		*** * ** * * * * * * * * * * * * * * * *	193389	在學習者最高關助 葡萄花。	22722042862	*********		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	#+ # - # + #		S + 2 2 4 3	· · · · · · · · · · · · · · · · · · ·	LF LG TE LA TE LA TE LA TE LA TE LA TE LA TE LA TE LA TE LA TE TE TE TE TE TE TE TE TE TE TE TE TE	B R II ( P		P8 0-3
001	Examine the dev	elopment ,ch	allenges and req	urements	of mobile communications		j	4	-		7	-	1	*	-	8	-	7.			-
00-2	Interpret the met	hode to impro	ove the data rate				ĵ		4		-	-	-	-		12		15			2.

Advanced Mobile Communication systems

00-0:	Connect the layers of communication systems	1	-		-3	-		1		Ť	: this	+	4	-		
004	Analyze the techniques of Planning and deployment of communication network			-	3	-				2		-			T	٦
00-5	Summarize the security, services and applications of Next generation communication techniques.	-	à	1	1	-	1	1	-	1		1	9			

Unit-1: -Introduction

Overview -What Is 507 -Background -Research and Challenges for Electronics -Especied 5G in Practice - 5G and Security -Motivations -5G Standardization and Regulation -Global Standardization in 5G Era. 5G Requirements Based on ITU-The Technical Specifications of 3GPP-The 5 G Security, Case Study, Mobile Network Operations and Mobile Device Manufacturers in India

Unit-2 : Data Rates in Mobile Communication

Fundamental Constraints in achieving High Data Rates Noise-limited scenarios Interference-limited scenarios Higher-order Modulation, Multi carrier modulation Wider bandwidth, Spectrum Composition Low frequency spectrum, capacity and coverage, spectrum for 5GNR, unlicensed mm waves bands. Terahertz spectrum, Spectrum requirements for 6G: SUB-6.

men Radio Network

Radio access technology-Orthogonal Frequency Division Multiplexing-Channel estimation and equalization-Multiple-Input Multiple-Output Techniques-Advanced MIMO-Radio network architecture and Interfaces, Case Study: The Role of 5G and beyond in the Cyber-World

Une4: Network Planning and Deploymen

Core and Transmission Network Dimensioning-Radio Network Planning-Core and Radio Network Deployment Scenarios-Standalone and Non-Standalone Deployment Scenarios-Network Interfaces and Elements-core deployment-Measurements. Case Study: Security Opportunities for Stakeholders

uses: Security Services and Applications

Security Threats and Challenges - Security Implications in 5G Environments and Use Cases - Security Layers - Device Security - Security between Network Entities , Vehicle Communications - Machine Learning and Artificial Intelligence Case Study: The concept and vision of 6G Massive IoT

Pearson, 2011

5G explained: security and deployment of advanced mobile communications by Jyrki T.J. Penttinen. Hoboken, NJ. USA: John Wiley & Sons, Inc., 2019.

6G wireless communications and mobile networking by xianzhong Xie, Bo Rong, Michel Kadoch-Bentham books

Rappaport T.S., "Wireless Communications: Principles and Practice", 2nd Edition,

Professional Bactive Courses

Chiller, "Mobile Communications", Pearson Education Asia Ltd., Reprint 2012.

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		Deep	Pactor	Dway	Predice	Theory	Poste
Lavel 3	Remember	12%		27%	100000	3%	- A THE 4
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Love 2	Apply	40%	1.0	28%		3%	7.7
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Course Designate		
Experts from Instaltry	Espeta hore Higher Technical Institutions	rtimal Espeta
		Dr C.T.Manimegalai
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Course Code	21ECC302T	Cour	13.30	ANALOG AND DIGI	TAL COMM	UNICATION		ourse tegory		С			PRO	FESSI	ONAL	COR	E		1	T 0	0	3
Pre-requis Course		21MAB20	)3T	Co- requisite Courses		Nil		Progr								Nil	1					
Course (	Offering Depart	ment		ECE	Da	ta Book / Codes / Stand	lards								Ni							
Course Le	arning Rational	e (CLR):	The purp	oose of learning this cour	se is to:	CHN			2			Progr	am Ou	tcome	s (PO	)					rograi	
CLR-1:	introduce to the	elearners	the basic co	oncepts involved in Commu	nication sys	tem		1	2	3	4	5	6	7	8	9	10	11	12		pecifi	
CLR-2:	comprehend th	e function	alities of va	rious radio transmitters and	receivers	100		90		70	40					×		9	7			
CLR-3:	realize the pro-	cess invol	ved in digita	communication systems	100			Med		E G	ation	ge				š		anc	On			
CLR-4:	explore the pa	ss band tr	ansmission .	system and analyze its perf	ormance in	terms of probability of en	ror	ŝ :	SIS.	орш	estigation	Es .	an an	ಪ _		Team Work	5	& Finance	suic			
CLR-5:	get exposed to	Informati	on theory ar	d channel coding concepts	-14			Engineering Knowledge	robiem Analysis	Design/development of solutions	EX	Modem Tool Usage	engineer and ety	Environment & Sustainability	97	ndividual &	Communication	Project Mgt.	ife Long Learning	7	-5	9
Course Ou	tcomes (CO):		At the e	nd of this course, learner	s will be ab	ele to:	4	Bu !	6	Desi	0,0	Mod	The en	Sust	Ethics	ng.	8	Proje	Je Je	PSO-1	PSO-2	PSO-3
CO-1:	explain the var	ious analo	g modulatio	n techniques	194	EN A WARRY		3			-	NE.	-		1	-		-	2	2	-	
CO-2:	analyze the no	ise perfori	mance of rai	dio transmitters and receive	rs	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	00	3	3	300	1	3-	1.	-	-	0.0	le.	-51	2	1.70	3	-21
CO-3:	demonstrate th	e demodu	lation and o	letection of received digital	data	The state of the state of		3	2	3.		G.	1		*	(*)		(a)	+			3
CO-4:	apply the suita	ble passb	and techniqu	ues for real time application	S	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		3				3	Pale	-	*							2
CO-5:	exposed to the	concepts	of informati	on theory and channel capa	city	I LA LA	7 = 2	3	-	3		1	-	*	83	8*0		8		3	*	*
Need for M Demodulati	ion of AM waves	es of Ana (Envelop	log Modulai Detector) - F	ion - Amplitude Modulation Frequency Modulation (FM)	- Types of I	FM -Narrow Band FM (NE															fodula	
	aves (Foster Se dio Transmitte			lodulation (PM)- Generation	of PM from	FM and FM to PM					7	1		-				_	_	_	9	Hour
AM Transm	itter (Low Level	and High	Level) - FM	Transmitter (Direct and Inc Pre-emphasis and De-emp	irect Metho hasis circui	d) - Characterístics and fi ts	unctio	ns of a	7000	eiver -	AM Su	perhe	terody	e Reco	eiver a	nd FN	I Supe	r Heter	odyne	Recei	ver - I	Noise
Unit-3 - Ba	seband and Dig	ital Mod	ulation Teci	hniques	Alle	CIN N X I I	CL2			4.3	N.D	1										Hour
Filter Recei	ver - Probability	of error fo	r Matched fi	ind P <mark>PM) - Digital Modulatio</mark> ilter - Inter Symbol Interfere			tion (F	PCM) S	yster	m) - D	ifferent	al PC	M (DP	CM) S)	ystem	- Delta	Modu	lation (	DM) S	ystem	- Mat	Iched
Unit-4 - Pa	ssband Transn	ission Sy	stem																			Hour
Passband	Transmission Sy	stem Mo	del - Passb	and Modulation Technique	s- Generati	on, Signal Space diagra	m, De	tection,	Pro	ilidada	y of E	rror fo	r BFS	K - BP	SK -	QPSK	- M-a	ry PSK	and I	SK (	Eleme	intary

Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia,

Taub & Schilling, "Principle of Communication Systems", McGraw Hill Inc, 2nd Edition, 2003.
 John G. Proakis, "Digital Communication", McGraw Hill Inc, 5th Edition, 2008.

9 Hour

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Entropy, Information rate, Source coding theorem, Shannon-Fano coding, Huffman coding, Mutual information - Shannon's channel capacity theorem

Simon Haykin and Michael Moher, Communication Systems," 5th edition.

Singh. R. P & Sapre. S. D, "Communication Systems: Analog & Digital," 3rd edition,

Treatment) - QAM System

Learning

Resources

Unit-5 - Information Theory and Channel Capacity

John Wiley & Sons, 2013

Mc GrawHill Education, Seventh Reprint, 2016.

earning Assessm	ient		O. C. C. C. C.	A						
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Level 2	Understand	25%	1/2/2017 101	20%		25%				
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Level 4	Analyze	20%	STREET, STREET	25%		30%				
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Level 6	Create		A - S FA COL	5%	The First I	- 40				
	Total	10	0 %	10	0 %	10	0%			

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2nd Edition, 2001

Course Designers											
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts									
<ol> <li>Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj.anii@gmail.com</li> </ol>	Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu	1. Dr. M. Sangeetha, SRMIST									
Mr. Hariharasudhan - Johnson Controls, Pune, hariharasudhan v@ici.com	Dr. Venkatesan, Sr. Scientist, NIOT, Chennal, venkat@niot.res.in	7 × 1									

Course	21ECC322I. Course Name	COMMUN	ICATION LAB		legory				Pro	fess	ion	ıl C	orc				0	0	4 2
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Course La	earning Rationale (CLR): The pu	rpase of learning this course	is to:					_	Pro	gram	Outo	omes	(PO)		_	_		Pro	gram
CLR-1:	Afford in depth awareness			tion techni	ques	1	2	3	4	5	6	7	-		10	11	12		eofic
CLR-2:	Familiarize effective method	ds of digital modulati	ion and demodulation te	chniques		٦h		$\top$		$\top$		ja.	$\forall$		$\neg$	$\top$	_	T	T
CLR-3:	Examine detailed knowledg techniques	e on microwave gene	eration, transmission and	l measure	nent	inger in	P.	ned	loss of		Jacob	stansile		Work		8008			
CLR-4:	Provide ample evidence on	light transmission th	rough optical fiber and t	heir mech	anisms	. 3	eefing Kriowledge em Analysis ons. Lit Investigations of Lit Investigations of en problems. en Tool Usage							8	8	& Finance	g,		
CLR-5	Practice acquired knowledg	e within the chosen a	rea for project develops	nent				griderel	duct inse	em Tool	engineer	owner	75	dust &		94.	de Long Lea	T 5	2 2
Course O	utcomes (CO): At the o	and of this course, learners w	ill be able to:			3	8	Opt of	8 8	Med	P.	E	8	g .	8	lo lo	5	PSO-1	8
00-1:	Recognize various analog me	odulation and demod	ulation techniques			2						+	-	+	3			3	
00-2:	Identify systematic methods	systematic methods of digital modulation and demodulation techniques						2		+	*		-	•	3	*		3	
20-3	Discover microwave signal g	eneration, transmissi	on and different measur	rement tec	hnique	s): [2			3		-	$\mathbf{E}$	*	**	-	*	4)	3	5
00-4:	Realize different characterist	ics and mechanisms	of light transmission thre	ough fiber		2			3	*.	+	${\bf k}_{i}$	-	-	* 1	-	0.1	3	1 5
	Justify the technical aspects of approach	of the chosen project	with a comprehensive a	ınd system	atic	2				*		50	50	3	ē	1	*	3	
Amplitu Unit-2: D Pulse Co Unit-3: M Characte and radia Unit-4: O Characte	Analog Modulation and Dem de modulation and demodu- igital Modulation and Dem xle Modulation and demodi- icrowave Communication ristics of Reflex Klystron, pi- tion pattern of Hom antena ptical Communication ristics of LED and Laser dio tal Optical Link	lation, DSB-SC moc odulation Technique itation, DM and den ower distribution in D a, Characteristics of	fulation and demodulation ps modulation, PSK Modul Directional coupler, E pla Strip Line	ation and	demod	ulatio Magic	n, QP Tec, I	SK N	ance	me	on a	nd l	ent l	by sk	ottec	d lin		11100000	340.2000
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Level 1	Remember	15%	-	1596		15%						
Level 2	Understand	25%	-	25%	7	25%	-					
Level 3	Apply	30%		30%	*	30%	-					
Level 4	Analyze	30%		30%		30%						
Level 5	Evaluate			-	(#	(4)	10					
Level 6	Create	*				(4)						
	Total		100 %		100 %	1	700%					

Course Designers										
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts								
<ol> <li>Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj.anii@gmail.com</li> </ol>	<ol> <li>Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu</li> </ol>	1. Dr. M. Neelaveni Ammal, SRMIST								
<ol> <li>Mr. Hariharasudhan - Johnson Controls, Pune, hariharasudhan.v@jci.com</li> </ol>	<ol><li>Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in</li></ol>	2. Dr. S. Vasanthadev Suryakala, SRMIST								

Course Code	21	ECC304 T	Course Name	MICROWAVE AND OPTICAL COMMUNICATION Category						Pro	Professional Core L T P 3 0 0 :									P (			
Pre-requ Course		21ECC3	02T		Co- requisite Courses				Progressi e Courses		1ECE	204T	, 21E	CE3	211	ŗ			_	_			
Course C	Offering	Department	ECE	E			Data Book / Codes / Standa	nds	+										_		_		_
Course (CLR):	Learnin	ng Rational	e	Тhе дигрозе	of kiaming this cour	rse is fo:							Proj	gun	Outo	orne	ı (PC	))					ogram pacific
CLR-1: Deliver in depth knowledge on microwave transmission and generation							1	2	3	4	5	6	7	8	9	10	1	12		tomes			
CLR-2	Pro	pose effic	e efficient methods to analyze S-parameters of microwave devices									П	T										
CLR-3:					easurement tec l'equipment.	hniques a	nd to provide complet	e knawl	edge	T Y													
CLR-4		er complet character		ition on ligh	it transmission t	through or	otical fiber and their me	echanis	m	E n Co M e n d u													
CLR-5:							design considerations ematical formulation	of link p	power	n sig sov s i n i c				Life.									
Course	Outcor	nes (CO):		At the end of	this course, learner	n will be able	As:			日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日	Pr obsi em An ally sis	1 日本の	事品を有 8 年 3 日 章	E+00-2+88*	*******	- · · · · · · · · · · · · · · · · · · ·	E + 8 - C +	34-41-88EV0-4	公司 衛星 報 8	M 0	- 江野は   田田   田田   田田   田田   田田   田田   田田	50.	# 8 0 0 0 3 2 2
CO-1:	Fam	illarize the	concept	of microwa	ve transmission	n and gen	eration			3	2			•	-	y	*		•		20	3	_ h1
CO-2:	Real	ze system	natic methods to design, analyze S-parameters of microwave devices					3	2			-	+	-	-	-	-	-	*	3	1		

con	Identify different measurement techniques for determining various parameters and to gain knowledge on microwave measurements and the techniques with associated equipment	2			3	٠	-		-	-		-	3	40	-
C04	Discover complete information on the fundamentals of light transmission through fiber and their characterization and mechanism	3	2			-	*	7		*	1	*	3	a	(5)
CO-5:	Recognize the link power budget design considerations of optical communication system	3		2				*	*		-	*	Г	2	

	troduction to microwaves and Sources	
History of Magnetro	of Microwave Engineering, Microwave transmission and Application oscillators, IMPATT, TRAPATT, Tunnel diode, Gunn diode.	ons, Microwave Tubes, Klystron amplifier, Reflex Klystron oscillators,
Unit-2 : S Scatterii Power di	parameters analysis for N-port microwave devices ig parameter, Directional coupler. E plane, H plane and Magic Tee, viders. Case study on Directional coupler	Junctions, Microwave Circulators, Isolators, Phase shifters, Attenuators and
	crowave Measurements and Equipments	
	pedance and Power measurement, Measurement of Frequency, Attenual naiyzer and Spectrum Analyzer, Case study on VSWR and Impedance me.	
	tical Fiber Communication Systems	
	on to Optical fiber communication, Ray theory transmission, Optical fiber m ED and LASER Diode, Optical detectors-PIN and Avalanche photo diode	odes and configurations, Fiber attenuation and dispersion mechanisms, Optical
Unit-5: Opti	cal Link Power Budget Analysis	
Digital li		and Risetime budget, Analog link and analysis, WDM and Passive devices,
Learning	Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Edition, Pearson Education, 2013,     Robert E. Collin, "Foundations for Microwave Engineering", 2nd edition, Wiley, Reprint 2014.	<ol> <li>David M. Pozar, "Microwave Engineering", 4th Edition, John Wiley &amp; Sons, 2012.</li> <li>Keiser G, "Optical Fiber Communication Systems", 5th Edition, 6th Reprint McGraw Hill Education (India), 2015.</li> </ol>

- 1	E-thirting rices surrice.		
ı	Bloom's	Continuous Learning Assessment (CLA)	Summative

	Remember	Theory	Practice	Theory	Practice	Theory	Fraction
	Remember	4.60			T Transaction	THEORY	Fracace
		15%	590	15%	- G	15%	7.40
evel 2	Understand	25%		25%	-	25%	
evel 3	Apply	30%	-	30%	-	30%	-
	Analyze	30%	-6	30%		32%	(4)
evel 5	Evaluate						
avel 6	Create	-			-		

Course Designers	Colorador State Construction Construction	- N - Cettini
xperts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Anuj Kumar, Bombardier Transportation,     Ahmedabad, kumaranuj anuj@gmail.com	<ol> <li>Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu</li> </ol>	1. Dr. Shanthi Prince, SRMIST
<ol> <li>Mr. Hariharasudhan - Johnson Controls, Pune, hariharasudhan.v@jci.com</li> </ol>	<ol> <li>Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in</li> </ol>	2. Dr. M. Neelaveni Ammal, SRMIST

Course	21ECC322L	Course Name		COMMUNICATI	ON LABORATORY		Course	,	С			PRO	FESS	ONAL	COR	E		1	0	P 4	2
Pre-requi		1MAB203T		Co- requisite Courses	NII		Prog	resi					21	ECC3	02T, 2	1ECC	304T				
	Offering Departm	ent		ECE	Data Book / Codes / Sta	ndards		-						Nil							
Course Le	arning Rationale	(CLR):	The purpos	e of learning this coun	se is to:	fil					Progr	am Ou	tcome	s (PO						rogra	
CLR-1:	afford in depth a	wareness o	n various an	alog modulation and de	modulation techniques		1	2	3	4	5	6	7	8	9	18	11	12		pecif	
CLR-2:	familiarize effec	tive methods	s of digital m	odulation and demodule	tion techniques		8		8	10					ň						
CLR-3:	examine detaile	d knowledge	e on microws	ave generation, transmis	sion and measurement technique	S	9	12	E .	ation	8	-			*		Finance	QI.			
CLR-4:	provide ample e	vidence on i	light transmi	ssion through optical fib	or and their mechanisms		5	を	8	restgations problems	3	ranc	nd _		& Team Work	8	ALT.	Learning			
CLR-5:	analyze the cha	racteristics o	of specific M	icrowave and Optical de	vices and Components		ngneering Knowledge	n Ana	deve a	d inve	m Tool Usage	engineer and sty	unbility			mical	ged Mgt.	ng Le			
Course Ou	tcomes (CO):		At the and	of this course, learner	s will be able to:		ugu	養	esign	f com	poden	he en	myero	Pics	dividual	E S	roect	the Long	100	505	503
CO-1:	1			d demodulation techniqu		17	2	-	-			- 0	W 69	-	-	3	-	-	3		
CO-2:	-	-		odulation and demodular		100			2		-	1	-	100		3	2	2	3		-
CO-3:	discover microw	sive signal g	peneration, tr	ransmission and differen	t measurement techniques	- 6	20	1	1.	3			-					-	3		
CO-4:	realize different	characterist	lics and med	hanisms of light transmi	ssion through fiber		2		9	3		-	-				-	-	3		-
CO-5:	characterize and	ł analyze M	krowave and	d Optical devices and C	omponents		2	-	3	4	77	100	*	9)	34		*	2		2	+
Amplitude i	nalog Modulation modulation and de gital Modulation	modulation	DSB-SC m	odulation and demodula	tion, frequency modulation and de	modula	tion					à									Hour
					dation and demodulation, QPSK II	Modulati	on and	Den	nodula	tion	_	_	_							12	mour
	crowave Commu			137.		V.					7									12	Hour
	tics of Reflex Klys stical Communic		r distribution	in Directional coupler, E	plane, H plane and Magic Tee, In	npedano	ce mea	sure	ment t	y slotte	d line	metho	d							43	Hour
			Characterist	tics of PIN and APD. Me	asurement of Numerical Aperture.	Propag	ution a	nd B	lending	kosser	-			_						14	mour
Unit-5 - Mi	crowave and Op	tical Comm	unication				-														Hour
Gain and re	sdiation pattern of	Hom anten	ria, Characte	eristics of Filters, Strip III	ne and Parašel line Coupler, Analy	sis al A	nalog a	ind L	Digital	Optical	Link :	Simula	tion of i	Optica	Com	munica	tion Sy	stem (	using (	Optika	1
Learning Resources	McGra	wHill Educat Haykin and	tion, Seventh	h Reprint, 2016.	stems," 5th edition, John Wiley	4. Kei	nuel Y. ser G. ' ia. 2015 boratory	Opti 5	cal Fib												stion,

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			Co	intinuous Learning	Assessment (CL	A)						
	Bioom's Level of Thinking	ехрег	CLA-1 Average of first cycle experiments (30%)		experiments cycle experiments				xamination eightage	Final Examination (0% weightage)		
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice			
Level 1	Remember	- 4	20%	- 1 T. T.	20%		20%		2			
Level 2	Understand		20%		20%	1.00	20%	1.00				
Level 3	Apply	-	30%		30%	6	30%					
Level 4	Analyze	79	30%		30%	100	30%		100			
Level 5	Evaluate		-			4.4						
Level 6	Create	- Gan	· ·					1000				
	Total	10	0 %	100	1%	10	0%					

Course Designers									
xperts from Industry	Experts from Higher Technical Institutions	Internal Experts							
Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj anii@gmail.com	Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu	Dr. M. Neelaveni Ammal, SRMIST							
Mr. Hariharasudhan - Johnson Controls, Pune, hariharasudhan v@jci.com	Dr. Venkafesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in	Dr. S. Vasanthadev Suryakala, SRMIST							

Course Code	21ECC304T	Course Name		MICROWAV	E AND (	OPTICAL CO	MMUNICATION		Coun		С			PRO	OFESS	IONAL	COR	E		1	T 0	P 0	3
Pre-requi		Nil		Co- requi			21ECC302T			ogres							NII	psi					П
Course	Offering Departm	ent		ECE		D	ata Book / Code	s / Standard	is		-					Nil							
Course Le	earning Rationale	(CLR):	The purpo	se of learning	this co	urse is to:		70	1	-	_		Progr	am Ou	rtcome	s (PO	1					rogra	
CLR-1:	deliver in depth						0		1	2	3	4	5	6	7	8	9	10	11	12		pecifi	
CLR-2:	propose efficient	methods to	analyze S	-parameters o	microw	rave devices					17				~								
CLR-3:	explore detailed techniques with			rement techni	ques an	d to provide	complete knowl	edge on the	8		jo.	12 04	1	society	Sustainability		Work		8				
CLR-4:	characterization		STATE PRODUCTION		1		and their med		nowlec	Sis	opment	estgations	Tool Usage	and so	& Susta		W mea	8	Finan	guim			
CLR-5:	acquire detailed optical communi						ations of link pow	er budget in	ngineering Knowledge	iem Analysis	gnidevelo	uct investiged by	en Tool (	engineer	nvironment 8	10	duai & Te	munication	oject Mgt. & Finance	fe Long Leaming	-	ci.	69
Course O	utcomes (CO):		At the end	d of this cours	e, learn	ers will be a	ble to:	Val. Els.	uğu	don	Desig	Duno.	Aode	2	Envir	Ethics	ndvi	W C	Proje	ife.	280	280	SO
CO-1:	familiarize the co	ncept of m	crowave tr	ansmission an	d genera	ation	a sta	100	3	2	-			1450	-		114			12	3		
CO-2:	realize systemat	ic methods	to design,	analyze S-para	meters o	of microwave	devices	78 - 1	3	2	Fa.		+			18.	1.00	-			3	*:	-
CO-3:	identify different microwave mea						ters and to gain i	knowledge or	2	- 9	7	3	ŀ	-	•		100				3		-
CO-4:	discover comple characterization			e fundamenta	is of lig	ght transmis	sion through fit	er and their	3	2	102	-	•	7	×	100	9	×	245	- 13	3	*	*
CO-5:	recognize the lin	k power bu	dget design	consideration	s of opti	cal commun	ication system	1	3		2			4,	×		14			9		2	*
History of I	troduction to Mic Microwave Engine	ering, Micro	wave trans	mission and A	pplication	ns, Microway	ve Tubes, Klystro	n amplifier, F	tellex K	lystro	n oscill	etors, l	Magnet	tron os	cillator	s, IMP	ATT, T	RAPA	TT, Tu	nnel di	ode, G	unn c	
	Parameters Analy parameter, Directi				lanic Tou	a binetions	Microwaya Circu	latore leniate	ve Pho	to ch	Hore I	Hooise	tore pr	nd Pou	vor divi	dore (	ace e	hada na	Dime	linnal r	nunla		Hour
	crowave Measur		. C pearer,	r i piane and in	agic rec	o puncingra, i	INCOMOVE CITCO	ISSUES, ASUMISIS	F3, F16	ac an	WELLY B.	MUTTOG	rur a car	10 1 04	nes cares	uera. c	703C 3	buy or	Direc	JUFFIGI C	oopie		Hour
	and Power measu		asurement	of Frequency,	Attenua	ation, Scatte	ring parameters,	Vector Netv	rork An	alyze	r, Signi	al Anal	yzer a	nd Spe	ectrum	Analy	zer Ca	se stu	dy on	VSWR	and	Imped	lance
The second section of the second	ptical Fiber Comm	nunication	Systems																			9	Hour
	n to Optical fiber co		on, Ray the	ory transmissio	n, Optic	al fiber mode	es and configurati	ons, Fiber at	enuatio	n and	disper	sion me	chanis	sms, O	ptical:	source.	s-LED	and L	ASER L	liode, I	Optica	i dete	clors-
	valanche photo dic ptical Link Power		atvele							-												0	Hour
Out-0	Direct Link Fower	Duoget Al	mily ara						_													- 0	riour

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Digital link-Point-to-Point link - System considerations, Link power budget and Risetime budget. Analog link and analysis, WDM and Passive devices, Case study on Point-to-Point link power budget analysis

Learning Resources	<ol> <li>Robert. E. Collin, "Foundations for M.</li> <li>Annapurna Das, Sisir K. Das, "Micros</li> </ol>	and Circuits", 3rd Edition, Pearson Education, 2013. icrowave Engineering", 2nd edition, Wiley, Reprint 2014. wave Engineering", 3rd Ed., McGraw Hill, 2015. pring", 4th Edition, John Wiley & Sons, 2012	Education (India), 2 John M. Senior, Education, 3rd Edit Vivekanand Mishr	2015. "Optical fiber Contion, 2009.	on Systems", 5th Edition, 6th Reprint, McGraw Hill nmunications: Principles and Practice", Pearson le, "Fiber Optic Communication: Systems and 2013
Learning As	sessment	CONT. NO.			
1		Continuous Learning Ass	nt (CLA)	1 1 1	Summative
	Disom's	Formative	Life-Long Lear	ming	Final Examination

		1	Continuous Learning	Assessment (CLA)		0	1000		
	Bloom's Level of Thinking	CLA-1 Avera	native ge of unit test %)	Life-Long CL	Learning A-2 0%)	Summative Final Examinatio (40% weightage			
		Theory	Practice	Theory	Practice	Theory	Practice		
Level 1	Remember	15%	12 A CO T 11	15%		15%			
Level 2	Understand	25%	18 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	25%		25%			
Level 3	Apply	30%		30%		30%	-		
Level 4	Analyze	30%		30%	- Y	30%	9		
Level 5	Evaluate	14		112			= =		
Level 6	Create		The latest transfer	Tells	R . J				
	Total	100 %		00 % 100 %			100 %		

Course Designers		
xperts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj.anii@gmail.com</li> </ol>	Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu	Dr. Shanthi Prince, SRMIST
Mr. Hariharasudhan - Johnson Controls, Pune, hariharasudhan.v@jci.com	<ol> <li>Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in</li> </ol>	2. Dr. M. Neelaveni Ammal, SRMIST

Code Code	21ECC4	TI	Course Name	Wire	less Commu	nications	and Antenna Systems	Course Category				Pro	fessi	iona	l Co	etc			3	0	0	3
re-requi Course		12051	, 18EC	C105T	Co-requisite Courses	Nil		Progress		ECE	2207											_
urse Off	ering Departn	ent		onics an seering	nd Communi	cation	Data Book / Codes / Standards	NII.		-												
sume I.	carning Rat	ionale	CLR: 7	he purpose	of learning this or	ourse is fo:			1			Pio	gram:	Outco	mes	PÓI				P	rogra	aim
R-1:	1		-				n and mobile communica	tions	1	2	3	4	5	6	_	1 9	10	11	12		ipea	
R-2:	-	_	27.7				n and mobile communica		11	1	-	H	1			+	-	+		OL	dicon	165
RJ:				_	A STATE OF THE PERSON NAMED IN		on - Small Scale Fading		11.			75	П		音			П		Ш		
R4:	-		-			-	s communications		1 2	1	III o	din		100	8	20		5	111			
R-5:		he kne	wledge	of Wire			dards and Understand and	l design	ering Khow	m Analysis	Mentigene	at investigat	n Tod Usag	greer and	nment & Su	sal & Tear	uscalan	Mg. & Fin	ng Lasering		_	-
wiese C	futcomes (C	Oi:	IA	t the and of	f this course, learn	ers will be	able to		- 6	8	gene	puo	log-	2	8	9 9	1	Defor	2 4	8	8	8
i-f:							nd basic cellular concepts		H	1	- 0	-		-	-			M	M		-	I.
2	Understan	d' the	essentia	l Radio	wave propag	ation an	d mobile channel models		11	H	H	H		-	-		-	M	M	-	-	H
-2:	Familiariza	abou	t Variou	s perfor	mance analy	is of me	bide communication syste	en.	11	Н	Н	-	-		-	- 1	-	1-			-	Н
4:	Attain the	know	edge of	Diversit	ty and capaci	ty conce	pts		H	H	-		+	-	-		-	М	М	+		L
							munication Systems and		H	H	H	H	M	-	-		M	M	M	*		Н
2.	various co performan		of wire	less com	munication,	its desig	n with respect to fading a	nd link		L								L				L
it-1: \	Vireless co	mmu	nication	Mobile	Communica	tions:																
ordless d near	systems- field-Free	Cellula	r teleph reuse,	one syst sectored	ems-Timing and omnidir	diagram rectional	nmunication- Classification - landline to mobile Two Antennas- Channel assigned Zone Concepts-Umbr	- Timing di	igram gies- F	- mol	bile to	mol	bile-	Bas	ic a	nteni	ıa pa	ram	eters	Far	f fie	dd
it-2: L itrodu odel-S iadow	arge Scale	Fadir dio W pathle ned p	ng: /ave Pro as mod athloss	opagatio el-Empe and sha	m-Large scal crical models dowing-Out	e and sr Okuma ige Prot	nall scale tading-Friss tra ra)- Emperical model(W sability-Cell coverage are	insmission e alfish and b a-Solving p	quatio ertoni robles	m-Fro	ee pro	pag HF	ation vise Ante	i me	odel ar r	-patl node _og	loss I-log perio	moi por dic	Jel- I mal dipo	wo mod e ar	ray lef- ray	

3. Constantine Balanis. A, "Antenna Theory: Analysis and Design",

3rd Edition, John Wiley, 2012. 4. Andreas F. Molisch., "Wireless Communications", Wiley, 2nd Edition-2005, Reprint-2014

			Continuous Le	aming Assessment (CLA)			training and the second
	Bloom's Level of Thinking		Formative verage of unit test (50%)	Lfe	Long Learning CLA-2 — (10%)		Examination 6 weightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%		15%		15%	
Level 2	Understand	25%		20%	-	25%	
Level 3	Apply	30%	, a	25%		30%	196
Level 4	Analyze	30%	-	25%		30%	
Lacont 6	Evaluate			60%			

7. Lee W.C.Y., " Mobile Communications Engineering: Theory and

Applications", McGraw Hill, New York, 2nd Edition, 1998

ы	Level 6	Create	-		5%			
		Total	10	2%	100	0%	10	0 %
		2				**		
þ	ourse Designers		Washington and			1000 1000		
Ē	xperts from Industry		Experts from H	gher Technical Institutions		Internal Experts		
k.	to Amil Vision II	combined on Transportation		D- Manualisti D	CPCP C	EC.		

Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj anii@gmail.com	<ol> <li>Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu</li> </ol>	t. Dr. Sandeep Kumar P, SRMIST	
Mr. Hanharasudhan - Johnson Controls, Punc, hanharasudhan.v@jci.com	<ol> <li>Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in</li> </ol>	2 Dr. T. Ramarao, SRMIST	

Theory C	and the second s								Т	$\neg$										1.	T	P	C										
Course Code	21ECC402P	Course Name	Comp	outer Commu	nication a	and Network Security	of Machinest Security		ourse ategory P		4.0		1 40		4.0		4.0		4.0											2	1	0	3
Pre- requisite Courses	NII			Co- requisite Courses	Nil			Prog e Cu			NII .																						
	offering Departm	ent Electro			unication	Data Book / Codes/Stand	lards	MI																									
Course (CLR):	Learning Ration	The pu	urpose of le	arning this cou	urse is to:							omes destina		High-	3)						5	rogra pecif	fic										
CLR-I	Introduce the l	asic concepts	s in the field	d of computer i	networks.			П	1	2	3	4	5	6	7	8	9	0	11	1 2	1	2	3										
CLR-2	provide the fim	ctional aspec	ts of OSI m	nodel architecti	wre.					P			м			T		C					Г										
CLR-3	Acoustics formula		S				$\neg$			0	De		0			П		0		Li													

Course	Outcomes (CO):	At the end of this course, learners will be able to:							
CO-1	provide the basic se	revices and concepts related to internetworking.							
CO-2	Explain the basic O	SI model architecture and its lower layer functions.							
CO-3	Give an insight of the	he various Network Layer concepts, mechanisms and protocols.							
CO-4	Gain knowledge in	the various forms of network security							
CO-5	The second second	ain knowledge in the various forms of network security nulyse the effects of intrusion, viruses, firewalls and various levels of system security							
CO- 6:	Evaluate the various Networking concepts and Routing protocols.								

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3				*	123	30		160			-			9	
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3		2		Ξ	4			12					-	3	
3		2	2	•		-					130			3	

Unit-1: Data communication and networking

Study the conceptx in network security

Identify the effect of various malwares and counter measures

9

Introduction to Data Communication and Networking, Data transfer modes-Serial and Parallel transmission, Protocols & Standards, Layered Architecture, Principles of Layering & Description, Brief description of concepts in OSI & TCP/IP model, Network topologies, switching- Circuit and Packet

Unit-2: Data link Layer

CLR-4

CLR-5

Network models, OSI layer architecture, Data Link Layer Introduction, Link Layer Addressing, Error Detection, Error correction, Data link Control -LLC, Data link control -MAC

Unit-3: Networking layer

Introduction to Network Layer, Need for Internetworking, Addressing-Classfea, Routing protocols- Distance vector and link state, Internet protocol-IPV4 and IPV6

Unit-4: Network security

Email security, Overview of PGP and SMIME, IP Security, Web Security, Secure Socket Layer, Transport Layer Security, Secure Electronic Transaction

Unit-5: Security attack

Intrasion Detection Techniques, Paxosord Management, Malicious software, Viruses, Worms, and Zombies, Introduction to Firewall Types and Configurations, Trusted System, Port Scanning and Knocking.

		Continuous L By the Cours	earning Assessment (C or Faculty	LA)			
	Hloom's Level of Thinking	Formative CLA-1 Average unit test (20%)	e of	Life Long* Learning CLA-II- Projec (60%)	ct based Learning	Report and viv Examination (20% weightage	
		Theory	Practice	Theory	Practice -	Theory	Practice -
Level 1	Remember	10 %	-		10 %		10 %
Level 2	Understand	15 %	-		15 %		15 %
Level 3	Apply	25 %		-	25 %	-	25 %
Level 4	Analyse	25 %		-	25 %		25 %
Level 5	Evaluate	25 %	-		25 %		25 %
Level 6	Create	+				4	*
	Total	100 %	1.	100 %		100 %	N.

Learning Resources	William Stallings, Cryptography & Network S     Behrouz A. Forouzan, Debdeep Mukhopadhy     Security, 2nd ed., Tata McGraw Hill, 2010		4. Bernard Menezes, Netwo	Cryptography, 2nd ed., 2015 rk Security and Cryptography, Cringage Leurning, 2010 communication & Networking*, Mc-Graw Hill, 5th. Edition Reprint, 2014
Course Des	gners			
Experts from	n Industry	Experts from Higher Technical I	Institutions	Internal Experts
The second of the second	Kunur, Bombardier Transportation, Ahmedabad, mii@gmail.com	Dr. Meenakshi, Professor of I meena68@annauniv.edu	ECE, CEG, Anna University,	Dr.E. Elamaran, Assistant Professor of ECE, SRMIST
The last of the la	Hariharasudhan - Johnson Controls, Pune, han v@ici.com	2. Dr. Venkatesan, Sr. S venkat@niot.res.in	cientist, NIOT, Chennai,	Dr. V. Nithyu, Associate Professor of ECE, SRMIST.

Course	21ECC401T	Course	WIRELESS COMMUNICATION AND ANTENNA SYSTEMS	Course	DDOCESSIONAL CODE	L	T	P	C
Code	21ECC4011	Name	WINELESS COMMUNICATION AND ANTENNA STSTEMS	Category	PROFESSIONAL CORE	3	0	0	3

Pre-requisite Courses	21ECC205T	Co- requisite Courses	Nii	Progressive Courses	Nil	
Course Offeri	ng Department	ECE	Data Book / Codes / Standards		Nil	

Course L	earning Rationale (CLR):	The purpose of learning this course is to:	Fe.	-4		. )	Progr	am O	ıtcome	s (PO	)					rogra					
CLR-1:	understand the element	s of Wireless Communication and mobile communications	1	2	3	4	5	6	7	8	9	10	11	12		pecif					
CLR-2:	understand the element	s of Wireless Communication and mobile communications	Ф		14	to		\$			*										
CLR-3:	2-3: analyze how to apply Mobile Radio Wave Propagation - Small Scale Fading				ntof	stigations	a)	society			Work		Finance								
CLR-4:					verapme	tigat	Usage	and	25		Теяш	-		aming							
CLR-5:	acquire the knowledge of systems	of Wireless System and Standards and Understand and design various wireless	ering Knowledge	n Analysis	develo	t invest	18	engineer	ment &		per 5ee	nication	ct Mgt. &	ong Lear							
Course C	Outcomes (CO):	At the end of this course, learners will be able to:	Engine	Probler	Design	Conduc	Modern	The en	Environment	Ethics	Individual	Communic	Project	Life Lor	PSQ-1	PSO-2					
CO-1:	acquire the knowledge of	of Wireless communication and basic cellular concepts	3	1.	10	1.00		1			*			2							
CO-2:	understand' the essenti	al Radio wave propagation and mobile channel models	(0)	3			4	1		X.	77.			2			3				
CO-3:	familiarize about Various performance analysis of mobile communication system				Fee.	18	-	-			*2			*	(*)	*:	3				
CO-4:	attain the knowledge of Diversity and capacity concepts					1150	- 1			142	41			\$			3				
CO-5:	be familiar with the various standards of Mobile Communication Systems and Explore the variou concepts of wireless communication, its design with respect to fading and link performance				1	*		C	Page	#	2			98.5	(4)	- 60	3				

#### Unit-1 - Introduction to Wireless Communications and Antennas

Introduction to wireless communication and mobile radio communication. Classification of wireless communications -simplex, half duplex, dull duplex. Paging and Cordless systems. Cellular telephone systems Timing diagram - landline to mobile Two- Ti<mark>ming dia</mark>gram - mobile to mobile- Basic antenna parameters, Far field and near field- Frequency reuse, sectored and omnidirectional Antennas- Channel assignmen strategies- Handoff and its types- Interference and system capacity--Cell splitting-Sectoring- Microcell Zone Concepts-Umbrella Cells- Solving Problem on antenna parameters

#### Unit-2 - Large Scale Fading

9 Hour

Introduction to Radio Wave Propagation-Large scale and small scale fading-Friss transmission equation-Free propagation model-pathioss model-Two ray model-Simplified pathioss model-Empirical model (Okumara)- Empirical model(Walfish and Bertoni model)-Piecewise linear model-tog normal model-Shadowing-Combined pathless and shadowing-Outage Probability-Cell coverage area-Solving problems-VHF/UHF Antennas - Log periodic dipole array - Parabolic Reflector antennas

## Unit-3 - Small Scale Fading

Introduction Small Scale multipath propagation-Impulse response model of multipath channel-Small Scale multipath measurements-Direct Pulse measurement-Slide -Small Scale multipath measurements-Sliding Correlator Measurements-Small Scale multipath measurements-Swept frequency measurement-Parameters of mobile multipath channel-Doppler spread and Coherent time-Type of fading: Flat and Frequency selective fading-Fast and slow fading-Ricean distribution-Rayleigh distribution-Solving problems(Doppler effect)- Design of Microstrip Patch Antenna

#### Unit-4 - Improvement of link Performance

9 Hour

Introduction to diversity, equalization, and capacity-Space Diversity-Scanning Diversity-Maximal ratio combiner-Equal gain diversity-Rake Receiver-Capacity in AWGN-Capacity of flat fading channels-Equalizer and its mode-Adaptive equalizer block diagram-Type of Equalizers-Introduction to MIMO antennas-Case Study: Recent Trends in Diversity and MIMO antennas

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# Unit-5 - Wireless Systems and Standards

9 Hour

AMPS Voice modulation Process- GSM system architecture and its interfaces-GSM frame structure-GSM speech operations input-output-Forward CDMA process-Reverse CDMA process-Multicarrier modulation-OFDM Transmitter Block diagram-OFDM Receiver Block Diagram-Importance of Cyclic Prefix-Case study (Modern Antennas)

Learning Resources

- Rappaport.T.S." Wireless Communications: Principles and Practice", 2nd Edition, Pearson, 2011.
  - John D Kraus, Ronald J Marhefka, Ahmed S Khan "Antenna and Wave Propagation", 4th Edition, Tata McGraw Hill, 2010
- Constantine Balanis. A, "Antenna Theory: Analysis and Design", 3rd Edition, John Wiley, 201.
- Andreas.F. Molisch., "Wireless Communications", Wiley, 2nd Edition- 2005, Reprint-2014 Andrea Goldsmith, "Wireless Communications", Cambridge University Press, Aug 2005
- Schiller, "Mobile Communications", Pearson Education Asia Ltd., Reprint 2012 6
- Lee W.C.Y., "Mobile Communications Engineering: Theory and Applications", McGraw Hill,
  - New York, 2nd Edition, 1998

	Y The second sec		Continuous Learning	Assessment (CLA)		Cum	native
	Bloom's Level of Thinking	CLA-1 Avera	native ge of unit test 3%)	CL	g Learning A-2 0%)	Final Ex	amination eightage)
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	F - 1 - 10 - 1	15%		15%	
Level 2	Understand	25%	The second second	20%		25%	-
Level 3	Apply	30%	12.4	25%	/	30%	
Level 4	Analyze	30%	Secretary of the second	25%		30%	
Level 5	Evaluate		West 150 130	10%	10 8 6 9		. 3
Level 6	Create	24 (12.1)	100	5%	0 %		
	Total	10	0 %	10	0 %	10	0 %

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
<ol> <li>Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj.anii@gmail.com</li> </ol>	Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu	Dr. Sandeep Kumar P., SRMIST
Mr. Hariharasudhan - Johnson Controls, Pune, hariharasudhan.v@jci.com	2. Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in	2. Dr. T. Ramarao, SRMIST



Course	21ECC402P	Course	COMPUTER COMMUNICATION AND NETWORK SECURITY	Course	0	PROFESSIONAL CORE	L	T	P	C
Code	Z IEGG402P	Name	COMPUTER COMMUNICATION AND NETWORK SECURITY	Category	9	PROFESSIONAL CORE	2	1	0	3

Pre-requisite Courses	NII	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offerin	ng Department	ECE	Data Book / Codes / Standards		Nil

Course L	earning Rationale (CLR):	The purpose of learning this course is to:	100	Program Outcomes (PO)												rogra		
CLR-1:	introduce the basic cond	cepts in the field of computer networks	1	2	3	4	5	6	7	8	9	10	11	12		Specific Outcomes		
CLR-2:	provide the functional as	spects of OSI model architecture	m		14	o		兪										
CLR-3:	acquire knowledge of th	e Network Layer protocols	edge		aut of	oris	40	000			Work		8	escon.				
CLR-4:	study the concepts in ne	itwark security	JOH)	100	орте	pod	sage	2	80		Team	c	E.	Die				
CLR-5:	identify the effect of vari	ous malwares and counter measures	20	ng/s	O. O.	N SS	) lo	99	世紀		- T	100	90	B9				
	7h - 2		eer	heering hem Ana gnideve gnideve	gn/de tons		duct in	am Te	engin	onme	1/2	dual	munic	ct Mgt	guo	7	2	17
Course C	outcomes (CO):	At the end of this course, learners will be able to:	Eug	B	Design	Comp	Mod	20	Sust	EFF	upu	5	Proje	90	PSO	PSO	PSO	
CO-1:	provide the basic service	es and concepts related to internetworking	2	3	3/	17.0		-								-		
CO-2:	explain the basic OSI m	odel architecture and its lower layer functions	2	3	-	12	2.	1450		74	*		14				3	
CO-3:	give an insight of the va-	riou <mark>s Networ</mark> k Layer concepts, mechanisms and protocols	3	149	100	- 10	28				.*.	10.50	1.0	120	(80	*2		
CO-4:	gain knowledge in the vi	arious forms of network security	3	14	2	A.E.		1.0	(*)	70				-	(6)	*:	3	
CO-5:	analyse the effects of in	trusion, viruses, firewalls and various levels of system security	3	-	2		Q.										3	

Unit-1 - Data Communication and Networking

9 Hour

Introduction to Data Communication and Networking, Data transfer modes-Serial and Parallel transmission, Protocols & Standards, Layered Architecture, Principles of Layering & Description, Brief description of concepts in OSI & TCP/IP model, Network topologies, switching- Circuit and Packet

Case Studies on Network topologies Unit-2 - Data Link Layer

9 Hour

Network models, OSI layer architecture, Data Link Layer-Introduction, Link Layer Addressing, Error Detection, Error correction, Data link Control-LLC, Data link control-MA, flow control and error control, HDLC Case Studies on Hamming code

Unit-3 - Networking Layer

9 Hour

Introduction to Network Layer, Need for Internetworking, Addressing-Classful, Addressing-Classless, Routing protocols- Distance vector and link state, Internet protocol-IPV4 and IPV6, border gateway protocol

Case Studies on Routing protocol-DVR

Unit-4 - Network Security

Email security, Overview of PGP and S/MIME, IP Security, Web Security, Secure Socket Layer, Transport Layer Security, Secure Electronic Transaction

Case Studies on Secure electronic Transaction

Unit-5 - Security Attack
[Intrusion Detection Techniques, Password Management, Malicious software, Viruses, Worms, and Zombies. Introduction to Firewall Types and Configurations, Trusted System, Port Scanning and Knocking.

9 Hour

Case Studies on firewall

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Learning	1.	Behrouz A. Forouzan, "Data communication & Networking", Mc-Graw Hill, 5th Edition	<ol> <li>William Stallings, "Cryptography &amp; Network Security", Pearson Education India, 6th edition 2014</li> </ol>
The state of the s		Reprint, 2014.	<ol> <li>Bruce Schneier, "Applied Cryptography", Pearson Education India, 2nd edition., 2015</li> </ol>
Resources	2	Andrew S. Tanenbaum, "Computer Networks", Pearson Education India, 5th Edition, 2013	<ol><li>Bernard Menezes, "Network Security and Cryptography", Cengage Learning, 2010</li></ol>

		<u> </u>	Co							
	Bloom's Level of Thinking	CLA-1 Avera	native age of unit test 0%)	CL	sed Learning A-2 0%)	Report and Viva Voce (20%)			Examination weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	20%			10%	4.0				
Level 2	Understand	25%	- A		20%					
Level 3	Apply	30%			25%	-	A .		4	
Level 4	Analyze	25%	(4		25%	Ob. III	100	14		
Level 5	Evaluate		13 Hg	- A	10%	la.	-	74		
Level 6	Create		940	10000	Maria S	200 10	10	-		
7210000000	Total	10	0%	10	0%	10	0%			

Course Designers	The state of the s		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts	
<ol> <li>Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj anii@gmail.com</li> </ol>	Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu	1. Dr.E. Elamaran, SRMIST	
2. Mr. Hariharasudhan, Johnson Controls, Pune, hariharasudhan, v@ici.com	2. Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in	2. Dr.V. Nithya, SRMIST	

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Course Code	21CSS303T	Course Name	D	DATA SCIENCE			ENGINEERING SCIENCES	2	T	0	2
Pre-requis	ite	MI	Co-requisite	NI.	Progre	ssive	NI				

Course L	earning Rationale (CLR):	The purpose of learning this course is to:	Program Outcomes (PO)													rogra	
CLR-1:	understand the basics of	data	1	2	3	4	5	6	7	8	9	10	11	12		pecif	
CLR-2:	learn the Pandas library t	o analyze data frames	100		11	6		À			-		52-				
CLR-3:	utilize different methods of	of data acquisition and data cleaning	edpe		5	Suo	9	90CH			Work		ance				
CLR-4:	explore the visualization t	tools for different kinds of input data formats	ring Know	12	пешдо	stigat	Usage	pue			Team	6	T.	ning			
CLR-5:	apply supervised and una output	apply supervised and unsupervise <mark>d learni</mark> ng to learn the hidden patterns from the data and predict the output		om Analy	nidevelo	uct investigation	m Tool L	ngneer	orment		dividual & T	nunication	d Mgt &	onglear	7	-2	m
Course C	Outcomes (CO):	At the end of this course, learners will be able to:	Enghe	Proble	Desig	Comp	Mode	The	Enviro	Ethics	Individ	Comin	Projec	Lifet	PSO.	-OS	PSO-
CO-1;	understand the relationsh	ip between data		25	V-V	-	1	1		-	-:	-		-	-	-	
CO-2:	identify the different data	structures to represent data		-			1	100		743	-			Ψ.			2
CO-J:	identify data manipulation	and cleaning techniques using pandas	-	1	de.	15	1	-	-	-	-		1.52	- 03			25
CO4:	constructs the Graphs an	d plots to represent the data using python packages	650		13	-30	7	-				3		-			*
CO-5:	apply the principles of the problem	se data science techniques to predict and forecast the outcome of real-world	-41		1	3	1				-		-				

Unit-1 - Introduction to Data Science, Numpy and Pandas

10 Hour

Introduction to Data science: Facets of data, Data Science Process Introduction to Numpy, Numpy, creating array, attributes, Numpy Arrays objects: Creating Arrays, basic operations (Array Join, split, search, sort), Indexing, Slicing and iterating, copying arrays, Arrays shape manipulation, Identity array, eye function Pandas: Exploring Data using Series, Exploring Data using DataFrames, Index objects, Re index, Drop Entry, Selecting Entries, Data Alignment, Rank and Sort, Summary Statistics, Index Hierarchy Data Acquisition: Gather information from different sources, Web APIs, Open Data Sources, Web Scrapping.

Unit-2 - Data Wrangling, Data Cleaning and Preparation

10 Hour

Data Handling: Problem faced when handling large data-General techniques for handling large volume of data-General programming tips for dealing large data sets Data Wrangling: Clean, Transform, Merge, Reshaping, Protting Data Cleaning and Preparation: Handling Missing Data, Data Transformation, String Manipulation, summarizing, Binning, classing and Standardization, outlier/Noise& Anomalies.

Unit-3 - Visualization

10 Hour

Customizing Plots: Introduction to Matplotlib, Plots, making subplots, controlling axes, Ticks, Labels and legends, annotations and drawing on subplots, saving plots to files, matplotlib configuration using different plot styles. Seaborn library: Making sense of data through advanced visualization: Controlling line properties of chart, creating multiple plots, Scatter plot, Line plot, bar plot, Histogram, Box plot, Pair plot, playing with text, styling your plot, 3d plot of surface

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Learning				
	Le.	arr	nin	g

 Grus, J. (2019). Data Science from Scratch, 2nd Edition. O'Reilly Media, Inc.
 Jiawei Han, Micheline Kamber and Jian Pei (2012), Data Mining Concepts and Techniques, Third Edition, Elsevier.

Course Offering Department Data Science and Business Systems Data Book / Codes / Standards

- Davy Cielen, Arno D. B. Meysman, and Mohamed Ali (2016), Introducing Data Science Big data, machine learning, and more, using Python tools. Manning Publications.
- McKinney, W. (2018). Python for data analysis: Data wrangling with pandas, NumPy and (Python. O'Reilly Media, Inc.
- Vanderplas, J. T. (2017). Python data science handbook: Essential tools for working with data. OReilly Media, Inc.
- Jetfrey S. Saitz and Jeffrey M. Stanton (2018), An Introduction to Data Science, Sage Publication.
   Shai Valingast (2014), "Beginning Python Visualization Crafting Visual Transformation Scripts".
- Second Edition, Apress, 8. Wes Mc Kinney (2012). "Python for Data Analysis", O'Reilly Media.

			Continuous Learning Assessment (CLA)					
	Bloom's Level of Thinking	CLA-1 Avera	native ge of unit test 7%)	C	g Learning LA-2 10%)	Final Ex	mative amination eightage)	
		Theory	Practice	Theory	Practice	Theory	Practice	
Level 1	Remember	40%	The Sales	20%	3. T.F	40%	-	
Level 2	Understand	40%		20%		40%		
Level 3	Apply	10%	The State of the S	20%		10%		
Level 4	Analyze	10%	2 - A - A	20%	1 H 1 H 1 1 1 1	10%		
Level 5	Evaluate		11.	10%				
Level 6	Create		G 15 15 7/	10%				
	Total	10	0%	10	00%	10	0 %	

Course Designers		THE RESIDENCE ASSESSMENT AND ADDRESS OF THE PARTY OF THE
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. Veeramanickam. M.R.M. Associate Professor Chitkara University Institute of Engineering and Technology	<ol> <li>Mr. Snehith Altern Raju Senior Manager Advanced Analytics &amp; Architecture Envista Holdings Corporation, Hyderabad.</li> </ol>	1. Dr.V.Kalpana, SRMIST
		2 Dr.G. Vadivu, SRMIST