

FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED CURRICULUM

Curriculum and Syllabus

BACHELOR OF TECHNOLOGY ELECTRONICS AND COMMUNICATION ENGINEERING (PART TIME) 2022

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING



VISION AND MISSION OF THE DEPARTMENT

VISION

- To create centers of excellence in evolving competent core areas of Electronics and Communication Engineering and effectively respond to the demands of industry, R & D organizations.
- To emerge as a premier centre of technology for research using open source tools

MISSION

- M1: To accomplish academic excellence through valuable teaching-learning processes to meet requirements of the industry and society.
- M2: To prepare students to face the challenges in the field of electronics and communication engineering and prepare them as responsible engineers with ethical values.
- M3: To promote the zeal for innovation and creativity among students towards research and development.
- M4: To augment students with skills needed for employability, entrepreneurship and for pursuing higher studies.



PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- **PEO 1**: To emphasize on the fundamental concepts of Electronics and Communication Engineering.
- **PEO 2**: To provide a conducive academic learning environment by creating awareness on lifelong learning and promoting research to excel in their career through higher education.
- **PEO 3**: To impart analytical skills to explore socially acceptable and economically feasible solutions for the real life problems using modern design tools.
- **PEO 4**: To inculcate effective communication skills and ethical team work so as to be capable of functioning in diverse environments.
- **PEO 5**: To instill leadership traits among the students and hone their innovative skills to become successful entrepreneurs.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon the completion of program, graduates will be able to

- **PSO1**: Recognize, adapt the knowledge of science, engineering and mathematics for providing solutions to techno-economical problems in real world.
- **PSO2**: Formulate logical approach to solve engineering problems in core area of Electronics and Communication Engineering.
- **PSO3**: Demonstrate inter-disciplinary subject knowledge in diverse fields of Engineering and Technology.
- **PSO4**: Apply the emerging technology and open source tool for life-long learning to face the challenges in society.



PROGRAM OUTCOMES (POs)

Engineering graduates will be able to:

- **PO-1** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO-2** Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO-3** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO-5** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO-9** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO-10** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO-11** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO-12** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



MISSION/ PEO	PEO1	PEO2	PEO3	PEO4	PEO5
M1	3	2	2	1	1
M2	3	2	3	3	1
M3	2	3	2	1	2
M4	2	3	1	1	3

Mapping of MISSION with PEO

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	1		1					2
PEO2	2	2	3	3	1			2	1			3
PEO3	2	3	3	3	3					1	1	
PEO4						2	3	2	3	3	3	1
PEO5						2	1	2	3	3		3

Mapping of PEO with PO

PEO/PSO	PSO1	PSO2	PSO3	PSO4
PEO1	1	3		2
PEO2	2	3	1	2
PEO3	2	2		3
PEO4		1	3	3
PEO5	2		2	

Mapping of PEO with PSO

Strength of Correlation : 3-High, 2-Medium, 1-Low



B.Tech. Electronics and Communication Engineering (Part Time) Curriculum – 2022 Regulation

Semester: 1

S.No.	SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL/IE	L	T/ SLr	P/ R	С	CATEGORY
1	EBEC22018	Circuit And Networks	Ту	3	1/0	0/0	4	PC
2	EBCS22ID2	C++ and Java Programming	Ту	3	0/0	0/0	3	ID
3	EBEC22003	Digital Electronics	Ту	3	1/0	0/0	4	PC
4	EBEC22019	Solid State Devices	Ту	3	0/0	0/0	3	PC
5	EBEC22L01	Digital Electronics Lab	Lb	0	0/0	3/0	1	PC

Semester: 2

Credits Sub Total: 15

S.No.	SUBJECT	SUBJECT NAME	Ty/Lb/	L	T /	P /	С	CATEGORY
	CODE		ETL/IE		SLr	R		
1	EBMA22010	Probability and Random Process	Ту	3	1/0	0/0	4	BS
2	EBEC22004	Electronic Circuits	Ту	3	0/0	0/0	3	PC
3	EBEC22007	Analog Communication	Ту	3	0/0	0/0	3	PC
4	EBEE22ID2	Electrical and Instrumentation Engineering	Ту	3	0/0	0/0	3	ID
5	EBEC22L03	Electronic Circuits Lab	Lb	0	0/0	3//0	1	PC

Semester: 3

5

SUBJECT SUBJECT NAME Ty/Lb/ **P**/ CATEGORY S.No. L **T**/ С CODE SLr ETL/IE R 1 EBEC22006 3 0/0 0/0 3 PC Linear Integrated Circuits Ty 4 PC 2 EBEC22005 Control Systems Engineering Ty 3 1/0 0/0 3 EBEC22009 0/0 0/0 3 PC Microprocessor and Ty 3 Microcontroller EBEC22ET2 4 Field and Wave ETL 2 0/0 2/0 3 PC Electromagnetics EBEC22L07 Lb 0 0/0 3/0 1 PC Microprocessor and Microcontroller Lab

Credits Sub Total: 14

Credits Sub Total: 14



Semester: 4

S.No.	SUBJECT	SUBJECT NAME	Ty/Lb/	L	T/	P/	С	CATEGORY
	CODE		ETL/IE		SLL	R		
1	EBEC22010	Digital Signal Processing	Ту	3	1/0	0/0	4	PC
2	EBEC22012	Digital Communication	Ту	3	1/0	0/0	4	PC
3	EBCC22ID2	Principles Of Management and Behavioral Science	Ту	3	0/0	0/0	3	ID
4	EBEC22EXX	Program Elective I	Ту	3	0/0	0/0	3	PE
5	EBEC22L14	Analog and Digital Communication Lab	Lb	0	0/0	3/0	1	PC

Credits Sub Total: 15

Semester: 5

S.No.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL/IE	L	T/ SLr	P/ R	C	CATEGORY
1	EBEC22011	Sensors and Robotics	Ту	3	0/0	0/0	3	PC
2	EBEC22008	Communication Networks	Ту	3	0/0	0/0	3	PC
3	EBEC22020	VLSI and Embedded System Design	Ту	3	0/0	0/0	3	PC
4	EBEC22EXX	Program Elective II	Ту	3	0/0	0/0	3	PE
5	EBEC22L11	VLSI and Embedded System Design Lab	Lb	0	0/0	3/0	1	PC

Credits Sub Total: 13

Semester: 6

S.no.	Subject	subject name	Ty/Lb/	L	Τ/	P /	С	Category
	code		ETL/IE		SLr	R		
1	EBEC22017	Wireless Networks	Ту	3	1/0	0/0	4	PC
2	EBEC22021	Optical Communication	Ту	3	0/0	0/0	3	PC
3	EBEC22022	RF and Microwave Engineering	Ту	3	0/0	0/0	3	PC
4	EBEC22EXX	Program Elective III	Ту	3	0/0	0/0	3	PE
5	EBEC22I05	Project Phase - I	Lb	0	0/0	3/3	2	Р

Credits Sub Total: 15



Semester: 7

S.No.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	С	CATEGORY
1	EBEC22EXX	Program Elective IV	TY	3	0/0	0/0	3	PE
2	EBEC22EXX	Program Elective V	TY	3	0/0	0/0	3	PE
3	EBEC22L13	Project Phase - II	LB	0	0/0	12/ 12	8	Р

Credits SubTotal: 14

Semester 1:15 Semester 2:14 Semester 3: 14 Semester 4: 15 Semester 5: 13 Semester 6: 15 Semester 7: 14

Total Credits: 100

 $C: Credits\ L: Lecture\ T: Tutorial\ S.Lr: Supervised\ Learning\ P: Problem\ /\ Practical\ R: Research\ T/L/ETL: Theory/Lab/Embedded\ Theory\ and\ Lab$



LIST OF PROGRAM ELECTIVES										
S.No	SUBJECT	SUBJECT NAME	Ty/Lb/	L	T/SLr	P/R	С			
	CODE		ETL/IE							
	I	ELECTIVE 1 – Electronics stream	1			1				
1.	EBEC22E01	Semiconductor Devices and its Applications	Ту	3	0/0	0/0	3			
2.	EBEC22E02	Real time Operating Systems	Ту	3	0/0	0/0	3			
3.	EBEC22E03	Introduction to PLC	Ту	3	0/0	0/0	3			
		ELECTIVE 1 – Communication stream	m							
4.	EBEC22E04	Antenna and Wave Propagation	Ту	3	0/0	0/0	3			
5.	EBEC22E05	Telecommunication Switching Systems	Ту	3	0/0	0/0	3			
6.	EBEC22E06	Audio Signal Processing	Ту	3	0/0	0/0	3			
		ELECTIVE 2 – Electronics stream								
7.	EBEC22E07	Intelligent Instrumentation	Ту	3	0/0	0/0	3			
8.	EBEC22E08	Advanced Microprocessors	Ту	3	0/0	0/0	3			
9.	EBEC22E09	Nano Electronics	Ту	3	0/0	0/0	3			
		ELECTIVE 2 –Communication stream	m							
10.	EBEC22E11	Internet of Things and its Application	Ту	3	0/0	0/0	3			
11.	EBEC22E13	Neural networks and its Applications	Ту	3	0/0	0/0	3			
12.	EBEC22E14	Radar and Navigational Aids	Ту	3	0/0	0/0	3			
		ELECTIVE 3 - Electronics strea	m							
13.	EBEC22E16	Embedded Software Design	Ту	3	0/0	0/0	3			
14.	EBEC22E17	Quantum Computing	Ту	3	0/0	0/0	3			
15.	EBEC22E18	Power Electronics	Ту	3	0/0	0/0	3			
	•	ELECTIVE 3 – Communication stream	n							
16.	EBEC22E19	High Speed Switching Architecture	Ту	3	0/0	0/0	3			
17.	EBEC22E20	Information Coding Techniques	Ty	3	0/0	0/0	3			
18.	EBEC22E21	Optical Network and Switching Techniques	Ty	3	0/0	0/0	3			
		ELECTIVE 4 - Electronics stream	, j	1						
19.	EBEC22E23	Device Modeling	Tv	3	0/0	0/0	3			
20.	EBEC22E24	VLSI Technology	Tv	3	0/0	0/0	3			
21	EBEC22E25	Biomedical Instrumentation	Tv	3	0/0	0/0	3			
		ELECTIVE 4 – Communication stream	<u> </u>	5	0,0	0/0				
22	FBFC22F28	Satellite Communication	Tv	3	0/0	0/0	3			
22.	EBEC22E20	Next Generation Communication	Ty	3	0/0	0/0	3			
23.	EBEC22E2)	Cognitive Radio	Ty	3	0/0	0/0	3			
24.	EDEC22E30	ELECTIVE 5 - Electronics stress	y	5	0/0	0/0	5			
25	FREC22E31	Introduction to MEMS System Design		3	0/0	0/0	3			
25.	FRFC22E31	Analysis and Design of Analog IC's	Ty Ty	3	0/0	0/0	3			
20.	EBEC22E32	Cyber Physical System	Ty	3	0/0	0/0	3			
27.		ELECTIVE 5 _Communication str	ream	5	0/0	0/0	5			
28	EBEC22E35	Electromagnetic Interference and	Tv	3	0/0	0/0	3			
20.		Compatibility	,		0,0	0,0				
29	EBEC22E36	Advanced Concepts in Signal Processing	Tv	3	0/0	0/0	3			
30.	EBEC22E37	Ultra Wide Band Communication	Ty	3	0/0	0/0	3			



COMPONENTS OF CURRICULUM AND CREDIT DISTRIBUTION

Course Component	Description	No. Of Courses	Credits	Total	Credit Weightage	Contact Hours
	Theory	1	4			
	Lab					
BASIC SCIENCCE	ETL			4	4	60
	Lab					
	ETL					
	Theory	16	54			
PROGRAM CORE	Lab	5	5	62	62	1095
	ETL	1	3			
	Theory	5	15			
PROGRAM ELECTIVES	Lab			15	15	225
	ETL					
	Theory	3	9			
INTER- DISCIPLINARY	Lab			9	9	135
	ETL					
PROJECT		2	10	10	10	90
OTHERS IF ANY						
	Total	33	100	100	100	1605



REVISION/MODIFICATIONS DONE IN THE SYLLABUS

S.No	Course	Course	Concept/	Concept/topic	% of Revision/
	(Subject)	(Subject)	topic if any, removed in	added in the new	Modification
1	Code EDEC22005	Name Control Systems	State Space Analysis in	Decign of	
	EBEC22005	Engineering	Unit 5 merged into Unit 1. Nichols Chart, and Constant M and N circles, Compensators, have been included as Qualitative	Controllers as a case study included in Unit 5	20%
2	EBEC22006	Linear Integrated Circuits			ETL Converted into theory
3	EBEC22008	Computer Networks			Nomenclature changed as Communicatio n Networks
4	EBEC22E12	Next Gen IP Networks	Unit 2 (IP Encapsulation Security Payload-IP Authentication using Keyed MD5-The ESP DES- CBC Transform) Unit 4 (User Packet Routing and Transport, Configuring PDP Addresses on Mobile Stations, GPRS Attach Procedure, Access to MWIF Networks, Session Management)		20%
5	EBEC22010	Digital Signal Processing	UNIT4(Multirate Signal Processing)	Finite word length effects	20%
6	EBEC22L07	Microprocessor and Microcontroller Lab		8085 Experiments Added	No Changes
7	EBEC22ET2	Field and Wave Electromagnetic s	Electromagnetics topic in Units 1 & 2 have been compressed into a single Unit with qualitative treatment	Plane Wave Propagation has been added	20%



S.No	Course (Subject) Code	Course (Subject) Name	Concept/ topic if any, removed in current curriculum	Concept/topic added in the new curriculum	% of Revision/ Modification done
8	EBEC22009	Microprocessors and Microcontrollers	curriculumAdvanced 80386Architecture,Addressing modes –Data types of 80386–Real address mode of80386 –Segmentation ,paging , SalientFeatures ofPENTIUM.ARM Architecture–ARM programmer'smodel- ARMdevelopment tools-memory hierarchy-ARM assemblylanguageprogramming-SimpleExamples-Architectural supportfor operating system-ARM instruction Set-Embedded ARMApplications	Register organization, memory segmentation, Signal descriptions of 8086-common function signals, minimum mode and maximum mode system design, timing diagrams, Interrupts of 8086 Instruction formats, Addressing modes, instruction set, assembler Directives. Macros, Simple programs involving Arithmetic, logical, branch and call instructions. Sorting, evaluating arithmetic expressions, string manipulations DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol, Traffic Light Interface, Interfacing matrix Keyboard, and (16x2) LCD interfacing	Elective converted into a core paper
9	EBEC22E08	Advanced Microprocessors	ARM Architecture -ARM programmer's model- ARM development tools- memory hierarchy - ARM assembly language programming-Simple Examples- Architectural support for operating system- ARM instruction Set-Embedded ARM Applications	Implementation of Strings, Procedures, Macros, BIOS and DOS Services using X86 Assembly Language Programming, Memory and I/O Interfacing, Analog Interfacing and Industrial Control.	20%



S.No	Course	Course	Concept/	Concept/topic added in	% of Revision/
	(Subject)	(Subject)	topic if any, removed	the new curriculum	Modification
	Code	Name	in current curriculum		done
10	EBEC22E09	Nano	UNIT 1:	Microelectronics	50
		Electronics	Nano-scale electronics;	towards biomolecule	
			Foundation of Nano-	electronics	
			electronics; Size & Scale	Growth, fabrication, and	
			Units Scaling Atoms,	measurement	
			Molecules, Clusters and	techniques for	
			Supramolecules;	nanostructures- Bulk	
			Materials for Nano	crystal and	
			electronics-	heterostructure growth-	
			Semiconductors-	Nanolithography,	
			Electron energy bands	etching, and other	
			UNIT-2: SYNTHESIS AND	means for fabrication	
			MEASUREMENT	of nanostructures	
			TECHNIQUES	Chemical and biological	
			Synthesis- Sol-gel	methods for Nano scale	
			methods, Mechanical	fabrication- Fabrication	
			methods: ball milling,	of Nano-	
			mechanical attrition,	electromechanical	
			Thin films methods:	systems.	
			chemical vapor	Electron transport in	
			deposition, physical	semiconductors and	
			vapor deposition	nanostructures- Time	
			UNIT III	and length scales of the	
			NANO MATERIALS & ITS	electrons in solids-	
			PROPERTIES	Statistics of the	
			UNIT-IV NANO	electrons in solids and	
			STRUCTURE DEVICES	nanostructures.	
			No Changes	Logic Devices-Silicon	
			UNIT-5	MOSFETs-Ferroelectric	
			APPLICATIONS OF	Field Effect Transistors-	
			NANOTECHNOLOGY	Superconductor Digital	
			Nano sensors- Nano	Electronics-Quantum	
			electronics in	Computing Using	
			Diagnostics applications,	Superconductors-	
			Environmental,	Carbon Nanotubes for	
			Agricultural and Food,	Data Processing-	
			Nano electronics for	Molecular Electronics	
			energy systems-		
			batteries, solar cells.		



S.No	Course	Course	Concept/	Concept/topic added in	% of Revision/
	(Subject)	(Subject)	topic if any,	the new curriculum	Modification
	Code	Name	removed in current		done
			curriculum		
11	EBEC22012	Digital		Geometric	20%
		Communication		Representation of	To Study about
				signals – Generation,	the digital
				detection, PSD & BER	modulation
				of Coherent BPSK,	scheme the
				BFSK & QPSK – QAM	contents have
				– Carrier	been included
				Synchronization –	
				Structure of Non-	
				coherent Receivers –	
				Principle of DPSK.	
				Hamming codes	In Error control
					coding
					hamming codes
					plays a vital
					role hence it is
		<u> </u>			added
12	EBEC22L14	Communication			Nomenclature
		Engineering lab			changed to
					Analog and
					Digital
					communication
					Lab
		1			



DETAILS OF NEW COURSES, ELECTIVES, INTER DISCIPLINARY, LIFE SKILL, COURSES FOCUSED ON EMPLOYABILITY, ENTREPRENEURSHIP, SKILL ETC.

S.No	New Courses (Subjects)	Value Added Courses	Life Skill	Electives	Interdisciplinary	Focus On Employabilit y/Entreprene
						urship/Skill Development.
1					Electrical and Instrumentation Engineering	
2					C++ and Java Programming	
3	Sensors and Robotics					
4	Electronic Circuits Lab					
5	VLSI Design and Embedde d System Lab					
6						Principles Of Management and Behavioral Science



SEMESTER-1

Subject Code:	Subje	ect Nam	e : CII	RCUITS	AND N	ETWO	RKS	Ty E1	/Lb/ TL/IE	L	T / S.L	r P/	R	C		
EBEC22018	Prere Electi	quisite: rical Co	: Mathoncepts	Mathematical Knowledge, cepts			nsic		Ту	3	1/0	0,	/0	4		
L : Lecture T :	Tutorial	I SLr :	Superv	vised Le	Learning P: Project R: Research C: C							ľ				
T/L/ETL : The	eory/Lab	/Embed	ded Th	eory and	l Lab											
OBJECTIVE	S:															
•	To uno	derstand	the co	ncept of	f circuit	elements	s lumpe	ed circu	its, wav	vefor	ms, o	circuit la	aws	and		
	networ	rk reduc	tion	on			1 1.1									
•		ve the e	lectrica	i networ	K USING I malveis i	nesn and	a nodal	analysi	s by app	piyir dom	ng ne	twork th	eore	ems		
	To un	derstand	1 the c	ds of circuits analysis in time doma the concept of resonance in Seri			Series	and net	rallel c	ircui	its ar	nd to kr	now	the		
	concep	ots of co	upled c	circuits.				una pu								
•	Obtain	ing equ	ations t	o solve	circuits in	n steady	state a	nd trans	ient sta	te						
COURSE OU	TCOM	ES (CO	(3)	- 5)												
The student w	ill be abl	e to	~) ~ (~	- /												
CO1	Under	rstand th	ne conc	ept of ci	rcuits, ne	etwork tl	neorem	s and va	rious ci	ircui	t law	S				
CO2	Analy	ze and s	solve a	lve a given electrical networks us			susing	mesh ar	nd noda	l ana	alysis					
CO3	Done	their in	ference	s to anal	yze circ	uits anal	ysis in	time do	time domain and frequency domain							
CO4	Demo	onstrate ts	their s	kills in	understa	nding tl	ne conc	cept of	various	res	onan	ce and	couj	pled		
CO5	Apply	their u	ndersta	nding to	derive t	he analy	ze the	equation	ns with	resp	ect to	o solving	g cir	cuit		
	transie	ents.														
Mapping of C	Course O	outcome	es with	Program	n Outco	mes (PO	Os)		1	1		I				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PC	<u>)10</u>	PO11	PO	<u>)12</u>		
CO1	3	3	3	3	3	2	3	3	3		3	3		3		
<u>CO2</u>	3	3	3	3	3	2	3	3	3		3	3		3		
CO3	3	3	3	3	3	2	3	3	3		3	3		3		
C04	3	3	3	3	3	2	3	3	3		<u>)</u> 2	3		<u> </u>		
COS / PSOs	J PS(<u> </u>	J PS	$\frac{3}{302}$	 PS	$\frac{2}{03}$	- J PSO	<u> </u>	3		3	3		3		
CO1	3	6	-	3	3	6	$\frac{150}{3}$	-								
CO2	3	6		3	3	5	3									
CO3	3	5		3	3	5	3									
CO4	3			3	3	5	3									
CO5	3			3	3		3									
3/2/1 indicate	s Streng	th of C	orrelat	ion 3-	High,2-	Mediur	n,1-Lo	W								
				<u>ହ</u>												
		ing	ies ial	Ű	Cor			ent	_							
	ces	leel	anit Soc	am.	am ive:	ive	plir	noc	ical ct							
	asic	ngi Sier	un p	ogn ogn	ogi ect	pen	ter isci	cill omj	act oje							
ory	Sc Bi	ыX	H	Pr Pr	Pr El	Ο̈́Ξ	D II	ų v	Pr Pr							
atego				\checkmark												
С																

IAL AND RESEARCI EMED TO BE UNIVERSIT (An ISO 21001 : 2018 Certified Institution) .V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

Subject	Subject Name : CIRCUITS AND NETWORKS	Ty /Lb/	L	Τ/	P/ R	C
Code:		ETL/IE		S.Lr		
EBEC22018	Prerequisite: Mathematical Knowledge, Basic	Ту	3	1/0	0/0	4
	Electrical Concepts					

UNIT-I: **BASIC CIRCUIT CONCEPTS**

V-I Relationships Of R, L And C – Independent Sources – Dependent Sources – Kirchhoff's Laws - Simple Resistive Circuits - Network Reduction - Voltage Division - Current Division - Source Transformation. Formation of Matrix Equations and Analysis Using Mesh-Current and Node-Voltage Methods.

UNIT-II: AC FUNDAMENTALS

AC Quantity, Phasor Representation – Analysis Of Simple Series And Parallel Circuits – Power And Power Factor - Analysis Mesh Current And Node Voltage Methods - Series Resonance And Parallel Resonance

UNIT-III: NETWORK THEOREM AND DUALITY

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Super position theorem - Delta-Wye Conversion. Duals, Dual circuits.

UNIT- IV: TRANSIENT ANALYSIS

Transient Concepts-Behavior Of Circuit Elements Under Switching Conditions and Their Representation-Forced and Free Response of RL, RC And RLC Circuits with D.C. And Sinusoidal Excitations Using Laplace Transform Method – Natural Frequency and Damping Facto

UNIT-V: COUPLED CIRCUITS

Mutual Inductance - Coefficient Of Coupling - Ideal Transformer - Analysis Of Multi Winding Couple Circuits – Single & Double Tuned Circuits – Critical Coupling.

Practical component P : Include case studies / application scenarios

Research component **R** : Future trends / research areas / Comparative Analysis

TEXTBOOKS:

- 1. A.Sudhakar & Shyanmugam S.Palli " Circuits & Network Analysis & Synthesis", 4th Edition, Tata McGraw Hill, 2010
- 2. Bruce Carlson, "Circuits: Engineering Concepts and Analysis of Linear Electric Circuits", Thomson Learning, 1st Edition, 2002
- 3. M.L Soni & J.C. Gupta, "Electric Circuit Analysis", Dhanpat Rai & Sons, New Delhi, 1999.

REFERENCE BOOKS:

- 1. Hyatt, W.H. Jr and Kimmerly, J.E., "Engineering Circuits Analysis", McGraw Hill International Editions.1993.
- 2. Edminister, J.A., "Theory and Problems of Electric Circuits", Schaum's Outline Series McGraw Hill Book Company, 2nd Edition, 1983.
- 3. Paranjothi S.R., "Electric Circuit Analysis", New Age International Ltd., Delhi, 2nd Edition, 2000.
- 4. Artice.M. Davis, "Linear Circuits Analysis", Thomson Learning 2002
- 5. Roy Choudhury, "Networks and Systems", New Age International Ltd, 1992

Subject Code:	Subject Name : C++ AND JAVA PROGRAMMING	Ty / Lb/ ETL/IE	L	T/SL r	P/R	C
EBCS22ID2	Prerequisite: Programming and Multimedia	Ту	3	0/0	0/0	3

12 Hrs

12 Hrs

12Hrs

12 Hrs

Total Number of Hours: 60

12 Hrs

18



INSTITUTE



(AI	n 150 2100	01 : 2018 Cei	rtified instit	ution)	
Periyar E.V.R. I	ligh Road,	Maduravoyal,	Chennai-95.	Tamilnadu, Ir	adia.

lab														
L : Lectu	ire T	: Tut	orial SL	r : Supe	rvised I	Learning	g P:Pi	roject R	: Resea	rch C:	Credi	its		
T/L/ETL	.: Th	eory/	Lab/Embe	edded T	heory a	nd Lab								
OBJEC	IIVI To in	と: trodu	ce the Obj	act Ori	antad D	rogrami	ning co	nconte u	ising Cu	⊥ and]	1 1 1 /	`		
	то ш То ш	uouu nders	tand object	et orient	ed prog	rammir	ining co	ents and	ising C4 Lannly i	+ and J them in	solvi	n ing prot	lems	
• 7	To in	trodu	ce the con	cepts of	f except	ion han	dling a	nd multi	threadir	nem m 19	30111	ing prot	Jenis.	
• 7	To an	nalyze	basic dat	a struct	ures as	well as	prograi	nming t	echniqu	es and a	algor	ithms th	nat oper	ates on
t	them.						1 0	U	1		U		Ĩ	
COURSE OUTCOMES (COs) : (3- 5) The Students will be able to														
CO1 Understand fundamentals of C++ programming such a execution methods etc				such as	variable	s, cond	itiona	al and it	erative					
CO2	Ana	alyze	the use of	of funct	tion to	create	progran	ns and o	evaluate	the co	oncep	ts of in	nheritan	ce and
polymorphism							1							
CO3 Identify the basic concepts of Java programming														
CO4 Design and development of programs for File a				File an	d excep	tions ha	ndling	using	JAVA					
CO5 Evaluate the concepts data structures and corresp					ponding	algorit	nms							
Mapping of Course Outcomes with Progr				am Ou	tcomes	(POs)								
COs/POsPO1PO2PO3PO4				PO4	PO5	PO6	PO7	PO8	PO9	PC 0	D1 P	011	PO12	
CO1		1	1	3	3	2	3	2		2		3		2
CO2		2	3	3	3	3	3	3		3	1	3		2
CO3		2	3	3	3	3	3	3		3	1	3		2
CO4		2	3	3	3	3	3	3		3	1	3		2
CO5		2	3	3	3	3	3	3		3		3		2
COs/		I	PSO1	PS	02	PS	03	PS	604					
PSOs		_			-			_ ~						
CO1		2		2		3		3						
CO2		3		1		3		3						
CO3		3		1		3		3						
CO4		3		1		3		3						
CO5		2		1		3		3						
H/M/L i	ndica	ates S	Strength o	of Corr	elation	H-H	igh, M-	Mediu	m, L-L	DW				
Category Basic Sciences Engineering Sciences Humanities and Social Program Core				Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Practical /	Project					
Subject Code: Subject Name : C++ A PROGRAMMING			ND JA	VA	✓	Ty / ETL	Lb/ ./IE	L	T/SL r	P/R	C			
EBCS22	2ID2		Prerequi lab	isite: Pı	rogram	ming a	nd Mul	ltimedia	n Ty		3	0/0	0/0	3

UNIT I **INTRODUCTION TO C++**

Programming Paradigms - Key Concepts of OOP - Advantages of OOP - Usage of OOP - Evolution of C++ -Input and Output in C++-Streams-Stream classes-Keywords, Identifiers, Variables, Operators, Expressions and Control Structures: If, If. Else, Switch - Repetitive Statements- for, while, do...while - arrays

IONAL AND RESEARCH

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UNIT II **CLASSES, INHERITANCE & TEMPLATES**

EMED

Main Function – Parts of function - Parameters Passing in Functions - Function Overloading - Constructors and Destructors- types -Operator Overloading - Inheritance - Pointers - Virtual Functions and Polymorphism

UNIT III INTRODUCTION TO JAVA

Introduction to Java : Basics of Java programming- Data types- Variables - Operators - Control structures Decision making- Looping control- Math class-string class-Arrays in java

UNIT IV FILE AND EXCEPTION HANDLING

File handling in java- Character stream – Java File class methods – File operations –Exception handling-Exceptions Methods-Catch-throw-Finally

UNIT V DATASTRUCTURES USING JAVA

Array-One Dimensional -Two Dimensional-Linked list-Single-Doubly-circular- Stack- Queue- Trees -Graphs

Practical component P : Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

Textbooks:

- 1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill..
- 2. Java Fundamentals A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
- 3. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education.
- Weiss, Mark Allen (2012). Data Structures and Algorithm Analysis in Java. 3rd ed. Prentice Hall. 4.

Reference Books:

- 1. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press.
- 2. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd.
- 3. Java for Programmers, P. J. Deitel and H. M. Deitel, Pearson education (OR) Java: How to Program P. J. Deitel and H. M. Deitel, PHI.
- 4. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
- 5. Data Structures and Algorithms in Java, Robert Lafore, Sams Publishing



9 Hrs

9 Hrs

9 Hrs

9 Hrs



Subject Code:	Subj	ject Na	me : D	IGITA	LELE	CTRO	NICS]	Fy / Lb/ ETL/IE	L	T/SL	r P/	R C		
EBEC22003	Prer	equisit	e: Basi	c electr	onics a	nd con	nputer	,	Гу	3	1/() 0/0	4		
	conc	epts													
L : Lecture T	: Tutor	rial SI	Lr : Sup	ervised	d Learning P: Project R: Research C: Credits										
T/L/ETL : Th	neory/L	ab/Emt	bedded '	Theory	and La	b									
OBJECTIVI	ES :							1.0		P					
• 1	o give	b give a conceptual understanding about the Digital fundamentals, Boolean algebrations in digital systems					gebra a	nd its							
a	pplicat	ions in	digital s	systems	of your	0110 00*	nhinati	anal d	aital airea		uning la	ain ant	22		
	o intro	duce th	e analy	ic and	design	ous coi	ire for s	Sinal u	igital circ	d act	using ic	ous sec	es. mential		
	ircuits	uuce m	c anary.	sis and	uesign	proceed		syncin	onous an	u asy	memon	ous see	ucintiai		
• T	o expla	ain vari	ous sem	nicondu	ctors m	emorie	snand r	elate t	echnolog	v.					
• T	o intro	duce th	e electr	onic cii	cuits in	volved	in mak	ing of	logic gate	es.					
COURSE O	UTCO	MES (COs):	(3-5)				0	00						
The Student v	will be	able to													
CO1	App	ly Bool	ean Alg	ebra, K	Karnaug	h map a	and Qui	ine Mo	Cluskey	meth	nodolog	y to mi	nimize		
	the g	given Bo	oolean f	function	ns.										
CO2	Desi	gn and	implem	ent cor	nbinatio	onal log	gic circu	iits.							
CO3	Desi	gn and	analyze	the system	nchrono	ous sequ	uential o	circuit	s.						
CO4	Desi	gn and	analyze	the as	ynchro	nous se	quentia	l circu	iits						
CO5	Com	pare di	fferent	types of	f logic f	families	s based	on the	ir charact	erist	ics and	summa	rize		
	type	s of sen	nicondu	ctor me	emories	•									
Mapping of	Course	Outco	mes wi	th Prog	gram C	Jutcom	es (POs	s)							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	B PO9	P	010	PO11	PO12		
CO1	3	3	3	2	3	3	2								
CO2	3	3	3	2	3	3	2					2	2		
CO3	3	3	3	2	3	3	2					2	2		
CO4	3	3	3	2	3	3	2					2	2		
CO5	3	1	1	1	1	3	2						2		
COs /	PS	01	PS	02	PS	03	PS	604							
PSOs		-				-							_		
<u>CO1</u>		3	3	3		2		2					<u> </u>		
<u>CO2</u>	•	3		3		2		2							
<u> </u>		5		5		2		2					<u> </u>		
<u> </u>		<u>5</u> 7		<u>,</u>	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		2								
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					3- Hign,2- Medium,1-Lov						1				
Þ.	3asic Sciences	Ingineering Science	Humanities and Social Sciences	Program Core	Program Electives	Dpen Electives	nter Disciplinary	skill Component	Practical / Project						
Categoi															



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Subject	Subject Name : DIGITAL ELECTRONICS	Ty / Lb/	L	T/SLr	P/R	С
Code:		ETL/IE				
EBEC22003	Prerequisite: Basic electronics and computer	Ту	3	1/0	0/0	4
	concepts					

UNIT I DIGITAL FUNDAMENTALS

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1 s and 2 s complements, Codes –Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Minimization using Karnaugh map, and Quine-McCluskey method.

UNIT II COMBINATIONAL LOGIC

Design of Combinational Logic Circuits – Half adder – Full adder, Half Subtractor, Full Subtractor – Binary parallel adder-Carry lookahead adder-BCD adder – Code Converters – Multiplexer – Demultiplexer-Encoder – Decoder – Magnitude comparator

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, – Design - Moore/Mealy models, state minimization, state assignment, State Reduction techniques- Design of Counters- Ring Counters, Shift registers, analysis of clocked sequential circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS

Design of asynchronous sequential circutis-Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Design of Hazard free circuits.

UNIT V LOGIC FAMILIES

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) -Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL.Digital logoc families, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics- TTL, ECL, CMOS-Operation and its Characteristics.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis Total Number of Hours: 60

TEXTBOOKS:

- 1. Charles H. Roth, "Fundamentals of Logic Design", cengageLearning, 5th Edition
- 2. FLOYD:"Digital Fundamentals", 10th Edition Universal Book Stall, New Delhi.1993
- 3. Morris Mano, "Digital Electronics and Design", Prentice Hall of India, 2000 .
- 4. A.Anand Kumar Fundamentals of Digital Circuits^{II}, 4th Edition, PHI Learning Private Limited, 2016.
- 5. Soumitra Kumar Mandal Digital Electronics, McGraw Hill Education Private Limited, 2016.

REFERENCE BOOKS:

- 1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
- 2. Jayadeep Chakravarthy "Digital electronics and logic design", Universities press.(2012)
- 3. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
- 4. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
- 5. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
- 6. Donald D.Givone, "Digital Principles and Design", TMH, 2003

12 Hrs

12 Hrs

12 Hrs

12 Hrs





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Subject	S	ubject	Name :	SOLI	D STA	ТЕ		Т	'y / Lb/	′ L	T/S	P /	С
Code:	D	EVIC	ES					E	TL/IE		Lr	R	
EBEC22019	P	rerequ	uisite: Ba	sics of				, r	Гу	3	0/0	0/	0 3
	E	lectric	al and E	lectror	nics.								
L : Lecture	T : Tutori	al SI	r : Super	vised I	Learnin	g P :	Project	R :	Resear	ch C:			
Credits T/L/	ETL: Th	eory/L	.ab/Embe	dded 'I	heory a	and L	ab						
OBJECTIV	/ES :												
• To l	learn the t	heory	of semico	onducto	or devic	ces su	ch as di	ode	s and z	ener dio	de	_	
Tos	study the	workin	ng and bia	asing of	f bipola	ar jun	ction tra	insis	stors bo	oth PNP	and NP	N.	
Tou	understan	d the c	onstruction	on and	operati	on of	FET ar	nd N	10SFE	T and the	ieir biasi	ng.	
To s	study beh	avior o	of power e	electroi	nic dev	ices li	ike SCR	κ, U.	JT, etc.	and pho	oto devid	ces.	
	study the	small s	$rac{1}{2}$	del and	analy:	SIS OF	transist	ors	and FE	<i>,</i> 1			
The students		ALS (C	(3):(3))- 5)									
	S will be a	somic	onductor	device	n lika	linda	and ze	nor	dioda				
	Leail	senne	onductor		.5 IIKC (noues		101	aiout				
CO2	Know	v worki	in <u>g</u> and b	iasing	of bipo	lar ju	nction t	rans	istors.				
CO3	Unde	rstand	the const	ruction	and op	perati	on of FI	ET a	and MC	DSFET			
CO4	Study	the be	havior of	power	r electro	onic a	ind phot	to el	ectron	ic device	es.		
CO5	Analy	ze trar	nsistors a	nd FET	using	small	signal	mod	lel				
Mapping of	f Course	Outco	mes with	Progr	ram Oı	itcon	nes (PO	s)					
COs/	PO1	PO2	PO3	PO4	PO5	PO	6 PO '	7	PO8	PO9	PO10	PO11	PO1 2
POs													
CO1	3	1	2	1	2	2	1		3	3	2	2	2
CO2	3	1	1	2	1	3	2		2	2	2	1	1
CO3	3	3	1	1	1	2	2		3	2	1	3	2
CO4	3	2	1	1	1	3	3		3	2	2	2	1
CO5	3	3	2	2	2	2	1		1	2	2	2	2
COs /	PS	01	PS	02	Р	SO3		PS	504				
PSOs			-										
<u>CO1</u>	3		2			1		1					
CO2	3		2			<u>/</u>		$\frac{2}{2}$					
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Ty / Lb/ Subject Name : SOLID STATE T/S **P**/ Subject L Code: **ETL/IE** Lr R DEVICES **EBEC22019** 3 0/0 0/0 Prerequisite: Basics of Electrical and Ty

UNIT I SEMICONDUCTOR DIODES

Electronics.

Theory of PN Junction Diode – VI characteristics – Static and Dynamic Resistance – Effect of Temperature on Diodes - Space Charge and Diffusion Capacitance - Zener Diode - Avalanche and Zener Break Down Mechanisms – Zener Diode as a Voltage Regulator.

UNIT II BJT & BIASING

Principles of Transistor Action - Current Components - Cut Off, Active & Saturation Region - I/P & O/P characteristics CE, CB and CC. Small Signal Large Signal '\beta', Break Down & Switching Characteristics -Transistor Biasing – Bias Stabilization – Bias Compensation – Thermal Runaway – Design with Heat Sink.

UNIT III FET & MOSFET

Construction Feature & Working Principles of JFET, MOSFET Depletion and Enhancement Mode, Biasing of FET, and MOSFETS, Transmission Gate using CMOS.

UNIT IV POWER DEVICES

Charge Transfer Device, UJT, SCR, Diac, Triac, GTO, MCT and Introduction to Gallium Arsenide Devices, FinFET, LDR, Photo Voltaic cell, Varactor diode.

UNIT V SMALL SIGNAL MODEL

Small Signal Model of Transistor- Analysis of Amplifiers using Small Signal Model. Common Emitter, Common Base, Common Collector, Common Source, Common Drain, Common Gate, Multistage Amplifiers.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis Total Number of Hours: 45

TEXTBOOKS:

- 1. Nandita Das Gupta, Amitava Das Gupta, "Semiconductor Devices", Prentice Hall of India, 2005
- 2. Sedra and Smith, "Microelectronic Circuits" Oxford University Press, 2004
- 3. Mohammed Gausi and Spencer, "Introduction to Electronics Circuit Design", Pearson Education, 2004

REFERENCE BOOKS:

- 1. Boylestad, Robert. L and Nashelsky Louis, "Electronic Devices and Circuit theory" Prentice Hall of India,6th Edition, 2001
- 2. William & Harris, "Electronic Devices and Circuits", Tata McGraw Hill International Editions, 2000
- 3. Millman Halkias, "Electron Devices", Tata McGraw Hill, 2000.
- 4. Donald neamam, "Micro electronics", Tata McGraw Hill, 2007.
- 5. Sedra smith, "Micro Electronic Circuits" Fifth edition, 2013.

9 Hrs

9 Hrs

9 Hrs

3

С

9 Hrs

24





Subject	Cod	e Su D	bject N IGITA	ame : L ELF	ECTRO	DNICS	LAB		Ty ET	/ Lb/ L/IE	L	T/S	Lr	P/R	C
EBEC2	2L01	l Pr	erequi	site: ni					Lb		0	0/	0	3/0	0
L : Lect T/L/ETI	ure T L : Tł	: Tuton neory/L	rial S ab/Eml	Lr : Suj bedded	pervise Theory	d Learn and La	ning P : ab	Projec	t R : R	esearch	C: 0	Credi	ts		•
OBJEC	TIV	E :													
•	To d	esign a	nd deve	elop a p	rogram	mable	digital o	circuit f	or pract	tical app	olica	tions			
COURS The Stue	SE O dents	UTCO will be	MES (able to	COs) :	(3- 5)										
CO1	Dev	velop a	simple	digital	circuits										
CO2	Tes	t the wo	orking	of logic	gates a	and flip	flops.								
CO3	Imp	lement	a digit	al seque	ential ci	ircuits f	for real	time ap	plicatio	ons					
Mappin	g of	Course	Outco	omes w	ith Pro	gram (Outcon	nes (PO	s)						
COs/PC)s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P	D10	PO	11	PO12
CO1		3	1	3	2	2	1	1		1					1
CO2		3	2	3	2	2					1				
CO3		3	2	3	2	2	1	1		2					1
COs / PSOs		PS	01	PS	02	PS	03	PS	604						
CO1		3		3				3							
CO2		3		3				3							
CO3		3		3				3							
	y	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project					
	Catego				\checkmark										



Subject Code	Subject Name : DIGITAL ELECTRONICS LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	С
EBEC22L01	Prerequisite: nil	Lb	0	0/0	3/0	0

LIST OF EXPERIMENTS:

- 1. Verification of Truth tables of Logic Gates
- 2. Implementation of Boolean function
- 3. Implementation of Half and full Adders
- 4. Implementation of Half and full Subtractors
- 5. Implementation of Multiplexers
- 6. Implementation of Demultiplexers
- 7. Implementation of Encoder
- 8. Implementation of Decoders
- 9. Verification of Flip Flops
- 10. Implementation of Shift Registers
- 11. Implementation of Counters
- 12. Study of A to D Converters

Total Number of Hours: 45



SEMESTER II

Subject Code	Subje PROI	ct Nam BABIL	ie : ITY AN	ND RAN	NDOM	PROC	ESS	Ty/ ET	Lb/ TL/IE	L	T S.I	/ I	P/R	C
EBMA22010	Prere	quisite	Highe	r secon	dary M	athem	atics		Ty	3	1/	0 ()/0	4
L : Lecture T :	Tutoria	l S.Lı	:: Supe	rvised I	Learning	g P:Pr	oject R	: Resea	arch C: C	Credit	ts			
Ty/Lb/ETL : T	heory/I	_ab/Em	bedded	Theory	and La	b	5							
OBJECTIVES	S :													
The student s	hould l	be mad	e to:											
To understand	the basi	ic conce	epts in t	he Prob	ability 1	ike Ind	epender	nt event	s, mutua	lly ex	cclusi	ive eve	nts a	ind
so on.					1.0									
To understand	the var	ious Sta	ndard L	Discrete	and Co	ntinuou	s proba	bility di	stributio	ons.		1		
To understand	the Bas	ac conc	epts in I	Kandon	n proces	s like P	oisson j	process,	Markov	proc	cess a	ind so c	on.	
To understand	the con	cepts II	ke Auto	correla	ation and	a Cross	correlat	tion						
To understand	the con	cepts II	ke Cros	s spectr	al densi	ty								
COURSE OU	тсом	ES (CO) s) :											
CO1	To un	derstan	the Ba	nsic con	cepts in	Probab	oility							
CO2	To un	derstan	d the Ba	sic con	cepts in	Probab	oility dis	stributio	ns					
CO3	To un	derstan	the Ba	sic con	cepts in	Rando	m proce	ess						
CO4	To un	derstan	the Ba	sic con	cepts in	Correl	ation							
CO5	To un	derstan	the Ba	sic con	cepts in	Spectra	al densi	tv						
Mapping of C	ourse (Dutcom	es with	Progra	am Out	comes	(POs)	<i>.</i> ,						
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PC)10	PO11	P	012
CO1	3	3	2	3	2	1	2	1	1		2	2		3
CO2	3	2	1	3	1	2	2	1	1		1	2		3
CO3	3	3	2	2	1	1	1	2	1		2	1		3
CO4	3	3	2	3	2	1	2	1	2	,	2	1		2
CO5	2	3	1	3	2	1	2	2	1		1	2		3
COs / PSOs		PSO1			PSO2			PSO	3			PSO	1	
CO1		1			3			1				2		
CO2		2			2			1				3		
CO3		1			2			2				3		
CO4		2			3			2				3		
CO5	G.	2	~ .		3			1				2		
3/2/1 Indicates	s Streng	gth Of	Correla	ation, 3	– High	<u>, 2- Me</u>	dium, 1	- Low					-	
		es												
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Subject Code	Subject Name : PROBABILITY AND RANDOM PROCESS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBMA22010	Prerequisite: Higher secondary Mathematics	Ту	3	1/0	0/0	4

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UNIT I **RANDOM VARIABLES**

Baye's Theorem - Applications - Random Variables - Distribution functions - Moments - Moment Generating functions - Chebychev's Inequality (Statement and Applications only) - Function of Random Variables.

UNIT II STANDARD DISTRIBUTIONS

Marginal and Conditional Distributions - Applications of Discrete Distributions: Binomial - Poisson -Geometric – Applications of Continuous distributions: Uniform – Exponential– Normal distributions – Central Limit theorem (Statement and Applications only).

UNIT III RANDOM PROCESS

Stationary Process - Ergodic Process - Poisson Process - Applications: Birth and Death Process - Markov Process - Markov Chains.

UNIT IV CORRELATION

Auto Correlation - Auto Covariance - Cross Correlation - Cross Covariance.

UNIT V **LINEAR SYSTEMS - APPLICATIONS**

Spectral Density - Cross Spectral Density - Applications to Linear Systems with Random Inputs and Outputs.

Total Number. of hrs: 60

REFERENCE BOOKS:

- 1) Veerarajan T., Probability, Statistics and, Random Processes, Tata McGraw Hill Publishing Co., (2008).
- 2) Singaravelu, Probability and Random Processes, Meenakshi Agency, (2017).
- 3) Gupta S.C., Kapoor V.K., Fundamentals of Mathematical Statistics, S.Chand & Co., (2007).
- 4) Richard Johnson A., Miller & Freund's Probability and statistics for Engineers (9th ed), Prentice Hall of India, (2016).



12 Hrs

12 Hrs

12Hrs

12 Hrs



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Subject Code:		Su	bject N	ame: E	ELECT	RONI	C CIR	CUITS	Ty ET	/ Lb/ L/IE	L	T/S Lr	P /	R	С
EBEC2200)4	Pre	erequis	ite: Sol	lid Stat	e Devi	ces		Ту		3	0/0	0/	/ 0	3
L : Lecture	T :	Tuto	rial S	Lr : Su	pervise	d Learr	ning P	: Projec	t R:R	lesearch	C: Cre	dits			
T/L/ETL : '	The	eory/L	.ab/Em	bedded	Theory	y and L	ab	5							
OBJECTI	VE	S :													
•	Or	n com	pletion	of this	course	the stu	dent wi	ll unde	rstand						
•	Th	ne cor	structio	on and	operatio	on of re	ectifiers								
•	De	esign	of amp	olifier c	ircuits										
•	W	orkin	g of os	cillators	3										
•	Co	onstru	ction o	f multiv	vibrator	S									
•	De	esign	of pow	er amp	lifiers										
COURSE	OU	TCO	MES (COs):	(3-5)										
The Studen	its v	vill be	e able to	0		.1.01									
<u>CO1</u>		Disc	uss var	10us tyj	pes of r	ectifier	·S.	1 .	• 1	1 1					
CO2		Desi	ign diff	terent a	mplifie	rs with	require	d gain	Indepen	ndently					
<u>CO3</u>		Con	struct the	ne teedl	back an	nplifier	s and o	scillato	rs for d	esired fi	equenc	сy.			
<u>CO4</u>		Calc	ulate th	ne delay	and de	esign m	ultivibi	ator ci	rcuits	1					
<u> </u>	• •	Desi	ign and	constru	ict pow	er amp	lifters f	or diffe	erent ap	plication	ns.				
Mapping o	of C	ours	e Outco	omes w	ith Pro	ogram	Outcor	nes (PC	Js)						
COs/POs	P	01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10) P(011	PO	12
C01		3	3	3	3	2	2	1	2	3	2		3		3
CO2		3	3	3	3	3	2	2	3	2	2		3		3
CO3		3	3	3	3	3	1	1	2	3	3		3		2
CO4		3	3	3	3	3	1	1	1	3	3		2		2
CO5		3	3	2	3	3	1	2	1	3	2		1		3
COs /		PS(D1	PS	02	PS	03	PS	604						
PSOs															
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CO2		3		2	2	<	3	,	3						
CO3		3		2	2		3		2						
CO4		3		3	3	1	2	-	1						
CO5		3			3		3		3						
H/M/L ind	lica	tes St	trength	of Co	rrelatio	on 3-	High, 2	2- Medi	ium, 1-	Low					
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Subject	Subject Name: ELECTRONIC CIRCUITS	Ty / Lb/	L	T/S	P/R	С
Code:		ETL/IE		Lr		
EBEC22004	Prerequisite: Solid State Devices	Ту	3	0/0	0/0	3

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UNIT I REGULATED POWER SUPPLIES

Linear mode power supply - Rectifiers: Half-wave rectifier - Full-wave rectifier - Bridge rectifier - Filters: L, C, LC and CLC filter - Voltage regulators - series and shunt - Over load protection - Switched mode power supply (SMPS) -IC voltage regulators.

UNIT II FEEDBACK AMPLIFIERS

Basic concept of feedback - Gain with feedback - Feedback factor - General characteristics of negative feedback amplifiers - Effect of negative feedback on input and output resistance; topologies of feedback amplifiers - Analysis of series-shunt, series-series, shunt-series and shunt-shunt feedback amplifiers -Nyquist criterion for stability of feedback amplifiers - Gain and phase margin.

UNIT III **OSCILLATORS**

Classification of Oscillators - Barkhausen criterion for oscillation - RC phase shift, Wien bridge and Twin-T oscillator - General form of LC oscillator - Hartley, Colpitts and Clapp oscillator - Ring oscillators -Crystal oscillators - Equivalent circuit of crystal - Miller and Pierce crystal oscillator - Frequency stability of oscillator.

UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS

RC differentiator and integrator - Diode clippers and clampers - Multivibrators - Collector-coupled astable multivibrator, monostable multivibrator and bistable multivibrator - Triggering methods for bistable multivibrators - Schmitt trigger - UJT relaxation oscillator.

UNIT V POWER AMPLIFIERS AND TUNED AMPLIFIERS

BJT Power amplifiers - Class A - Class B - Class AB - Class C - MOSFET Power amplifiers - Tuned amplifiers- Q of tank circuits- Single tuned amplifier-Frequency response - Double tuned amplifier - Effect of cascading single tuned and double tuned amplifiers on bandwidth - Stagger tuned amplifiers -Comparison of tuned amplifiers .

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total number of hrs: 45

TEXT BOOKS

- 1. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, Seventh Edition, 2016.
- 2. Salivahanan S and Suresh Kumar N, Electronic Devices and Circuits, McGraw Hill Education, Fourth Edition. 2017

REFERENCE BOOKS

- 1. Millman J, Halkias C and Chetan D. Parikh, Integrated Electronics, McGraw Hill Education (India) Private Ltd., Second Edition, 2015.
- 2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, Eleventh Edition, 2016.
- 3. Millman J, Taub H and Suryaprakash Rao Mothiki, Pulse Digital and Switching Waveforms, McGraw Hill Education (India) Private Ltd., Third Edition, 2011.
- 4. David A. Bell, Solid State Pulse Circuits, Prentice Hall of India, Fourth Edition, 1992.
- 5. David A. Bell, Electronic Devices and Circuits, Oxford University Press, Fifth Edition, 2017.

9 Hrs

9 Hrs

9 Hrs

9 Hrs

9 Hrs

30



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Subject Co	ode:	Subje ANA	ct Nam LOG C	e : OMM	UNICA	TION			Ty/ L ETL/	/b/ IE	L	T/S Lr	P/ R	r	С
EBEC2200)7	Prere	quisite:	Proba	bility aı	nd rano	dom		Ту		3	0/0	0/	0	3
L : Lectur	e T : Tu	torial S	<u>ss</u> SLr : Sui	oervise	d Learni	ng P : I	Project	R : R	esearcl	h C: Cr	edit	s			
T/L/ETL :	Theory	y/Lab/En	bedded	Theory	and La	b									
OBJECT	IVES :														
	• T	o study v	various A	Amplitu	ide mod	ulation	and de	modu	ilation	system	s.				
	• 1	o provid	e some c	lepth a	nalysis i	n noise	perform	manc	e of va	rious re	eceiv	/er.			
	• 1	o study s	some bas	sic info	rmation	theory	with so	ome c	hannel	coding	g the	orem.			
COURSE		COMES	(COs) :	(3-5)											
The Stude	ents will	be able the	0 e types (of Nois	e and ev	nress tl	ne need	for r	nodula	tion					
	I.	ichtify th	e types (51 11015		ipiess u			nouura	uon.					
CO2	II	lustrate t	he conce	epts of a	amplitud	le modu	ulation	and i	ts trans	missio	n teo	chnique	e.		
CO3	A	rticulate	the gene	eration	& demo	dulation	n of FM	4 syst	ems.						
CO4	A	nalyze th	e analog	g to dig	ital conv	version	method	ds.							
CO5	Ir	nplement	the cod	ing tec	hniques	and cal	culate	the cl	nannel	capacit	y.				
Mapping	of Cou	rse Outc	omes w	ith Pro	gram C	Outcom	es (PO	s)							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	,	PO8	PO9	P	010	PO11	PO	012
CO1	3	3	2	1	3	2	3		1	2	3		1	2	
CO2	3	3	3	3	3	2	2		2	2	2		3	3	
CO3	3	3	3	3	3	2	2		1	2	2		3	3	
CO4	3	3	3	3	3	1	2		1	2	2		3	3	
CO5	3	3	3	3	3	1	2		3	1	2		2	3	
COs/ PSOc	PS	501	PS	02	PS	503		PSO4	ł						
CO1	3		2		2		3								
CO2	3		3		3		3								
CO3	3		3		3		3								
CO4	3		2		2		3								
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3/2/1 indi	cates S	trength o	of Corre		3- Hig	gh, 2- N	lediun	1, I-L	JOW	1					
ory	Basic Sciences	Engineering	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical /	Project					
Categ				\checkmark											

Subject Code: Subject Name : Tv/ Lb/ L T/S

	ANALOG COMMUNICATION	ETL/IE		Lr	R	
EBEC22007	Prerequisite: Probability and random	Ту	3	0/0	0/0	3
	process					

UNIT I INTRODUCTION TO COMMUNICATION SYSTEMS AND NOISE

Basic Communication Systems – Need for Modulation in Communication Systems - Noise - Sources of Noise – Types of Noise - External Noise – Thermal Agitation – Shot Noise – Noise Figure – Signal to Noise Ratio – Equivalent Noise Resistance, Amplitude Modulation and demodulation- Frequency Spectrum – power relations in Amplitude Modulation.

UNIT II CONTINUOUS MODULATION SYSTEMS

Balanced Modulator, DSB – SC, SSB and VSB – Modulation and Demodulation - AM Transmitter, Receiver- Types, AM receivers. UNIT III ANGLE MODULATION 9 Hrs

Frequency modulation – Mathematical representation of FM – Frequency Spectrum – Phase Modulation – Noise triangle – Pre-emphasis, de- emphasis- Comparison of Wide band and Narrow band FM, AFC - Stereophonic FM multiplex system – Generation of FM - FM receivers - Communication receivers.

UNIT IV ANALOG TO DIGITAL CONVERSION

Sampling Theorem - PAM- Quantization of signal - Quantization Error – PWM , PPM – Introduction todigital modulation systems – ASK, FSK, PSK – Transmitter and receiver.UNIT V INFORMATION THEORY AND CODING9 Hrs

Introduction –Information - Entropy - Information rate, Classification of codes, Kraft McMillan inequality –-Source coding theorem - Shannon , Fano coding - Huffman coding, Joint and conditional entropies–Channel capacity -- Mutual information.

Practical component P : Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

- 1. Roy Blake, "Electronic Communication Systems", Thomson Learning 2nd Edition, 2002.
- 2. George Kennedy: "Electronic Communication Systems", Tata McGraw Hill publications, 1992.
- 3. R Bose, "Information theory, Coding and Cryptography", TMH 2007.

REFERENCE BOOKS:

- 1. 1.K.C.Raveendranath, "Communication system modeling and simulation using matlab& Simulink" universities press, 2011.
- 2. Taub & Schilling," Principles of Communication", Tata McGraw Hill, 1986 3.Simon Haykins, "Principles of Communications", Prentice Hall of India. 2001



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9 Hrs
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9 Hrs

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EBEE22ID2	Prere	equisite	: Basic	Electri	ical cor	ncepts		Ту	7	3	0	0	3
L : Lecture T :	Tutorial	S.Lr	: Super	vised L	earning	g P:Pr	oject R	: Resea	rch C: C	Credi	ts		
Ty/Lb/ETL : T	heory/L	ab/Emb	edded 7	Theory	and La	b							
OBJECTIVES	5:	,											
I ne student si	nould D	e made	to:										
Constru	uctional	details,	princip	ole of or	peration	n, perfo	rmance	, starters	and test	ting	of D.C	C. machi	nes.
To illus	strate th	e operat	ing pri	nciple a	nd perf	ormanc	e of tra	nsforme	rs.	U			
Constru	uctional	details,	princip	ole of op	peration	n and pe	erforma	nce of A	C rotati	ng m	nachin	es.	
• To sum	imarize	the ope	rating p	rinciple	e of alte	ernators	and sp	ecial ma	chines.				
Constru	ictional	details	and pri	nciple of	of opera	tion ele	ectrical	measuri	ng instru	ımen	its		
COURSE OU	ICTIONAL	details	and prin	ncipie c	or opera	ition ele	ectronic	measuri	ing instr	umei	nts		
COURSE OU	Illust	ate the	working	o nrinci	inle of l	DC ma	hines						
C01	inusu A 1		WOIKIN				1		6				
CO2	Analy	ze the l	osses, e	efficien	$\frac{cy}{dt}$ and $\frac{cy}{dt}$	voltage	regulat	10n of tr	ansform	ers.			
CO3	Identi	fy the a	ppropri	ate rota	ting ma	achines	for var	ious app	lications	<u>s</u>			
C04	Expla	in the t	ypes and	d opera	ting pri	nciples	of elec	trical me	easuring	insti	rumen	ts	
Manning of C	merp		s with	Drogro	m Out		$\frac{111}{(\mathbf{PO}_{c})}$	lents					
COs/POs	PO1	PO2	PO3	PO4		PO6	$\frac{(FOS)}{PO7}$	PO8	POQ	PC	10	PO11	PO12
CO3/1 OS	3	3	3	3	2	2	2	100	2	2	/10	2	1012
CO2	3	3	3	3	2	2	2	1	2	1		2	1
CO3	3	3	2	3	3	3	2	2	2	2		3	2
CO4	3	2	3	3	3	3	2	2	3	2		3	3
CO5	3	3	3	3	3	3	2	2	3	2		3	2
COs / PSOs	PSO1			PSO2			PSO3		•	P	SO4		
CO1	3			3			3			2			
CO2	3			3			3			2			
CO3	3			3			2			2			
CO4	3			3			2			2			
CO5	2	41. 06 (Y 1	3	TT! -1.	2 M.	2	1 T		3			
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Subject Ty/Lb/ **T**/ L P/R С Code: Subject Name : ELECTRICAL AND **ETL/IE** S.Lr **INSTRUMENTATION ENGINEERING Prerequisite: Basic Electrical concepts EBEE22ID2** Ty 3 0 0 3

UNIT-I: D.C MACHINES

Introduction – Constructional Features– Motor and Generator mode - EMF and Torque equation –Starting and Speed Control-Testing And Efficiency – Losses in DC Machines -Brushless DC Motors- Universal Motor –Stepper Motor –Servo Motor - Tachogenerator - Linear Induction Motor

UNIT-II: TRANSFORMERS

Introduction - Ideal and Practical Transformer - EMF Equation – Phasor diagram– Per Unit System – Equivalent circuit- Testing- - Losses and Efficiency – Voltage Regulation – Three Phase Transformers – Auto Transformers, Advantages- Harmonics.

UNIT-III: AC ROTATING MACHINES

Principle of operation of three-phase induction motors – Construction –Types –Single phase Induction motors -Construction– Types–starting methods. Alternator: Working principle–Equation of induced EMF Synchronous motors- working principle-starting methods – Torque equation.

UNIT-IV: MEASUREMENTS USING ELECTRICAL INSTRUMENTS

Functional elements of an instrument-Standards and calibration- Operating Principle -types - Moving Coil and Moving Iron meters-Measurement of three phase power -Energy Meter- Instrument Transformers-CT and PT-DSO- Block diagram- Data acquisition

UNIT-V: MEASUREMENTS USING ELECTRONIC INSTRUMENTS

Electronic Instruments: CRO: -Measurements of Voltage & Frequency, Function generator:- Frequency Measurements in Various Range and Wave Form : Power Supply: -Fixed and Variable :Multi-meter:- Measurement of Voltage ,Current, Frequency, R,L,C : IC tester:-Linear ICs and Non Linear ICs

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hrs: 45

TEXT BOOKS:

1. Mulukutla.S.Sarma, "Electric Machines, Stead state theory and dynamic Performance", 2nd Edition Thomson Learning 1997

2. S.K Bhattacharya, "Electrical Machines", 3rd Edition Tata McGraw Hill Publications 2008.

3. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 2015.

REFERENCES:

1. I.J. Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill Publications, Second Edition 1997.

2. Nasar S.A, "Electrical Machines & Power Systems", TMH Publications

3. I McKenzie Smith, "Hughes Electrical Technology", Revised Low price Edition, Pearson Education, Seventhedition.

4. Irving I.Kosow, "Electric Machinery and Transformers", PHI, Second Edition, 2001

9 Hrs

9 Hrs

9Hrs

34

9 Hrs





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Subject	Subject Name : ELECTRONICS CIRCUITS LAB								/Lb/	L	T/SLr	P/R	C
EBEC22LO	3 Prerequisite: Nil									0	0/0	3/0	1
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C:													
Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab													
OBJECTIVES :													
 To gain nands on experience in designing electronic circuits. To familiarize students with the implementation of basic analog circuits using discrete. 													
 To tramilarize students with the implementation of basic analog circuits using discrete components. 													
components.													
To observe characteristics of electronic circuits.													
COURSE	$COUDSE OUTCOMES (CO_2) + (2, 5)$												
COURSE OUTCOMES (COS) : (3- 5) The Students will be able to													
CO1 Construct and Verify rectifier circuits.													
CO2	Design amplifiers and oscillators using transistors												
CO3 Design multivibrators and power amplifiers													
CO4 Verify network theorems, KCL and KVL													
Mapping of Course Outcomes with Program Outcomes (POs)													
COs/	PO1	PO2	PO3	PO4	PO5	PO6	P	07	PO8	PO9	PO10	PO11	PO12
POs													
CO1	3	3	3	2	2	2		1	3	2	2	3	2
CO2	3	2	3	2	2	1		2	2	1	2	2	1
CO3	2	3	3	3	1	1		1	1	2	2	2	2
CO4	2	3	2	3	3	2		1	1	2	1	2	3
COs /]	PSO1		PSO2		PSO3		I	PSO4				
PSOs		-											
CO1		3		3		2		3					
CO2		3		3		3		2					
CO3		3		2		3		2					
CO4		2		2		2		2					
	H /.	M/L inc	licates	Strengtl	n of Cor	relation	3-	High	n, 2- M	ediun	n, 1-Low		
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									\checkmark				



Subject	Subject Name : ELECTRONICS	Ty /Lb/	L	T/SLr	P/R	С
Code:	CIRCUITS LAB	ETL/IE				
EBEC22L03	Prerequisite: Nil	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

- 1. Verification of Half–Wave Rectifier
- 2. Verification of Full-Wave Rectifier
- 3. Shunt Voltage Regulator
- 4. Frequency Response of RC Coupled Amplifier.
- 5. Hartley and Colpitts Oscillators
- 6. Wien Bridge Oscillator
- 7. Waveshapping Circuits Clipper and Clamper
- 8. Monostable Multivibrator Circuit
- 9. Astable Multivibrator Circuit
- 10. Class A Power Amplifier
- 11. Verification of Network Theorems
- 12. Mesh and Node Analaysis

Total Number of Hours: 45



SEMESTER- III

Subject Code:		Subject CIRCU	Name : ITS	D	Ty / L ETL/I	/b/ IE	L	T/S Lr	P/R	С				
EBEC22006	5	Prerequ electron	uisite: Electronic Circuits/Digital nics						Ту		3	0	0	3
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits														
T/L/ETL : 7	T/L/ETL : Theory/Lab/Embedded Theory and Lab													
OBJECTIVES :														
	• To introduce the basics of linear integrated circuits.													
	• T	o unders	tand the	applica	ations of	opera	tiona	l amplif	iers.					
	• To design comparators, signal generators and timers.													
	• To express analog multiplier and PLL.													
• To examine the concepts of IC regulators and Data converters.														
COURSE OUTCOMES (COs) : (3- 5) The Students will be able to														
CO1	R	ecognize	e the basi	cs of l	inear IC'	s and	chara	acteristi	cs of op	erati	iona	l amplifi	er	
CO2	E	Express various applications of op-amp.												
CO3	D	Design comparators and signal generators using op-amp.												
CO4	A	Analyze the characteristics of Analog multipliers and PLL												
CO5	E	Examine IC regulators and implement data convertors for real time application												
Mapping of Course Outcomes with Program Outcomes (POs)														
COs/P	PO1	PO2	PO3	PO4	PO5	PO	6	PO7	PO8	PO	9	PO10	PO11	PO12
OS	_	_		_		_		-					-	
CO1	3	3	3	3	3	3		3	1	2		1	2	2
CO2	3	3	3	3	3	3		3	1	2		1	2	2
CO3	3	3	3	3	3	2		2	1	3		1	1	2
CO4	3	3	3	3	3	3		3	1	2		1	2	1
CO5	3	3	3	3	3	3		3	1	2		1	2	2
COs/	P	PSO1 PSO2 PSO3							504					
PSOs														
CO1	3		3		3			3						
CO2	3		3		3			3						
CO3	3		3		3			3						
CO4	3		2		2			2						
<u>CO5</u>	3	(1			2			2	.					
3/2/1 indica	ates St	rength o	of Corre	lation	3- Hig	sh, 2-	Med	ium, 1-	Low					
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Subject	Subject Name : LINEAR INTEGRATED	Ty / Lb/	L	T/S	P/R	C
Code:	CIRCUITS	ETL/IE		Lr		
EBEC22006	Prerequisite: Electronic Circuits/Digital	Ту	3	0	0	3
	electronics		Č	v	Ŭ	Č

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INTRODUCTION TO INTEGRATED CIRCUITS UNIT I

EMED

Integrated circuit and its classification, Introduction to Operational amplifier-General operational amplifier stages-Internal circuit diagram of IC 741, Ideal Op-Amp, DC & AC Characteristics, Slew rate and methods of improving slew rate, CMRR, PSRR, Frequency Response and Compensation techniques

UNIT II **APPLICATIONS OF OPAMP IC741**

Scale changer, Voltage follower, Inverting and Non-Inverting amplifiers, V-to-I and I-to-V converters, Summer and Subtractor - Multiplier and Divider - Differentiator and Integrator - Instrumentation Amplifier, Op- Amp Circuits using Diodes, Precision Rectifier - Clipper and Clamper - Sample and Hold Circuit - Log and Antilog Amplifiers.RC Active filters-low pass and High pass-Band pass and Band reject-Switched capacitor and Butterworth filters

COMPARATORS AND SIGNAL GENERATORS UNIT III

applications of Comparators - Regenerative Comparators (Schmitt Trigger) - Sine wave generator, Square Wave Generator (Astable Multivibrator) – Monostable Multivibrator – Triangular Wave Generator – Saw Tooth Wave Generator – IC 555 Timer

UNIT IV ANALOG MULTIPLIER AND PLL

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell - Variable transconductance technique, analog multiplier ICs and their applications, PLL Basic Principles, Monolithic PLL IC 565, Functional blocks of PLL-Phase Detector -Comparator-Analog and Digital Voltage Controlled Oscillator, Applications of PLL-AM detection-FM detection-FSK modulation and demodulation-Frequency synthesizing

UNIT V IC REGULATORS AND DATA CONVERTERS

IC voltage regulators: Introduction, Fixed voltage regulators, SMPS, current limiting and current feedback techniques using IC723.DA converters- DAC Specifications -Weighted resistor type, R-2R Ladder type, A/D converters-ADC Specifications -- Counter ramp type, Successive Approximation, Dual slope, Flash type, High Speed A/D Converters

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

- 1. James. M. Fiore, "Operational Amplifiers and Linear Integrated Circuits", First Edition, Thomson Learning.
- Roy Choudhury and Shail Jain, "Linear Integrated Circuits", Wiley Eastern Ltd., 1991. 2.
- 3. Coughlin and Dirscol, "Operational Amplifiers and Linear Integrated Circuits",

Prentice Hall of India Pvt., Ltd., 1992

REFERENCE BOOKS:

- 1. Millman and Halkias, "Integrated Electronics", McGraw Hill, 1992.
- 2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Third Edition, TMH, 2002.
- 3. Ramakant A. Gayakwad, "Op amp and Linear Integrated Circuits", Fourth edition, PH

9 Hrs

9 Hrs

9 Hrs

9 Hrs

9 Hrs



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Subject	Su	bject N	lame :	CONT	ROL	SYSTE	EMS]	Гу / Lb/	L	T/SL	P/R	С	
Code:	EN	IGINE	ERING	J				I	ETL/IE		r			
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EDEC 22005		athema	fics	ignais	anu Sy	stems,	Dasic		L y	3	1/0	0/0	4	
L : Lecture T	T: Tuto	rial S	Lr : Su	pervise	d Learn	ing P:	Projec	t R	: Research	C: Cre	edits			
T/L/ETL : T	heory/L	.ab/Eml	bedded	Theory	and La	ab	5							
OBJECTIV	ES :													
• 7	To lear	n the ba	sic eler	nents o	f contro	ol syste	m with	matl	nematical	model.				
• 7	To unde	erstand	the time	e respo	nse of f	first and	l secono	d ord	ler system	feedba	ck.			
•	To lear	n the fre	equency	respon	ise of s	ystems	using b	ode	plot and p	olar pl	ot.			
•	Fo chec	k the st	ability	of Con	trol sys	tem usi	ng vari	ous 1	echniques	•				
COURSEO		MES ($\frac{COs}{COs}$	$\frac{1}{(3-5)}$	ors and			лю	leis.					
The student	will be	able to	COS).	(5- 5)										
CO1	Mode	l physic	cal syste	ems usi	ng bloc	ck diagr	am and	lsigi	nal flow g	aph.				
		1.2	5					0		•				
CO2	Analy	ze the s	system	in time	domaiı	n tor sta	andard i	inpu	t functions	5				
CO3	Perfor	rm anal	ysis of	open ar	nd close	ed loop	system	s in	frequency	domain	1.			
CO4	Expla	in the n	ature of	f stabili	ity for t	he give	n syste	m.						
CO5	Design compensators to obtain the required dynamic response of the system and identify													
	the need of different types of controllers													
Mapping of Course Outcomes with Program Outcomes (POs)														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PC	98 PO9	PO10	PO11	PO)12	
CO1	3	3	3	3	3	2	2	1			2	1	Ĺ	
CO2	3	3	3	3	3	1					1	1	L	
CO3	3	3	3	3	3	2	1				1	1	L	
CO4	3	3	3	3	3	2					2	1	1	
CO5	3	3	3	3	3	1	DC	1			2]	L	
COs /	PS	01	PS	02	PS	03	PS	04						
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CO3		3	3	3		2		2						
CO4		3		3		2		2						
CO5	4	3	с.,	3	2	2	2	2						
3/2/1 indicat	tes Stre	ength of	f Corre	elation	3- Hi	igh,2- N	Aediun	1, 1-	Low					
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Subject Code:	Subject Name : CONTROL SYSTEMS ENGINEERING	Ty / Lb/ ETL/IE	L	T/SL r	P/R	C	
EBEC22005	Prerequisite: : Signals and Systems, Basic mathematics	Ту	3	1/0	0/0	4	

UNIT I SYSTEM REPRESENTATION & STATE SPACE ANALYSIS 12 Hrs

Control Systems – Basic elements in control systems – Open and Closed loop systems – Mathematical models of physical systems – Transfer function – Block diagram reduction techniques – Signal flow graph-Concepts of state variables -Solution of state equations- Conversion of transfer function to state space model.

UNIT II TIME RESPONSE

Standard Test Signals-Time Domain study of first order and second order feedback control systems -Time domain Specifications - I and II order System Response - Error Coefficients - Generalized Error Series - Steady State Error

UNIT III FREQUENCY RESPONSE

Frequency Domain Specifications -Correlation between Frequency Domain and Time Domain Specifications- Bode plot - Polar plot – Introduction to Closed Loop Frequency Response- Constant M and N circles – Nichols chart (Qualitative approach)

UNIT IV STABILITY OF CONTROL SYSTEM

Characteristics Equation - Location of Roots in S plane for stability - Routh Hurwitz Criterion - Root Locus Construction - Effect of Pole, Zero Addition - Gain Margin and Phase Margin - Nyquist Stability Criterion-Concept of Controllability & Observability.

UNIT V COMPENSATORS AND CONTROLLERS

Compensator-Types -Lag, Lead and Lag-Lead Compensators (Qualitative approach)- Controllers -Need -Types-P, I, D – Effect of PI, PD and PID controller- Intelligent controllers (Case Study)

Practical component P: Include case studies / application scenarios Research component R: Future trends / research areas / Comparative Analysis Total Number of Hours: 60

TEXTBOOKS:

- 1. K. Ogata, "Modern Control Engineering", 4th edition, Pearson Education, New Delhi, 2003 / PHI.
- 2. I.J. Nagrath& M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
- 3. B.C. Kuo, "Automatic Control Systems", Prentice Hall of India Ltd., New Delhi, 7th Edition, 1995.

REFERENCES:

- 1. M. Gopal, "Control Systems, Principles & Design", Tata McGraw Hill, New Delhi, 2002.
- 2. M.N. Bandyopadhyay, "Control Engineering Theory and Practice", Prentice Hall of India, 2003.
- 3. A.Nagoorkani, "Control System Engineering" RBA Publications.
- 4. Stefani, Shanian, Savant, Hostetter, "Design of Feedback Control Systems", 4thEdition, Oxford university press 2002.

12 Hrs



12 Hrs

12 Hrs



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Subject	ode:	Subje	ct Nam	e : MI	CROP	ROC	ESSO	Ty / Lb/	L	T/	P/R	C		
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EBEC2	200	<u> </u>	Prerec	quisite:	Digita	I Elec	troni		D		3	0/0	0/0	3
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ODJE		develo	n an in-	denth u	ndersta	ndino	of the	operat	ion of r	nicronroce	ssors			
•	To	master	the asse	embly l	anguage	e prog	ramm	ing usi	ng conc	epts like a	ssembl	er directiv	ves.	
	pro	cedure	s, macro	os, softv	vare int	errupt	s etc.			• • • • • • • •			,	
•	To	create	an expo	sure to	basic p	eriphe	rals, i	ts progr	ammin	g and inter	facing	technique	es	
•	То	study t	he archi	tecture	and ass	embly	/ lang	uage pr	ogramn	ning of 805	51 mici	ocontroll	er	
•	5.7	To desi	gn and i	mpleme	ent inte	rfacing	g unit	s with 8	8051 mi	crocontrol	ler base	ed system	IS.	
COU	RSE	E OUT	COMES	6 (COs)	:									
The st	ude	nts will	be able	to					-					
COI		Develop	o prograi	ms 1n 8	J86 mi	derstand	ding its arc	hitectu	re and ins	struction	1			
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CO2	U	ndersta	nd the p	rogram	ming m	lodel c	of mic	ro proc	essors a	and microc	ontroll	ers		
CO3	S	Show th	eir abili	ty to in	terface	periph	erals	with m	icropro	cessors				
CO4	Develop programs in 8051 microcontroller by understanding its architecture and instruction set													
CO5	Design various interfacing units with 8051 microcontroller based systems													
Марр	Mapping of Course Outcomes with Program Outcomes (POs)													
COs	/	PO	PO2	PO3	PO4	l PO	05	PO6	PO7	PO8	PO	PO10	PO	PO12
POs		1									9		11	
CO1		3	2	3	2		2	1			2	2	2	1
CO2		3	2	2	2		2				2	3	1	2
CO3		3	3	3	2		-	1			2	3	2	2
CO4		2	2	2	2		3	3			3	3	3	2
		<u>э</u>	3	<u>2</u>				1	DSO/	<u> </u>	<u> </u>	2		2
		P)	501		502		P59	03	P504	•				
CO1			3		3		3		2					
CO1			3		2		2	<u>.</u>	2					
CO2			$\frac{3}{2}$		2		3							
CO4			3		3		3	6	3					
CO5			3		2		3	,	3					
3/2/1 i	ndi	cates S	trength	of Cor	relatio	n 3-	High	n, 2- Me	edium,	1-Low				
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Subject Code:	Subject Name : MICROPROCESSOR	Ty / Lb/	\mathbf{L}	T /	P/R	С
	AND MICROCONTROLLER	ETL/ IE		SLr		
EBEC22009	Prerequisite: Digital Electronics	Ту	3	0/0	0/0	3

UNIT I- THE 8086 MICROPROCESSOR

Introduction To 8085 Micro Processor

8086 architecture- functional diagram, Register organization, memory segmentation, Signal descriptions of 8086-common function signals, minimum mode and maximum mode system design, timing diagrams, Interrupts of 8086

UNIT II - INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086

9 Hrs Instruction formats, Addressing modes, instruction set, assembler directives. Macros, Simple programs involving Arithmetic, logical, branch and call instructions. Sorting, evaluating arithmetic expressions, string manipulations

UNIT III - PERIPHERALS AND INTERFACING

Programmable Peripheral Interface (8255), Serial Communication Interface (8251), Keyboard display controller (8279), Programmable Interval Timer/counter (8254), Programmable interrupt controller (8259), DMA controller(8257), ADC and DAC Interface.

UNIT IV- 8051 MICROCONTROLLER

8051 - Architecture, Instruction set, Comparison between Microprocessor and Microcontroller, Addressing modes, Assembly language programming, I/O Ports, Timers / counters, serial communication, Interrupt, Special Function Registers (SFRs).

UNIT V- MICROCONTROLLER BASED SYSTEM DESIGN

Interfacing High power devices-Stepper Motor, DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol, Traffic Light Interface, Interfacing matrix Keyboard and (16x2) LCD interfacing

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

- 1. .R.S. Gaonkar,"Microprocessor Architecture Programming and Application, with 8085", Wiley Eastern Ltd., New Delhi, 2013.
- 2. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 2007.
- 3. Krishna Kant, "Microprocessors and Microcontrollers, Architecture, programming and system design using 8085, 8086, 8051 and 8096", PHI 2007.
- 4. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay "The 8051Microcontroller and Embedded Systems", Second Edition, Pearson Education 2008.

REFERENCES:

- 1. Douglas V Hall, "Microprocessor and Interfacing, Programming and hardware", TMH, 2006.
- 2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", Delmar Publishers, 2007.
- 3. Steve furber "ARM Systems on chip Architecture", Second Edition Addison Wesley trade computer publication,2000.
- 4. John .B.Peatman "Design with PIC Microcontrollers", Pearson Education, 3rd Edition, 2004

9 Hrs

9 Hrs

9 Hrs





Subject Co	ode:	Sub EL	ject Na ECTR(ame : F DMAG	TIELD NETIO	AND V CS	Ty / Lb/ ETL/IE	L	T/S r	L P	/ R	С				
EBEC22E	T2	Pre	reanisi	te: Ba	sic Ma	themat	ics.		ETL	2	0/0) 2	/0	3		
		Phy	sics El	ectrica	l and H	Electro	nics				0/0		/ 0	U		
L : Lecture	T : Tuto	orial S	Lr : Suj	pervise	d Learr	ing P	Projec	tR:	Research	C: Cr	edits		I			
T/L/ETL:	Theory/I	Lab/Eml	bedded	Theory	and L	ab										
OBJECTI	VE :															
• To	understa	and the l	Basics of	of elect	romagr	ietics										
• 10 • To	analyse	the diffe	erent ty	pes of 1	transmi	ssion li	nes									
					ueis											
COURSE	OUTCO	OMES (COs):	(3-5)												
Upon the c	ompletio	on of the	course	the stu	idents v	vill be a	able to									
CO1	Underst	and the	fundam	ental p	ostulat	es of ele	ectrosta	ostatics and magneto statics								
CO2	Demons	trate the	e signifi	icance (of Tele	grapher	's equat	ions								
CO3	Analyse	the imp	bedance	match	ing usi	ng diffe	erent me	methods								
CO4	Illustrate	e the dif	ferent p	olarisa	sation methods adopted											
CO5	Apply rl	he wave	guide p	rincipl	e in rea	l time a	pplicat	ions								
Mapping of Course Outcomes with Program Outcomes (POs)																
COs/POs	PO1	PO2	PO3	PO4	PO5 PO6 PO7 P			PO	8 PO9	PO	10	PO11	PO	12		
CO1	3	3	3	1	2	2	1						1			
CO2	3	2	3	2	3	3			2				1			
CO3	3	3	3	3	3	1				3		2				
CO4	3	2	3	2	3	1	1	1		2		_				
<u>CO5</u>	3	3	3	2	3	3	3	3	2			2	1			
CUS / PSOs	PS01		P502		P503)	P504	•								
CO1	3		2				3									
CO2	3		2				3									
CO3	3		3				3									
CO4	3		3				3									
CO5	3		3				3									
H/M/L ind	licates S	trength	of Cor	relatio	n H-	High,	M- Me	diun	n, L-Low							
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Subject Code:	Subject Name : FIELD AND WAVE ELECTROMAGNETICS	Ty / Lb/ ETL/IE	L	T/SL r	P/R	С
EBEC22ET2	Prerequisite: Basic Mathematics, Physics Electrical and Electronics	ETL	2	0/0	2/0	3

UNIT I ELECTROMAGNETICS

Introduction to Electrostatics and Magnetostatics-Fundamental Laws- Boundary Conditions- Analogy between the parameters-Divergence and Curl Equations-Maxwell's Equations - Poynting Vector and Theorem

UNIT II TRANSMISSION LINES

Introduction-Wave Equations of Lossless Lines- Finite Difference Method-Laplace's equations and Telegrapher's Equations-Octave Simulation

UNIT III LOSSY TRANSMISSION LINES

Transmission Lines with Losses-Reflections and Reflection Coefficient -Voltage Reflection Coefficient and Standing Wave Ratio - Graphical Representation of Reflection Coefficient - Impedance Matching using Smith Chart - Impedance Matching Demonstration using VNA - Octave Simulation

UNIT IV POLARISATION

Polarisation of Electromagnetic Waves - Electromagnetic Waves in Conducting Media - Plane Waves-Plane Waves at normal incidence - Plane Waves at oblique incidence -Perpendicular Polarisation-Dielectric Conductor Interface-Octave Simulation

UNIT V WAVEGUIDES

Parallel Plate Waveguide- Rectangular Waveguide-Phase Velocity and Group Velocity-Modes and Field Pattern in Waveguides - Cavity Resonators- Octave Simulation-Real Time Applications.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXT BOOKS:

1. David K.Cheng,'Field and Wave Electromagnetics", Pearson Education, 2 ed.

2. William Hayt," Engineering Electromagnetics", Tata McGraw Hill

REFERENCES:

1. "Transmission Lines and Networks"; Umesh Sinha, Sathya Prakasam

2. R.K. Shevgaonkar, "Electromagnetic waves"

12 Hrs

12 Hrs

12 Hrs

12 Hrs

12 Hrs



Subject Cod	le:	Subje AND	ect Name MICRC	e :MIC DCONT	ROP	ROC	ESSOI LAB	R	T y/ Lb/ ETL/IE	L	T/S Lr	P/R	С
EBEC22L0	7	Prere	equisite: ocontrol	Micro _l ler	proce	essor a	and		Lb	0	0/0	3/0	1
L : Lecture Credits T/L	T : Tu /ETL :	torial Theory	SLr : Suj /Lab/Em	pervise bedded	d Lea l Theo	rning ory an	P : Pro d Lab	ject	R : Resea	rch C:			L
OBJECTI	VE :												
• To v	write As	ssembly	Langua	ge Prog	gram f	for arit	thmetic	c and	logical of	peration	ns in 808	5 / 8086.	
• To v	vrite As	ssembly	Langua	ge Prog	gram f	for ari	thmetic	c and	logical of	peration	ns in 805	1.	
• Tou	indersta	and strif	ig manip ous perip	oheral in	nterfa	cing t	echniq	8086. ues u	sing 8086	5/8051			
COURSE The Studen	OUTC its will	OMES be able	(COs) : to	(3-5)									
CO1	Write	assem	oly langu	age pro	ogram	nming	in 808	5 / 80	86 micro	proces	sor		
CO2	Interf	ace per	ipherals	with 80)86 m	icropr	rocesso	or/80	51 Microo	control	ler		
CO3	Devel	op prog	grams us	ing 805	1 Mic	rocon	troller						
Mapping of Course Outcomes with Program Outcomes (POs)													
COs/	PO1	PO2	PO3	PO4	PC)5	PO6	PO7	7 PO8	PO	PO10	PO11	PO12
POs						_				9			
C01	3	3	3	3		3	1			2	3	3	3
CO2	3	3	3	3		3	2			2	3	3	3
C03	<u>3</u>	3	3	3	·	3 DSC	2			2	3	3	2
CUS/ PSOs	PS	501	P	502		PSU	15		PS04				
CO1		3		3		3			3				
CO2		3		3		2			5				
CO3		<u>-</u> 3		<u>-</u> 3		- 3			3				
3/2/1 indic	ates St	rength	of Corre	lation	3- I	High,2	2- Med	ium,	1-Low				
		_											
	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project				
Category													



Subject Code:	Subject Name :MICROPROCESSOR AND MICROCONTROLLER LAB	T y/ Lb/ ETL/IE	L	T/S Lr	P/R	С
EBEC22L07	Prerequisite: Microprocessor and Microcontroller	Lb	0	0/0	3/0	1

LIST OF EXERCISES USING 8085/8086 Kits:

1. Basic Arithmetic, Logical operations and move a data block without overlap.

LIST OF EXERCISES USING 8086 kits / MASM

- 2. Decimal Arithmetic, Code conversion, and Matrix operations.
- 3. String manipulations.
- 4. Sorting and Searching

PERIPHERALS AND INTERFACING EXPERIMENTS

- 5. Traffic light control
- 6. Stepper motor control
- 7. Key board and Display
- 8. Serial interface
- 9. Parallel interface
- 10. A/D and D/A interface and Waveform Generation

LIST OF EXERCISES USING 8051 kits

- 11. Basic Arithmetic, Logical operations, Square and Cube program
- 12. Find 2s complement of a number
- 13. Conversion of packed BCD to unpacked BCD

Total Number of Hours: 45



SEMESTER IV

Subject Code:	Sul PR	bject N OCESS	ame : I SING	DIGITA	AL SIG	NAL			Ty ET	/ Lb/ L/IE	L	T/SL r	P/R	C		
EBEC22010	Pre	erequis	ite: Sig	nals Sy	stem				Ty		3	1/0	0/0	4		
L : Lecture T	: Tutor	ial SI	Lr : Sup	ervised	Learni	ng P:	Project	R :	Res	search (C: Cree	lits				
T/L/ETL : Th	neory/L	ab/Emb	bedded '	Theory	and La	b	5									
OBJECTIV	ES:			•												
• To le	arn the	concep	ts of Fo	ourier tr	ansform	n and it	's Appl	icat	ions							
• To u	ndersta	nd the d	lesign te	echniqu	es of di	igital II	R filters	S								
To le	arn the	concep	ts and c	lesign t	echniqu	ues of d	igital F	IR f	ïlter	s.						
• To u	ndersta	nd the c	oncepts	s and ap	plication	ons of N	Multi – 1	rate	sam	pling.						
• To in	troduce	e the arc	chitectu	re of D	igital S	ignal Pi	rocesso	rs.								
COURCE OF	COURSE OUTCOMES (COs) : (3- 5)															
COURSE OUTCOMES (COs) : (3- 5) The students will be able to																
The students	Will be	able to	mi on tro	n of o ma		ta										
	Inustr	ale Fou	Irier tra		concep	us.	214									
	Interp	te desi	knowle	dge of d	Jesignii	ng IIR 1	inters.									
	Learn	to desi	gn FIR	millers.	the offer	- 40 or d	~~~~									
	Summ	h a th a	inite wo	ord leng	un erret		quantiz	$\frac{1}{1}$	n eri	rors						
CO5 Describe the modules in the architecture of digital signal processor.																
Mapping of Course Outcomes with Program Outcomes (POs)																
COs/POs	POI	PO2	PO3	PO4	P05	PO6	PO7	PC	J8	P09	POI	POI)12		
C01	3	3	3	3	3	2	1			1	1	2		2		
CO2	3	3	3	3	3	2	2			2	2	1		2		
CO3	3	3	3	3	3	2	1			1	1	2		1		
<u>CO4</u>	3	3	3	3	3	1	2			2	1	2		2		
CO5	3	3	3	2	2	2	1			2	2	2		2		
COs /	PS	01	PS	02	PS	03	PS	04								
PSOs		_				_										
CO1		3		3	1	2	3									
CO2		3		3	2	2	2	2								
<u>CO3</u>		3		3		1		3								
<u>CO4</u>		3		3		1	4	2								
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IIR Filters- Properties of IIR Filters - Analog Low pass Filter Design - Butterworth Filter - Chebyshev Filter - Design of IIR Filters from Analog filters - Approximation of Derivatives - Impulse Invariance - Bilinear Transformation – The Matched z- Transformation - Frequency Transformation.

UNIT III **DESIGN OF FIR FILTER**

FIR Filters - Characteristics of FIR Filters with Linear Phase-Properties of FIR Filters-Design of FIR Filters using Windows-Fourier Series Method-Frequency sampling Method

UNIT IV FINITE WORD LENGTH EFFECTS

Fixed point and floating-point number representations - Comparison - Truncation and Rounding errors -Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error Limit cycle oscillations- Zero- Input Limit cycle oscillations- Overflow Limit cycle oscillations- Signal Scaling.

UNIT V **OVERVIEW OF DIGITAL SIGNAL PROCESSOR** 12Hrs

Overview of Digital Signal Processors - Application of Digital Signal Processor - Memory Architecture of DSP Processor - Von Neumann Architecture - Harvard Architecture - Architecture of TMS32C5X Processor - Addressing modes - Pipelining.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXTBOOKS:

- 1. John . G. Proakis and Dimitris C.Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, Third edition 2006.
- 2. Sanjit k.Mitra "Digital signal processing", A Computer Based Approach, Tata McGraw Hill, New delhi,2001.
- 3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete Time Signal Processing", 8th Indian reprint, Pearson 2004.

REFERENCE BOOKS:

- 1. Ashok Ambardar, "Analog and Digital Signal Processing", 2nd Edition, Thomson Learning 2000.
- Ashok Ambardar,"Analog and Digital Signal Processing A Modern Introduction", 1st edition Thomson 2. Learning 2006

12 Hrs

12 Hrs

48



Subject	Subject Name : DIGITAL SIGNAL	Ty / Lb/	L	T/SL	P/R	С
Code:	PROCESSING	ETL/IE		r		
EBEC22010	Prerequisite: Signals System	Ту	3	1/0	0/0	4

UNIT I **DFT AND FFT**

Discrete Fourier Transform (DFT) - Properties-Convolution of Sequences - Linear Convolution - Circular Convolution - Introduction to Radix-2 FFT- Properties - DIT (FFT)-DIF (FFT) - Algorithms of Radix-2FFT-Computing Inverse DFT by doing a direct DFT.

DESIGN OF IIR FILTER UNIT II

12 Hrs



(All 13	0 21001 . 2010 Ce	runeu msutu	lion)
eriyar E.V.R. High	Road, Maduravoyal,	Chennai-95. 7	Familnadu, India.

Subject Code:	Su	bject N	ame :]	DIGIT	AL CO	OMMU.	NICAT	TION	Ty / Lb/ ETL/IE	L	T/SL r	P/R	C	
EBEC22012	Pr	erequis	site: Co	mmun	ication	System	n,		Ту	3	1/0	0/0	4	
	Pr	obabili	ty and	Rando	m Proc	ess, M	athema	tics-I						
L : Lecture T	: Tuto	rial S	Lr : Sup	bervised	l Learn	ing P:	Project	R : Re	esearch C:	Credi	ts			
T/L/ETL : Th	neory/L	ab/Emt	bedded	Theory	and La	ıb	Ū							
OBJECTIV	ES:													
• To st	tudy de	tection	, estima	ation ar	nd discu	uss the	process	s of san	npling, qu	antiza	tion and	l coding	g that	
are fu	undame	ental to	the digi	ital tran	ismissic	on of an	alog sig	gnals.						
• To u	ndersta	nd the	concept	s of dif	ferent of	digital i	nodulat	ion tec	hniques ai	nd the	r applic	ations 1	n our	
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	earn er	arn error control coding which encompasses techniques for the encoding and decoding of data streams for their reliable transmission over noisy channels.												
		data streams for their reliable transmission over noisy channels.												
	Intorn	ICOMED (UDS): (3-5) I ne students will be able to Interpret the sampling process in real-time systems and reconstruct the signal with the												
COI	estima	estimation of noise												
CO2	Desig	n a syst	em wit	hout dis	stortion	and int	terferen	ce						
CO3	Hone	their in	nference	es to d	evelop	various	s modu	lation t	technologi	es for	the sta	te of th	ie art	
	comm	unicati	on.											
CO4	Demo	Demonstrate their skills in generating a unique code for detecting the error in digital												
	comm	unicati	on											
CO5	Apply their understanding to improve the digital communication efficiency in a multipath													
	environment.													
Mapping of	Course	e Outco	mes wi	ith Pro	gram (Jutcom	nes (PO	s)				. [_	- · · ·	
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10) PO1	<u>1</u> P	012	
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	3	3	3	3	3	3	1	1	3	3	2		1	
<u>CO3</u>	3	3	3	3	3	3	2	1	3	3			3	
	3	3	3	3	3	2	2		2	3	1		3	
<u>CO5</u>	3	3	3	3	3	2	1	1	3	3			3	
COs /	PS	01	PS	02	PS	03	PS	04						
PSUs CO1		,		•		1		1						
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<u>CO2</u>		3		L	-	1		2						
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Subject Name : DIGITAL COMMUNICATION T/SL Subject Ty / Lb/ P/R С L Code: ETL/IE r **EBEC22012** Prerequisite: Communication System, Ty 3 1/00/0 4 Probability and Random Process, Mathematics-I

UNIT I DETECTION, ESTIMATION AND SAMPLING PROCESS

Model of Digital Communication System, Gram Schmidt Orthogonalization Procedure, Matched Filters, Correlation Receivers, Error Probability, Maximum Likelihood Estimation, Linear Prediction and Prediction Filters, Sampling Theorem, Quadrature Sampling of Band-Pass Signals, Reconstruction of a message from its samples

UNIT II WAVEFORM CODING TECHNIQUES AND BASEBAND SHAPING 12 hrs

PCM and TDMA Principles, Channel Noise and Error Probability, Quantization Noise and SNR. Differential Pulse Code Modulation and Delta Modulation, Speech Coding at Low Bit Rates, Power Spectra of PAM Signals, Inter Symbol Interference, Nyquist Criterion for distortionless baseband transmission, Correlative Coding and Precoding, Eye Patterns and Equalization Techniques.

DIGITAL MODULATION SCHEME UNIT III

Geometric Representation of signals – Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK – QAM – Carrier Synchronization – Structure of Non-coherent Receivers – Principle of DPSK.

UNIT IV ERROR CONTROL CODING

Need for Coding, Types of Codes, Hamming codes, Linear Block Codes, Cyclic Codes, Convolution Codes, Maximum, Likelihood Decoding of convolutional Codes, Distance Properties and Sequential Decoding of convolutional Codes, Trellis coding, Viterbi coding.

UNIT V SPREAD SPECTRUM SYSTEMS

Generation of Pseudo Noise Sequences, Correlation Properties, Direct Sequence Spread Spectrum Systems, Frequency Hop System, Signal Space Dimension and Processing Gain, Probability of Error, Antijam and Multipath Performance.

Practical component P: Include case studies / application scenarios Research component R: Future trends / research areas / Comparative Analysis

TEXTBOOKS:

- 1. Simon Haykin, "Digital communications", John Wiley & Sons, 1988.
- John. G. Proakis, "Digital Communication", McGraw Hill Inc., Third Edition, Malaysia, 1995. 2.
- 3. B.P. Lathi, "Modern Digital and Analog communication system", Oxford publications, Third edition.

REFERENCE BOOKS:

- 1. Roy Blake, "Electronic Communication systems", Thomson Learning, 2nd edition 2002.
- 2. M.K. Simen, "Digital Communication Techniques Signal Design & Detection", Prentice Hall of India, 1999.
- 3. Bernard Sklar, "Digital Communication: Fundamentals and Applications", Prentice Hall, 2011 Edition.
- UpamanyuMadhow, "Fundamentals of Digital Communication", Cambridge University Press, 4. 2008
- 5. Robert G. Gallager, "Principles of Digital Communication", Cambridge University Press 2008

12 hrs

12 hrs

Total Number of Hours: 60

12 hrs

12 hrs





Subject Code	: Subje MAN	ct Name AGEMI	e: PRI ENT AI	NCIPLE ND BEH	ES OF AVIOI	RAL SC	CIENCE	Ty/L ETI	b/ L/IE	L	T/ SL	r P/ R	С
EBCC22ID2	Prer	equisite	: Nil					Г	y	3	0/0	0/0	3
L : Lecture T	: Tutorial	SLr:	Superv	ised Lear	ning P	: Projec	t R : Rese	earch C:	Credits				
T/L/ETL : The	eory/Lab.	/Embed	ded The	eory and I	Lab.								
OBJECTIVE	The stu	dent wil	l learn:					~					
	AboutThe ap	the evol	ution, f is of the	unctions a principl	and prii es in ar	nciples of organiz	of Manage zation	ement St	tudies				
COUDG	• The sys	stem and	d proces	ss of effe	ctive co	ntrollin	g in the or	rganizati	ion.				
COURSE		OMES ((COs):	The stud	ent wil	l be abl	e to		.				
	Clear u	indersta	nding i	n plannin	g, and I	have kno	owledge i	n aspect	t of Mar	nager	nent	Studies ((Level 2)
	Unders	standing	the pla	anning pr	ocess ir	n the or	ganization	າ. (Level	2)				
CO3	Unders	standing	g the co	ncept of	organiz	ation. (l	evel 2)						
CO4	Demor	nstrate t	he abili	ty to dire	cting a	nd coor	dinating.	(Level 3)					
	Analyz	e and fo	ormulate	e the bes	t contro	ol metho	ods. (Leve	el 4)	G	• 0			
Mapping of C	Jourse O	utcomes	s (COs)	with Pro	ogram	Outcon	nes (POs)	& Prog	gram Sp		ic Ou	itcomes ((PSOs)
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PC	010	PO11	PO12
CO1	3	2	2	3		2	-	3	3	2	2	3	2
CO2	3	2	2	3		2	-	3	2		3	-	2
CO3	3	-	-	2		-	3	2	-	2	2	2	2
CO4	3	3	3	3		2	-	2	2	2	2	2	2
CO5	2	3	3	-	3	3	3	2	3	1	2	2	2
COs / PSOs	PSO	D1	PS	SO2	PS	603	PSO4						
CO1	-			2		3	3						
CO2	-			2		3	3						
CO3	-			2		3	3						
CO4	-			2		3	3						
CO5	-			2		3	3						
itegory	Basic Science	Engineering Science	Humanities and social Science	Humanities and social Science Program Core Program elective Open Elective Inter Disciplinary					Practical /Project				
Ca							~						51

Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers - managerial roles and responsibilities - Evolution of Management -need and Importance of Organizational Behavior, Leadership styles - Theories - Leaders Vs Managers.

UNIT – II PLANNING & ORGANISING

UNIT-I INTRODUCTION

Nature and purpose of planning - planning process - types of planning - Planning premises objectives hierarchy of objectives, Management By Objectives (MBO)- Decision making process. Nature and purpose of Formal and informal organization structure- types - Line and staff authority- delegation of authority - centralization and decentralization.

UNIT-III STAFFING AND COORDINATING

Human Resource Planning, Job Analysis, Recruitment, Selection, Training and Development, Performance Management, Career planning. Coordination -Nature and purpose - Coordination at various levels: Top management, Middle management, Supervisory management and workers. Techniques for effective coordination

UNIT- IV DIRECTING AND CONTROLING

Direction: Principles of direction – Need and Importance for directing, process of controlling – budgetary and non-budgetary control techniques - use of technology. Recent Trends in Management controlling.

UNIT-V GROUP BEHAVIOUR AND MOTIVATION

Group Dynamics - How Groups Work, Stages of Group Development, Team building, Motivation -Theories of motivation Organizational Conflict - Causes - Types of Conflicts, Managing conflicts.

Total No. of Periods: 45

Reference Books:

- 1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
- 2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
- 3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
- 4. S.S. Khanka Organizational Behaviour S. Chand Ltd. 2006.
- 5. L.M.Prasad Organizational Behaviour. S. Chand Company 3rd edition 2004.

9 Hrs

9 Hrs

9 Hrs

9 Hrs

9 Hrs

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Subject Code:	Subject Name : PRINCIPLES OF MANAGEMENT AND BEHAVIORAL SCIENCE	Ty/Lb/ ETL/IE	L	T/ SLr	P/ R	С
EBCC22ID2	Prerequisite: Nil	Ту	3	0/0	0/0	3





Subject Co	de:	Subje DIGI	ct Name ГAL CC	LOG NICA	F ANE ATIO) N LA	T B F	T y/ Lb/ ETL/IE	L	T/ SLr	P/ R	С			
EBEC22L1	4	Prere	quisite:	Analog	g com	muni	cation	,	Lb	0	0/0	3/0	1		
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Credits T/I	L/ETL:	Theory/	Lab/Em	bedded	Theo	ory an	d Lab	ject K	. Researc	лс.					
OBJECTI	VE :	-				-									
• To t	test and	design A	AM, FM	System	ns.										
•	undonat	and the	Comulia	a tha am	••										
• 10	underst	and the	Samping	g theor	у.										
• To i	impleme	ent Digit	al modu	lation t	echni	ques.									
COURSE		UTCOMES (COs) : (3- 5)													
The Studer	nts will	will be able to													
CO1	Devel	op a AN	I/FM tra	iner kit	s.										
CO2	Desig	n and te	st the Pr	e-empl	hasis	and D	e-emp	hasis c	ircuits.						
<u> </u>	Apply	the cod	ing toch	niques	ford	ata on	counti	20							
Mapping (of Cour	se Outc	omes wi	ith Pro	gram		comes	(\mathbf{POs})							
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COs/	PO1	PO2	PO3	PO4	PC)5	PO6	PO7	PO8	P	PO10	PO11	PO12		
POs										9					
CO1	3	2	2	3		:	2	-	3	3	2	3	2		
CO2	3	2	2	3		:	2	-	3	2	3	-	2		
CO3	3	-	-	2			-	3	2	-	2	2	2		
COs /	PS	01	PS	SO2		PSC	03	F	PSO4						
PSUs CO1			2		2			2							
CO1 CO2	-		2		3			3							
CO2	-		2		3			3							
3/2/1 indic	ates Sti	rength o	of Corre	lation	3- I	ligh,2	2- Med	ium,1·	Low						
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Subject Code:	Subject Name :ANALOG AND DIGITAL COMMUNICATION LAB	T y/ Lb/ ETL/IE	L	T/ SLr	P/ R	С
EBEC22L14	Prerequisite: Analog communication, Digital communication	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

- 1. Design and testing of Amplitude modulation and demodulation.
- 2. Design and testing of Frequency modulation and demodulation.
- 3. Design and testing of Pulse Amplitude modulation & demodulation.
- 4. Design and testing of Pulse Width modulation & Pulse Position modulation.
- 5. Design and testing of Pre-emphasis and De-emphasis.
- 6. Design and testing of Narrow Frequency modulation.
- 7. Design and testing of ASK, FSK and PSK
- 8. Study of Line Coding and Decoding techniques
- 9. Study of Sampling
- 10. Study of Pulse Code modulation

Total Number of Hours: 45



SEMESTER V

Subject Co	ode:	Subject	Name :	SENS	ORS A	ND RO	BOTIC	CS	Ty / Lb/ ETL/IE	L	T/SI r	P/I	R C	
EBEC2201	11	Prerequ Microco	isite: M ntrolle	licropro r	ocessor	and			Ту	3	0/0	0/0	3	
L : Lecture T/L/ETL : '	T : Tu Theory	itorial S y/Lab/Em	SLr : Suj ibedded	pervised Theory	d Learni and La	ng P:1 b	Project	R : F	Research C:	Cree	dits			
OBJECTI	VE:													
• To	o marouce the basic concepts, parts of robots and types of robots.													
• To	To develop a deep knowledge sensors and their applications in robot.													
		-r r		-8			TF							
COURSE	RSE OUTCOMES (COs) : (3-5)													
The studer	Idents will be able to Predict the importance of robotics in today and future goods production													
CO1		Predict t	he impo	ortance of	of roboti	ics in to	day and	futu	re goods pr	oduc	tion.			
CO2		Analyze	the rob	ot conf	iguratio	n and su	ıbsysten	ns.						
CO3		Illustrate	the role	e of mai	nipulato	rs and e	end effect	ctors						
CO4		Understa	and the f	fundame	ental co	ncepts c	of sensor	r and	its charact	eristi	cs			
CO5		Identify	the wor	rking of	sensors	in diffe	erent ap	plica	tions.					
Mapping of	of Cou	ourse Outcomes with Program Outcomes (POs)												
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	РО	8 PO9	PO	10 1	PO11	PO12	
CO1	3	2	2	3	2	2	3				1	1	3	
CO2	3	3	3	3	2	2	3		1		1	1	3	
CO3	3	2	3	3	2	2	3		1				3	
CO4	3	3	3	2	2	2	3						3	
CO5	3	3	3	3	2	2	3						3	
COs /	PSO	1	PSO2		PSO3		PSO4							
PSOs CO1	2		2		2		2							
C01	3		2		3		3							
CO2 CO3	3		2		3		3							
CO4	3		3		3		3							
CO5	3		3		3		3							
H/M/L ind	licates	s Strength of Correlation H- High, M- Medium, L-Low												
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T/SL P/R **Subject Code:** Subject Name : SENSORS AND ROBOTICS Ty / Lb/ С L ETL/IE r EBEC22011 3 0/0 0/0 3 Prerequisite: Microprocessor and Ty

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INTRODUCTION TO ROBOTICS UNIT I

Microcontroller

Robot - Definition - Law of Robotics - Robot Anatomy - Coordinate Systems- Robot Classification- Wrist configuration-Technical Specifications of Robot - Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II **ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS** 9 Hrs

Robot drive mechanisms- hydraulic - electric -pneumatic drives- servomotor- stepper motor- Mechanical transmission method - Gear transmission - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion.

UNIT III MANIPULATORS AND END EFFECTORS

Construction of Manipulators- Electronic and Pneumatic manipulators-Classification of End effectors -Tools as end effectors -Mechanical grippers- -Magnetic grippers-Vacuum grippers-hydraulic grippers -Gripper force analysis

BASICS OF SENSOR UNIT IV

Sensor definition- Sensor Systems - Sensor Characteristics- - Sensor Classification-Types of sensors -Transducer and actuators

APPLICATION OF SENSORS UNIT V

Mechanical sensors- Temperature sensor- pressure sensor- optical sensors- proximity sensors-biosensors-Role of sensors in robotics and automation.

Practical component P : Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

TEXT BOOKS:

- 1. Deb S. R. and Deb S., "Robotics Technology and Flexible Automation", Tata McGraw Hill Education Pvt. Ltd, 2010.
- 2. John J.Craig, "Introduction to Robotics", Pearson, 2009. 3. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.
- Jacob Fraden, "Handbook Of Modern Sensors Physics, Designs, And Applications" 2. Jon S. 3. Wilson," Sensor Technology Handbook 3. S J Prosser, E. Lewis, "Sensor and their Applications XII" **CRC** Press

References:

- 1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering - An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
- 2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill. 1987
- 3. Ian Sinclair, "Sensors and Transducers" eBook ISBN: 9780080516998
- 4. H.Rosemary Taylor, "Data acquisition for sensor systems", Chapman & amp; Hall, 1997. 5. Ramon Pallas-Areny, John G. Webster, "Sensors and signal conditioning" John Wiley & amp; Sons, 2001.

9 Hrs

9 Hrs

Total Number of Hours: 45

9 Hrs



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Periyar E.V.R. High l	Road, Maduravoyal,	Chennai-95.	Tamilnadu, India.

Subject Code:	Su NI	bject N ETWO	lame : (RKS	COMN	IUNIC	ATIO	N	Ty ET	/ Lb/ L/IE	L	T/SL r	P/R	C	
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T/L/ETL : Th	neory/L	.ab/Eml	bedded	Theory	and La	ıng F. ıb	riojeci	К.1	Kesearen	C. CIE	uns			
OBJECTIV	ES :													
• 1	o unde	erstand	differen	t storag	ge medi	a and C	OSI laye	rs						
• 1	'o intro	duce th	e featu	res of d	ifferent	I/O per	ripheral	devi	ces and p	rotocol	s.			
• 7	o intro	duce th	e stude	nts the	functio	ns and s	standarc	ls of I	LAN.					
• 1	l O Intro	a studer	tee sta	ndard e	mploye	u in co	mputer	netwo	orking.	naturarl		nanta		
	0 max	TCOMES (COs) · (3-5)												
COURSE O	UTCO	$\begin{array}{l} \Gamma \text{COMES} (\text{COs}) : (3-5) \\ \text{ill able to} \end{array}$												
The Students	will at	Describe the basic concepts of data communication and OSI layers.												
COI	Descr	ibe the	basic co	oncepts	of data	a comm	unicatio	on and	1 OSI lay	ers.				
<u>CO2</u>	Analy	ze data	link co	ntrol pi	otocol.			x						
<u>CO3</u>	Expla	in diffe	rent sta	ndards	and pro	otocols	used in	LAN						
<u>CO4</u>	Expre	ess the c	luties of	f netwo	rk supp	ort laye	er and V	AN	protocols					
<u>CO5</u>	Demo	onstrate	the fun	ctions of	of upper	r OSI la	ayer	<u> </u>						
Mapping of	Course Outcomes with Program Outcomes (POS)													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	8 PO9	PO10	PO1	1 PC	D12	
CO1	3	1	1	1	1	1	1	3	3	2				
CO2	3	3	1	1	2	1	1	1			2			
CO3	2	2	2	1	3	2	2	2					3	
CO4	3	1	2	2	2	2	2	2	2				3	
CO5	3	2	1	2	1	3	2	1	2	2	2			
COs /	PS	01	PS	02	PS	03	PS	04						
PSOs CO1		2		2		1	3	2						
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CO4		<u> </u>	1	, 1	-	2 1	1	<i>.</i> 						
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3/2/1 indicat	es Stre	ength of	f Corre	lation	3- Hi	gh, 2- N	Medium	i, 1-L	ow					
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Subject Name : COMMUNICATION T/SL P/R С Subject Tv / Lb/ L Code: **NETWORKS ETL/IE** r **EBEC22008** Ty 3 0/0 0/0 3 **Prerequisite: Communication System**

UNIT I DATA COMMUNICATION

Introduction, Basic concepts, OSI Reference Model, Transmission of Digital Data –Electrical Interface, Modems-Transmission rate-modem standards-Guided Media-Twisted –pair Cable-Coaxial cable-Performance- Error Detection and Correction (CRC) - Time and Frequency domains Signals

UNIT II DATA LINK CONTROL AND PROTOCOLS

Flow Control and Error Control, Stop And Wait - Sliding Windows- Automatic Repeat (ARQ), Asynchronous Protocols - X Modem, Y Modem, Synchronous Protocols – Character Oriented and Bit Oriented Protocols (HDLC).

UNIT III LOCAL AREA NETWORKS

IEEE 802 Standards, LLC, MAC Layer Protocols –CSMA/CD Ethernet, Token Bus, Token Ring, FDDI, Distributed Queue Dual Bus, Switched Multimegabit Data Service

UNIT IV WIDE AREA NETWORKS

Switching, Duties of the Transport Layer, ATM Protocol –Architecture Header Structure, Function of AAL Layer, Internetworking Devices, Repeater, Bridge, Routers and Gateways, Routing Algorithms- Link Stateand Distance Vector routing.

UNIT V UPPER OSI LAYERS

Session Layer - Presentation Layer – Translation, Brief Introduction to Encryption / Decryption, Authentication -Data Compression, Application Layer Protocols, MHS, File Transfer , Virtual Terminal, Common Management Information Protocol.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

TEXT BOOKS :

- 1. Behrouz A. Forouzan, "Data Communication and Networking", Tata McGraw Hill, 5th Edition, 2013.
- 2. William A, Shay, "Understanding Data Communications and Networks", Thomson Learning, 3rd Edition 2003.
- 3. Gallo, "*Computer Communications and Networking Technologies*", Thomson Learning, 1st edition 2001.

REFERENCE BOOKS:

- 1. William Stallings, "Data and Computer Communication", Prentice Hall of India, Fifth Edition 1997.
- 2. Andrew S. Tanenbaum, "Computer Networks", prentice hall of India, Third Edition 1996.
- 3. Fred Hallsall, "Data Communication Computer Networks and Open System", Addison Wesley, 1992

9 Hrs

9 Hrs

9 Hrs

58

9 Hrs



Total Number of Hours: 45

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Subject Cod	e: Su VI	bject N LSI AN	ame : D EMF	BEDDE	D SYS	TEMS	DESIG	T N E	y/ Lb/ FL/IE	L	T/SI	r I	P/R	C
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L : Lecture T	: Tutor	ial SI	_r : Sup	ervised	Learnir	ng P:P	Project 1	R : Rese	earch C:	Cred	lits			
T/L/ETL : TI	neory/La	ab/Emb	edded	Theory	and Lab)	-							
OBJECTIV	Е:													
• To ex syste	nable th ms	e stude	nts to ui	nderstai	nd vario	us desig	gn flow	in VLS	I and the	eir ap	plicat	tions	in fu	zzy
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CO5 Des	ion diff	erent ty	mes of a	adders a	nd mult	tinliers	y about	testing	teeninge	105.				
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COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PC)10	PO1	1	PO12
CO1	3	3	2	1	2	1	3	2	3	3	/10	3	1	3
CO2	3	3	2	3	3	2	3	2	3	3		3		3
CO3	3	3	3	2	3	3	3	2	3	2		3		3
CO4	3	3	3	3	3	3	3	1	3	2		3		3
CO5	3	3	3	3	3	3	3	2	3	3		3		3
COs /	PSO1		PSO2	-	PSO3	-	PSO4			-		-		-
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CO1	3		2		2		3							
CO2	3		3		2		3							
CO3	3		3		3		3							
CO4	3		3		2		3							
CO5	3		3		3		3							
3/2/1 indicat	es Stre	ngth of	Correl	ation	3- Hig	h,2- Me	edium, 1	1-Low						
tory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project					
Categ														

ject Code:	Subject Name :	T y/ Lb/	L	T/SLr	P/R

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Subject Code:	Subject Name :	I Y/ LD/	L	1/SLI	I/N	C
	VLSI AND EMBEDDED SYSTEMS DESIGN	ETL/IE				
EBEC22020	Prerequisite: Solid State Devices, Digital	Ту	3	0/0	0/0	3
	Electronics					

UNIT I MOS TRANSISTOR THEORY

C--L

Introduction – NMOS and PMOS transistor, Threshold voltage, Body effect, MOS device – Basic DC equations ,Second order effects, MOS models, Small signal AC characteristics, Complementary CMOS Inverter, Power dissipation and scaling of MOS transistors.

UNIT II DESIGNING COMBINATIONAL LOGIC CIRCUITS

EMED

Static CMOS design - Complementary CMOS, Propagation Delay and Power Consumption in static CMOS, Pseudo NMOS Logic, Pass Transistor Logic, Transmission gates, Dynamic CMOS Design - Basic principle, Speed and Power dissipation of Dynamic logic, Signal integrity issues in dynamic design, CMOS Domino logic, np CMOS logic.

UNIT III DESIGNING SEQUENTIAL LOGIC CIRCUITS

Introduction - Timing metrics for sequential circuits, Classification of memory elements, Static latches and registers – The bi-stability principle, Multiplexer based latch, Master slave edge triggered register, Static SR flip flop, Dynamic latches and registers – Dynamic transmission gate edge triggered registers, clocked CMOS register.

UNIT IV VHDL & VERILOG PROGRAMMING

VHDL background - VHDL requirement, Elements of VHDL, operators, Basic concepts in VHDL, Structural modeling, Behavioral modeling and Dataflow modeling in VHDL and Simple programs, Verilog HDL - Basic concepts - Gate Level modeling, Dataflow modeling and Behavioral modeling - Simple programs.

UNIT V PIC MICROCONTROLLER

Introduction - PIC16F877 Micro controller overview, Special Function Registers, I/O Ports, Timers, Oscillators, Capture/ Compare and PWM module, Serial communication module, Analog module and Instruction set.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Neil H.E. Weste, Kamran Eshraghian, "Principles of CMOS VLSI Design – A system perspective", second edition, Addison Wesley, 1997.

2. Jan M.Rabaey, Ananth Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits : A Design perspective", second edition, Prentice Hall of India, 2003.

3. ZainalabedinNavabi, "VHDL – Analysis and modeling of Digital Systems", Second edition, Mcgraw – Hill International Editions, 1998.

REFERENCE BOOKS:

1. A. Pucknell, Kamran Eshraghian, "Basic VLSI Design", Third Edition, Prentice Hall of India, 2007.

2. R.Jacob Baker, Harry W.Li, David E. Boyce, "CMOS circuit design, Layout and Simulation", Prentice Hall of india, 2005.

3. J.Baskar, "A VHDL Primer", Third edition, Pearson Education, 2004.

4. Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis", second edition, Pearson Education,2003.

5. pic-microcontroller.com / free- ebook- pic-microcontrollers.

9Hrs

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9Hrs

9Hrs

9Hrs

9Hrs



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Subject	Cod	Code: Subject Name : VLSI AND EMBEDDED SYSTEM DESIGN LAB									Lb/ /IE	L	[/SLr	P/R	C
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CO1	Den	nonstra	te the a	bility to	design	and co	nduct n	nicrowa	we ex	xperin	nents,	analy	ze and	interp	ret data.
CO2	Den	nonstra	te the	skills to	o use n	nodern	engine	ering to	ools,	softw	vare a	nd eq	luipme	nts to	analyze
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mappin	ig or	Course	ourse Outcomes with Program Outcomes (POs)												
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CO	L	3	3	3	3	3	3	3			2			2	2
CO2	2	3	3	3	3	3	3	3			2			2	2
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COs PSO	/ s	PS	01	PS	02	PS	03	PS	504						
CO	[3	3	3		3		2						
CO2	2		3	3	3		3		2						
CO3	3		3	2	2		2		2						
H/M/L	indic	ates St	rength	of Cor	relation	n 3-H	ligh, 2-	Mediu	m, 1	-Low					
	gory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project					
	Categ														



Subject Code:	Subject Name : VLSI AND EMBEDDED SYSTEM DESIGN LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	С
EBEC22L11	Prerequisite: Introduction of VLSI & embedded system design	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

SIMULATION OF DIGITAL CIRCUITS USING Verilog

- 1. Design and Verification of Adder and Subtractor
- 2. Design and Verification of Multiplexer, Demultiplexer, Encoder, Decoder.
- 3. Design and Verification of Magnitude Comparator with 4 Bits.
- 4. Design and Verification of Jk, D, T and Sr Flip Flops
- 5. Design and Verification of Synchronous & Asynchronous Counters.
- 6. Design and Verification of Shift Registers (Right / Left).

INTERFACING WITH PIC MICROCONTROLLER

- 7. ADC Interface with LM 35.
- 8. Stepper Motor Interface
- 9. Traffic Light Controller Interface
- 10. DC Motor Interface
- 11. LCD Display Interface.
- 12. LED Interface

References:

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Total number of hours: 45



SEMESTER VI

Subject Cod	le: Sub	oject Na	ame : V	VIREL	ESS N	ETWO	ORKS	Ty ET	/ Lb/ L/IE	L	T /SLr	P/R	С	
EBEC22017	Pre	requisi	ite: Co	mputer	netwo	rks		Ту		3	1/0	0/0	4	
L : Lecture T	: Tuto	rial S	Lr : Sup	pervised	l Learn	ing P:	Project	R : R	esearch	C: Cree	dits		<u> </u>	
T/L/ETL : T	heory/L	.ab/Emt	bedded	Theory	and La	ıb								
OBJECTIV	ES:		1	.1 ·	1	. 1	1.4		. 1	1	1			
	ive a de	ep insi	ght for	the wire	eless ne	tWOrk 8	MAC 2	tures, p	rotocols	s, and a α	pplicati	ons.		
• To u	ndersta	nd the v	vireless	s sensor	networks	rks and	its MA	C & Ro	outing prot	rotocol	s.			
COUDER O									01					
COURSE O	will be	MES (able to	COs):	(3-5)										
CO1	Under	stand th	e conce	epts of V	WLAN	and PA	N							
CO2	Identif	v and A	Analyze	the iss	ues in A	Adhoc v	vireless	netwo	·ks					
<u> </u>	Design		protoco	ols and	study it	s imple	mentati	on in 4	dhoc n	etwork	3			
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CO5	Learn	the arch	nitectur	e of wir	eless se	ensor ne	etworks	and th	e metho	d of da	ta transi	mission	IN	
	SENS	OR NE	TWOR	KS										
Mapping of	f Course Outcomes with Program Outcomes (POs)													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10) PO1	1	PO12	
CO1	3	3	3	3	3	2	2	2	2	2	2	2		
CO2	3	3	3	3	3	2	2	2	2	2	2	2		
CO3	3	3	3	3	3	2	2	2	2	2	2	2		
CO4	3	3	3	3	3	2	2	2	2	2	2	2		
	5 DC	$\frac{3}{01}$	3 DC	$\frac{3}{2}$	5 DS	2	2	$\frac{2}{04}$	2	2	2	2		
PSOs	rs	UI	rs	02	rs	05	rs	04						
CO1		2	1	1		2		3						
CO2		3		3		2		3						
CO3		3		3		3		2						
CO4		3		3		3	,	2						
CO5		2	1	1		1		3						
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Subject Code:	Subject Name : WIRELESS NETWORKS	Ty / Lb/ ETL/IE	L	T /SLr	P/R	С
EBEC22017	Prerequisite: Computer networks	Ту	3	1/0	0/0	4

INSTITUTE

UNIT I WIRELESS LANS AND PANS

Introduction - FUNDAMENTALS OF WLANS- Technical Issues - Differences Between Wireless and Wired Transmission, Use of WLANs, Design Goals- Network Architecture - Infrastructure Based Versus Ad Hoc LANs, Components in a TypicalIEEE802.11 Network, Services Offered by a TypicalIEEE802.11 Network- IEEE802.11 STANDARD- Physical Layer, Basic MAC Layer Mechanisms- HIPERLAN standard-Bluetooth

AD HOC WIRELESS NETWORKS **UNIT II**

INTRODUCTION - Cellular and Ad Hoc Wireless Networks - definition, characteristics features, Applications of Ad Hoc Wireless Networks- Issues in ad hoc wireless networks - Ad Hoc wireless internet.

UNIT III MEDIUM ACCESS PROTOCOLS

MAC Protocols: design issues, Design goals of a MAC protocol For Ad Hoc wireless networksand classification of MAC protocols -Contention based protocols- with reservation, with scheduling mechanisms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15, 802.16.

UNIT IV NETWORK PROTOCOLS

Routing Protocols: Design issues, goals and classification of Routing Protocols - Proactive Vs reactive routing, Table-driven routing protocols: Destination sequence Distance - Vector routing Protocol, wireless Routing Protocol - On-demand routing protocols: Dynamic source Routing protocol, Ad Hoc on Demand Distance – vector Routing protocol - Hybrid Routing protocol : Core extraction distributed Ad Hoc routing protocol, Zone routing protocol - Power-aware routing protocols: Power - aware routing metrics.

WIRELESS SENSOR NETWORKS UNIT V

Introduction - Sensor Network Architecture - Data Dissemination - Data Gathering - MACPROTOCOLS for Sensor Networks - Location Discovery - Quality of a Sensor Network

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXT BOOKS:

- 1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007
- Charles E. Perkins, Ad hoc Networking, Addison Wesley, 2000 2.

REFERENCES:

- 1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hocnetworking, Wiley-IEEE press, 2004. Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.
- 2. T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad Hoc Network
- 3. Research," Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad HocNetworking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.
- 4. A survey of integrating IP mobility protocols and Mobile Ad hoc networks, FekriM.Abduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, v no.12007
- 5. V.T. Raisinhani and S.Iyer "Cross layer design optimization in wireless protocolstacks" Comp. communication, vol 27 no. 8, 2004.
- 6. V.T.Raisinhani and S.Iyer, "ÉCLAIR; An Efficient Cross-Layer Architecture forwireless protocol stacks", World Wireless cong., San francisco, CA, May 2004.

12Hrs

12Hrs

12Hrs

12Hrs

64



Subject Code:	Subject N	ame O	PTICA	L CO	MMUN	ICAT	ION	Ty/ Lb/ ETL/IE	L	T/S Lr	P/R	C	
EBEC22021	Prerequis	ite: Bas	sic Phy	sics				Tv	3	0/0	0/0	3	
L : Lecture T : T	utorial	SL	r : Sup	ervised	Learn	ing P :	Proje	ct R : Res	searc	h C: (Credits	5	
T/L/ETL : Theor	y/Lab/Em	bedded	I Theo	ry and	Lab	U	Ū						
OBJECTIVES :													
• To learn t	he basic el	ements	of optic	cal fiber	r transn	nission	link, ty	pes of fib	ers, S	licing	g and		
connector	S. the differen	+ kinda	offiba	r motor	iala on	tionlas	117000 0	nd its mo	dulati	on ma	thoda		
 To study To learn t 	he various	ontical	losses :	and fibe	er optic	al recei	vers su	ind its mo		D diod	les noi	ise	
performat	nce in photo	o detect	ors and	l optica	l netwo	rk conc	cepts.		,	<i>u</i> ioc			
COURSE OUTC	OMES (C	Os):		1			1						
The Students will	be able to												
CO1 A	nalyze the	various	optical	laws a	nd its p	ropertie	es.						
CO2 D	educe the c	lassifica	ation of	f fiber a	and thei	r mater	ial cha	racteristic	s.				
CO3 D	escribe the	fiber op	otic sys	tem des	sign by	their lo	osses.						
CO4 Le	earn techni	ques for	desigr	ning opt	tical sys	stems u	sing sc	ources.					
CO5 D	esign effici	ent opti	cal det	ectors a	ind syst	ems us	ing buo	dget calcu	lation	IS.			
Mapping of Cou	Course Outcomes with Program Outcomes (POs)												
COs/POs Po	D1 PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI	lo P	PO11	PO12	
CO1 3	3	2	1	3	2	3	1	2	3	1		2	
CO2 3	3	3	3	3	2	2	2	2	2	3	•	3	
CO3 3	3	3	3	3	2	2	1	2	2	3	}	3	
CO4 3	3	3	3	3	1	2	1	2	2	3	}	3	
CO5 3	3	3	3	3	1	2	3	1	2	2		3	
COS/PSOS PS	501	PSO2		PS03)	PS04	•						
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CO5 3		2		3		2							
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Subject Name OPTICAL COMMUNICATION T/S P/R **Subject Code:** Tv/ Lb/ L С ETL/IE Lr **EBEC22021** 3 0/0 0/0 3 **Prerequisite: Basic Physics** Ty

UNIT I: OVERVIEW OF OPTICAL FIBER COMMUNICATION

The general system - advantages of optical fiber communications - Optical fiber waveguides - introduction, ray theory transmission, total internal reflection, acceptance angle, numerical aperture, skew rays -Cylindrical fibers - modes, V number, mode coupling, step index fibers, graded index fibers

UNIT II: OPTICAL FIBERS

Evolution of Fiber Optical System - Elements of an Optical Fiber Transmission Link - Cylindrical Fiber -Single Mode Fibers and Multimode Fibers - Fiber Splicing and Connectors - Fiber materials - glass fiber plastic fiber

UNIT III: OPTICAL LOSSES

Absorption Losses - Scattering Losses - Bending Losses - Core and Cladding Losses - Signal Distortion in **SM** Fibers

UNIT IV: OPTICAL SOURCES

Direct and Indirect Band Gap Material - LED Structures - LED Power and Efficiency - Modulation - Laser Diodes Structures - laser diode rate equations - Modulation of Laser Diodes

UNIT V: OPTICAL DETECTORS AND NETWORKS

PIN and APD Diodes - Photo Detector Noise, SNR, Detector Response Time, Avalanche Multiplication Noise - Comparison of Photodetectors - Point to Point Links - System Design Consideration - Line Power Budget - Rise Time Budget - SONET - WDM

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

- 1. Gerd Keiser, "Optical Fiber Communication System", McGraw Hill, International, Singapore 3rd ed., 2000.
- John M. Senior, "Optical Fiber Communication principles and practice", Prentice Hall of India 2. private limited, 1996.

REFERENCE BOOKS:

- 1. J. Gower, "Optical communication system", Prentice Hall of India, 2001.
- 2. Govind P. Agrawal "Fiber-Optic Communication Systems", Wiley India 3rd Edition.
- 3. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.
- 4. Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.

9 Hrs

9Hrs

9 Hrs

9 Hrs

9 Hrs

RESE **BE UNIVE** (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.





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Periyar	E.V.R.	High	Road,	Madura	voyal,	Chennai	-95.	Tamilnadu,	India.

Subject	Cod	e: Su	bject N	ame : l	RF AN	D MIC	ROWA	VE		Ty/	Lb/	L	T/SL	P/I	R	С
EBEC2	2022	Pro Pro	erequis	ite: Tr	ansmis	sion Li	nes and	1			_/IE	3	<u>r</u> 0/0	0/	/0	3
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	•	To lea	udv the	operati	on of n	nicrowa	ve acti	ve devid	ces a	nd it	s appl	ication	s in cir	cuits		
	•	To Le	earn the	import	ance of	microv	wave m	easuren	nents	5.					-	
COURS	E O	UTCOM	IES (C	Os):(3	3- 5)											
The stud	lents	will be able to lyze the characteristics of microwave passive devices using Scattering matrix														
CO1	Ana	alyze the	he characteristics of microwave passive devices using Scattering matrix													
CO2	App	oly the pr	inciple	of gene	erators i	n devel	oping 1	nicrowa	ave s	ignal	ls					
CO3	Der	nonstrate	the ch	aracteri	stics of	microv	vave so	lid state	e dev	ices.						
CO4	Dev	velop the	concep	ts of mi	croway	ve trans	istors in	n the fal	orica	tion	of RF	circuit	s.			
CO5	Ana	allyze the	param	eters of	transm	ission l	ines in	microw	vave	circu	its.					
Mappin	g of	Course (Irse Outcomes with Program Outcomes (POs)													
COs/P	Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	98]	PO9	PO10	PO2	11	PC)12
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C04		3	3	3	3	3	3	1	1		<u> </u>	2	1		4	<u>-</u> २
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ONAL AND RESEARCH

DEEMED TO BE UNIVERSIT University with Graded Autonomy Status

Subject Code:	Subject Name : RF AND MICROWAVE	Ty / Lb/	L	T/SL	P/R	С
	ENGINEERING	ETL/IE		r		
EBEC22022	Prerequisite: Transmission Lines and	Ту	3	0/0	0/0	3
	Waveguides, Antenna and Wave Propagation					

UNIT I MICROWAVE PASSIVE DEVICES

EDUCAT

Transmission Lines for use at Microwave Frequencies – Attenuators, Directional Couplers, Terminators, Phase Shifters, Faraday Rotation Isolators and Circulators, Field Displacement Isolators, Microwave Filters, Frequency Meters, Hybrid Junctions – Scattering Analysis.

UNIT II MICROWAVE GENERATORS

Limitations of Conventional Tubes at Very High Frequencies – Velocity – Modulated Tubes, Two – Cavity Klystron Amplifiers, Reflex Klystron Oscillators – Periodic Slow Wave Structures and their Use in Travelling Wave Tube Amplifiers, Focusing Techniques, TWTA Performance Characteristics – Electron Motion in Crossed Electric and Magnetic Fields - Magnetron Oscillators, Hartree Equation Rieke Diagram and Performance Charts .

UNIT III MICROWAVE SOLID-STATE DEVICES

Varactor Diodes, Manley – Rowe Relations, Low Noise Parametric Amplifiers – Transferred – Electron Devices and Their Operation, Cavity – Controlled Modes, LSA Mode-Avalanche – Transit Time Devices and Their Operation, TRAPATT Mode, BARITT mode, PIN Diodes and Their use as Attenuators and Switches.

UNIT IV MICROWAVE CIRCUITS

Small – Signal Equivalent Circuits, High-Frequency Applications, Performance Criteria and Limitations of BJTs and FETs – HEMTs – Fabrication Techniques.

UNIT V MICROWAVE MEASUREMENTS

Slotted - Line Techniques – Measurements of Wavelength – Measurement of Low and High VSWR – Measurement of Frequency and Frequency Meters – Measurement of Insertion Loss and Attenuation by Substitution Methods – Measurement of Low and High Powers at Microwave Frequencies – Modern Measurement Techniques using Automatic Network Analyzer and Spectrum Analyzer. **Practical component P: Include case studies / application scenarios**

Research component R: Future trends / research areas / Comparative Analysis

TEXTBOOKS:

- 1. Annapurna Das, Sisir. K. Das, "Microwave Engineering", Tata McGraw Hill Co., Ltd., 1999. Reprint 2001.
- 2. Samuel Y. Liao: "Microwave Devices and Circuits", Prentice Hall of India 3rd Edition (2003)
- 3. SubalKar, "Microwave Engineering", Universities press(India) private limited -1^{st} Edition (2016)

REFERENCE BOOKS:

- 1. D.M. Pozer, "Microwave Engineering", Addison Wesley, 1998.
- **2.** R.E. Collins: "Foundations for Microwave Engineering", IEEE Press Second Edition (2002) David K. Cheng," Field and Waves in Electromagnetism", Pearson Education, 1989.

Total Number of Hours: 45





9 Hrs

9 Hrs

9 Hrs

9 Hrs



Subjee	ct Code	: S	Subject	Name	: PRO	L	T/SL r	P/R	C					
EBEC	22105	P	Prerequ	isite:	NIL				I	Lb	0	0/0	3/3	2
L : Leo	cture T	Tuto	orial S	SLr : S	upervis	ed Learn	ing P:	Project	R : F	Research C	C: Crec	lits		
T/L/EI	ΓL : Th	eory/I	Lab/Em	bedde	d Theor	y and La	ab							
OBJE	CTIVE	S:7	The obj	ective	of the	Main P	roject i	s to cu	lmina	te the aca	demic	study a	and prov	vide an
opport	unity to	expl	ore a p	oblem	or issu	e, addre	ess throu	ugh foc	used a	and applied	l resea	urch und	er the di	rection
or a ra	acquired to real-world issues and problems. This project affirms the students to think critically and													
creativ	ively, find an optimal solution, make ethical decisions and to present effectively.													
COUR	RSE OU	TCC)MES	(COs)	: (3- 5)			•• p1•					
CO1	Apply	the k	nowled	lge and	l skills a	acquired	in the c	course c	of stud	y addressi	ng a sj	pecific p	oroblem	or
	issue.													
CO2	Form	late s	students	to thi	nk critio	cally and	l creativ	ely abo	ut soc	ietal issue	s and o	develop	user frie	ndly
	and reachable solutions													
CO3	Analy	ze res	search s	kills a	nd dem	onstrate	their pr	oficienc	ey in c	ommunica	ation s	skills.		
CO4	Make	the st	udents	to face	e challei	nges of t	eam wo	rk, prep	oare a	presentati	on and	l demon	strate the	2
	innate talents.													
Mappi	ing of (ours	e Outc	omes	with Pr	ogram (Outcom	nes (PO	s)					
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CO3		3		2			3		3					
CO4		3		2		2	2		3					
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Subject Code:	Subject Name : PROJECT PHASE - I	T y/ Lb/ ETL/IE	L	T/SL r	P/R	С
EBEC22I05	Prerequisite: NIL	Lb	0	0/0	3/3	2

Students are expected to do the Project in a group of 3 to 4 students. They should identify the area/topic of the Project and should collect the literatures related to the project. Students intending to do Industrial projects will approach the industries with the support of the university, identify the industrial problem and finalize the project. In case of Industrial projects apart from Industry guide, a guide has to be appointed by the department. At the end of the Semester the students should submit their Project Phase - I report to the Department and Viva -Voce examination will be conducted by the examiners duly appointed by the Head of the department.

SEMESTER VII



Subjee	ct Cod	e: Subject Name : PROJECT PHASE - II							Ty	/ Lb/	L	T/SL	P/R	C
EBEC	22L13	13 Prerequisite: NIL									0	r 0/0	12/12	8
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits														
T/L/ETL : Theory/Lab/Embedded Theory and Lab														
OBJECTIVES: The objective of the Main Project is to culminate the academic study and provide an														
opportunity to explore a problem or issue, address through focused and applied research under the direction														
of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge														
and skills acquired to real-world issues and problems. This project affirms the students to think critically														
and creatively, find an optimal solution, make ethical decisions and to present effectively.														
COURSE OUTCOMES (COs) : (3- 5)														
CO1 Apply the knowledge and skills acquired in the course of study addressing a specific problem or														
CO2 Formulate students to think critically and creatively about societal issues and develop user friendly														
and reachable solutions														
CO3	CO3 Analyse research skills and demonstrate their proficiency in communication skills.													
CO4	Make	e the stu	dents to	face cl	hallenge	es of tea	amwork	, prepai	e a pres	entatio	n an	d demo	onstrate (he
	innat	e talents												
Mappi	ing of (Course	Outcon	nes wit	h Progi	am Ou	itcomes	(POs)						
COs	/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P	PO10	PO11	PO12
CO	01	3	3	3	3	3	3	3	3	3		3	3	3
CO2		3	3	3	3	3	3	3	3	3		3	3	3
<u>CO3</u>		3	3	3	3	3	3	3	2	2		3	3	3
CO4		<u> </u>	3	<u> </u>	3	<u> </u>	3	3 DC	$\frac{2}{04}$	2		3	3	3
COs / PSOs		PS	<u>PS01</u>		PS02		PS03		PS04					
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Subject Code:	Subject Name : PROJECT PHASE - II	Ty / Lb/ ETL/IE	L	T/SL r	P/R	С
EBEC22L13	Prerequisite: NIL	Lb	0	0/0	12/12	8

To make the students to make use of the knowledge and skill developed during their four years of study and to apply them for making an innovative product/process for the development of society and industries.

Students are expected to do a Project work either in an Industry or at the University in the field of relevant Engineering /inter-disciplinary /multi-disciplinary area in a group of 3 or 4 students. The work to be carried out in Phase II should be continuation of Phase I. Each group will be allotted a guide based on the area of Project work. In case of industrial Project external guide has to be allotted from Industry. Inter disciplinary/multi-disciplinary project can be done with students of different disciplines as a group. Monthly reviews will be conducted during the semester to monitor the progress of the project by the project review committee. Students have to submit the Project thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by the examiners duly appointed by the Controller of Examination. In case of industrial project certificate in proof has to be included in the report along with the bonofide certificate.



PROGRAM ELECTIVES


Elective-1 E	lectron	ics stre	eam											
Subject	Sub	oject N	ame : S	SEMIC	ONDU	CTOR	DEVI	CES	Ty / Lb/	L	T/SI	Lr P/	R	С
Code:	AN	D ITS	APPLI	CATI	ONS				ETL/IE					
EBEC22E01	Pre	requisit	e: Solic	l state I	Devices				Ту	3	0/	/0 0/		3
			- ~									0		
L : Lecture T T/L/ETL : Th	' : Tuto neory/L	rial S .ab/Em	Lr : Suj bedded	pervised Theory	d Learn and La	ing P: ab	Project	: R : R	esearch C	: Cre	dits			
OBJECTIV	ES :													
	٠	To lear	n the fu	inctions	of spec	cial dio	des and	their a	pplication	s.				
	•	To gair	the kn	owledg	e about	operati	ion of p	ower c	liodes.	1	1		. 1	
	•	To app	ly the p	ower a	lodes IC	or miver	lers, col	iverter	s and regu	Tatec	i powe	er supp	лу.	
COURSE O	UTCO	MES (COs):	(3-5)										
The Students	will be	e able to)											
CO1	Unde	rstand t	the char	acterist	ics of s	pecial c	liodes							
CO2	Apply	y the di	odes fo	r basic	electror	nic desi	gn							
CO3	Reme	Remember the operations of inverters.												
CO4	Illust	lustrate the different types of converters.												
CO5	Demo	Demonstrate the design of protection and switch gear												
Mapping of	Course	Course Outcomes with Program Outcomes (POs)												
COs/POs	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	10	PO11]	PO12
CO1	1	1	2	2	2	1	1	1		`			_	
$\frac{C01}{C02}$	2	1	2	2	2	1	1	1		2			-	
CO2 CO3	2	1	1	2	2	2	2	1	1	2			-	2
CO4	2	1	1	2	2	2	2	1	1	2		1		
CO5	2	2	3	3	2	1	2	3	2	2		1		2
COs /	PS	01	PS	02	PS	03	PS	04						
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EMED

TO

Subject Code:	Subject Name : SEMICONDUCTOR DEVICES AND ITS APPLICATIONS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	С
EBEC22E01	Prerequisite: Solid state Devices	Ту	3	0/0	0/ 0	3

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UNIT I SPECIAL DIODES

Breakdown Diodes-Avalanche Multiplication, Zener breakdown and its characteristics, Tunnel Diodes – Principle and Characteristics, Photodiode and its characteristics, Photo Voltaic Effect, and Light Emitting Diodes, Four Layer diode and its characteristics

UNIT II APPLICATIONS OF DIODES

Diode as clipper, clamper, comparator, sampling gate, voltage multipliers and peak detectors - Regulated Power Supply

UNIT III INVERTERS

Single Phase and three phase inverters-Voltage source inverters-current source inverters-Multilevel inverters-Resonant inverters

UNIT IV CONVERTERS

Single phase and three phase converters -Buck-Boost Converters-Dc to Dc converters-Ac to Ac Converters- Resonant Converters-Cycloconverters

UNIT V FIRING AND PROTECTING CIRCUITS

Necessity of isolation, pulse transformer, optocoupler - Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT - Over voltage, over current and gate protections

Total Number of Hours: 45

TEXT BOOKS :

1. Jacob Milman, Christos Halkias and Chetan D.Parikh, 'Integrated Electronics, Analog and Digital Circuits and Systems"

2. Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004

3. B.W Williams 'Power Electronics Circuit Devices and Applications'.

REFERENCES:

1. P.S.Bimbra, 'Power Electronics", Khanna Publishers, Eleventh Edition 2003

2. Ned Mohan, T.MUndeland and W.P Robbin, "Power Electronics: converters, Application and design" John Wiley and sons. Wiley India edition, 2006

3. P.C. Sen, "Modern Power Electronics", Wheeler Publishing Co, First Edition, New Delhi, 1998

9 Hrs

9 Hrs

9 Hrs

9 Hrs





(An 150 210	JUT : 2018 Certified Instit	ution)
Periyar E.V.R. High Road	, Maduravoyal, Chennai-95.	Tamilnadu, India.

Subject C	ode:	Su	ıbject N VSTEM	Name : 1 IS	REAL	L TIME OPERATING T y/Lb/L T/SLr P/R						С					
EBEC22E	E02	Pr	erequi	site: Op	peratin	g Syste	ms Co	ncepts		Ty	3		0/0	0/	0	3	
L : Lecture	e T : '	Tuto	rial SI	Lr : Sup	ervised	Learni	ng P:	Project	R : 1	R : Research C: Credits							
T/L/ETL :	Theo	ory/L	.ab/Emt	bedded '	Theory	and La	b	-									
OBJECT	IVES	5:															
•	Rev	view	of elem	ients an	d funda	mental	s of Sys	stems.									
•	10 To	knov	v the op	be imposed	of emb	of que	softwar	e tools schedu	ling								
COURSE			MES (COs:		or que	ues anu	scheuu	inng								
The Stude	nt wi	will be able to															
CO1	Understand the fundamentals of embedded system																
CO2	Apply scheduling techniques for completing an operation																
CO3	Remember the functions of key elements of RTOS																
CO4	Implement the design of simple RTOS																
CO5	Demonstrate the applications of software development tools in real time system.																
Mapping	of Co	ourse	e Outco	mes wi	th Pro	gram C	Outcom	es (PO	s)								
COs/PO	PO)1	PO2	PO3	PO4	PO5	PO6	PO7	PO	8 PO9	PO	10	PO	11	PO	012	
S																	
CO1	1		1	1	1	1	3	1	1	1							
CO2	2	2	3	3	3	3	2		1	2	3	3	2			1	
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EMED TO BE UNIVERSIT niversity with Graded Autonomy Status

ONAL AND RESEARCH

Subject Code:	Subject Name : REAL TIME OPERATING SYSTEMS	T y/ Lb/ ETL/IE	L	T/SLr	P/R	С	
EBEC22E02	Prerequisite: Operating Systems Concepts	Ту	3	0/0	0/0	3	

INSTITUTE

UNIT I EMBEDDED SYSTEM FUNDAMENTALS

Complex systems and microprocessors– Embedded system design process –Designexample: Model train controller- Design methodologies- Design flows - RequirementAnalysis – Specifications-System analysis and architecture design – Quality Assurancetechniques - Designing with computing platforms – consumer electronics architecture –platform-level performance analysis.

UNIT II SURVEY OF SOFTWARE ARCHITECTURES

Round –robin, Round-robin with interrupts, queues. Function- scheduling architecture, Real time operating system architecture, Scheduling architecture.

UNIT III ELEMENTS OF REAL TIME OPERATING SYSTEMS

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation Tasks & Task states, Tasks & data, Semaphores & shares data, Message Queues, Mailboxes and Pipes, Timer functions, Events, Memory management and Interrupt Routines in an RTOS environment.

UNIT IV BASIC DESIGN USING REAL-TIME OPERATING SYSTEMS 9 Hrs

Principles, encapsulating semaphores & queues, hard real-time scheduling considerations, saving memory space, saving power.

UNIT V EMBEDDED TOOLS

Embedded software development tools- host and target machines, linker/locators for embedded software, getting embedded software into the target system. Debugging techniques- testing on host system, instruction set simulators, the assert, macro using laboratory tools.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

TEXT BOOKS:

- 1. Wayne Wolf, "Computers as Components- Principles of Embedded Computing Systems Design", Academic press, 2001.
- 2. David E. Simon, "An Embedded Software Primer", Pearson education, 1999.

REFERENCES:

- 1. 1.Arnold S. Berger, "Embedded Systems Design- an Introduction to Processes, Tools & Techniques", CMP books, 2002.
- 2. 2. Jean J. Labrosse, "Embedded Systems Building Blocks", CMP books, 2002.
- 3. 3. Michael Barr, "Programming Embedded Systems in C andC++", O'Reilly, 1999.
- 4. 4.Lyla B.Das, —Embedded Systems : An Integrated Approach Pearson Education, 2013.
- 5. Jonathan W.Valvano, —Embedded Microcomputer Systems Real Time Interfacingl, Third Edition Cengage Learning, 2012.
- 6. David. E. Simon, —An Embedded Software Primer[∥], 1st Edition, Fifth Impression, Addison Wesley Professional, 2007.
- 7. Raymond J.A. Buhr, Donald L.Bailey, —An Introduction to Real-Time Systems- From Design to Networking with C/C++I, Prentice Hall, 1999.

9 Hrs

9 Hrs

9 Hrs

9 Hrs

Total Number of Hours: 45



Subject Code	e: Su	bject N	ame :	INTRO	DUCT	ION TO) PLC		Ty / Lb/ FTL /IF	LT	'/SLr	P/R	C
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T/L/ETL : Th	eory/L	ab/Emb	edded T	Theory a	nd Lab	5 1 . 1 1	oject K	. Rese		reuns			
OBJECTIV	ES :												
To study the	workin	g princi	ples of I	Program	mable I	Logic C	ontrolle	r:					
Provide stude	nts wit	h oppor	tunities	to deve	lop basi	c skills	in the d	esign o	f electron	ic equi	pment	using]	PLC
To understand	d the ge	eneric ar	chitectu	ire and	constitu	ent com	ponents	s of a Pi	rogramma	able Lo	gic Co	ontrolle	r.
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	evelop a	architect	ture of F	LC exp	laining	each un	lit in dei	tall.	nd to alm	ana far			
• 10 de	nly kn	op a software program using modern engineering tools and tec									FLC trial		
• 10 ap	pry Kit	ations											
		$\frac{10000}{1000}$											
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CO2	Enabl	e the sti	idents to		<u>р кnow</u>	leage o	n role (or autor	nation and	<u>a impo</u>	rtance	OI PL	
	Interp	oret the	Program	nming e	quipme	nt, Vari	ous tech	iniques	of progra	imming	g in PL	Ľ	
C03	Famil	Familiarize the students about the components of PLC											
CO4	Understanding the architecture of SCADA and explain the importance of SCADA												
CO5	Develop the various industrial applications of PLC												
Mapping of Course Outcomes with Program Outcomes (POs)													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	10 P	011	PO1 2
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CO4	3	2	3	3	3	2	2		3	2		3	3
CO5	3	3	3	3	3	2	2		3	2		3	2
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CO3		3		3		2		2					
CO4		3		3		2		2					
CO5		2		3		2		3					
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ONAL AND RESEARCH

Subject Code:	Subject Name : INTRODUCTION TO PLC	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E03	Prerequisite: Logic gates operations, Boolean algebra	ETL	1	0/1	3/0	3

UNIT I **INTRODUCTION TO PLC**

Role of automation in Industries - benefits of automation - Necessity of PLC - History and Evolution of PLC -Definition, types, selection criterion - Overall PLC system - PLC Input and Output modules - CPU, programmers and monitors, power supplies – Solid state memory 9 Hrs

UNIT II PROGRAMMING OF PLC

Programming equipment, Various techniques of programming, Ladder diagram fundamentals, proper construction of ladder diagram, basic components and their symbols in ladder diagram, Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of operation

UNIT III COMPUTER CONTROLLED TEST SYSTEM

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, architecture, PLCs versus Computers, PLC Size and Application.PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs). Definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PLC design, study of at least one industrial PLC.

UNIT IV SCADA FUNDAMENTALS

Introduction, Open system: Need and advantages, Building blocks of SCADA systems, Remote terminal unit (RTU): Evolution of RTUs, Components of RTU, Communication subsystem, Logic subsystem, Termination subsystem, Testing and human-machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Intelligent electronic devices (IEDs).

UNIT V APPLICATIONS OF PLC

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Measurement of temperature, flow, pressure, force, displacement, speed, level Developing a ladder logic for Sequencing of motors, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking Motors Controls

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis **Total Number of Hours: 45**

TEXTBOOKS:

1. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition

2. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers

3. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition

4.L.A. Bryan, E. A. Bryan, "Programmable Controllers Theory and Implementation" Industrial Text Company Publication, Second Edition

REFERENCE BOOKS:

1. Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition

- 2. Krishna Kant, "Computer Based Industrial Control", PHI
- 3. M. Chidambaram, "Computer Control of Process", Narosha Publishing
- 4. P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications

5. Webb J. W, "Programmable Controllers", Merrill Publishing Company, 1988

9 Hrs

9 Hrs

79



9 Hrs

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Elective-1 Communication stream

Subject Code	e: Su	bject N	ame :		T DDAI		ION		Ty FT	/ Lb/	L	T/	P/ P	C
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T/L/ETL : Th	eory/La	ib/Embe	dded Th	neory ar	nd Lab	,	<i></i>	. 100	ocure		cuito			
OBJECTIVE	ES :													
• To stu	udy Ant	enna Pa	rameter	s.										
 To stu 	udy Rad	liation R	lesistan	ce, Ante	enna Eff	ficiency	Measu	eme	nt.					
• To stu	idy Ant	enna Ar	rays.											
• To stu	idy diff	erent ty	pes Ante	ennas										
• 10 sti	idy Rac	lio wave	e propag	ation.										
COURSE OU	JTCON	AES (C	Os):(3	3- 5)										
The students v	will be a	able to												
CO1	O1 Understand the knowledge about antenna basics.													
CO2)2 Write about the radiation from a current element.													
CO3	Analyze the antenna arrays.													
CO4	E	Explain various types of antenna.												
CO5	CO5 Describe various types of radio wave propagation.													
Mapping of Course Outcomes with Program Outcomes (POs)														
COs/Pos	PO1	PO2	PO3	PO4	PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO						D12			
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CO3	3	3	3	3	3	2	2						_	
CO4	3	3	3	3	3	2	2						_	
CO5	3	3	3	3	3	2	2					_	_	
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Τ/ **Subject Code:** Subject Name : Tv / Lb/ L P/ С **ETL/IE** ANTENNA AND WAVE PROPAGATION S.Lr R **EBEC22E04** Prerequisite: EMF, TLWG 3 0/0 Ty 0/0 3

UNIT I **ANTENNA BASICS**

Antenna Parameters - Gain, Directivity, Effective Aperture Polarization, Beam width, Balun, Ground System, Top loading, monopole and Half wave dipole antenna, Short linear antenna, Beam solid angle, Antenna Temperature.

UNIT II **RADIATION PRINCIPLE AND ANTENNA TERMINOLOGIES** 9Hrs

Principle of Radiation, pattern, Antenna Terminologies - Reciprocity Theorem, Friss Formula, Slot Antennas, SWR(Standing Wave Radiators)

UNIT III ANTENNA ARRAYS

Arrays - Two Element Arrays - Uniform Linear Array - Broadside Array - End fire array - Principle of Pattern Multiplication – Binomial Arrays.

UNIT IV SPECIAL ANTENNA

Dish Antenna – Helical Antenna, Biconical Antenna, Microstip Patch Antenna, Turnstile Antenna, Yagi – uda antenna, Loop Antenna, Antenna Low and Medium Frequencies.

UNIT V WAVE PROPAGATION

Wave Propagation - Surface Wave Propagation, Structure of the Ionosphere, Space Wave Propagation-Determination of Critical Frequencies - Maximum Usable Frequency - Effect of Earth's Magnetic Field -Fading - Super Refraction - Scatter Propagation.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

- 1. Constantine A.Balanis, "Antenna theory analysis and design" JohnWiley, 2nd Edition 2007.
- 2. G.S.V. Raju, "Antenna wave propagation", pearson education, 2004.
- 3. R.E. Collins, "Antenna and Radio wave propagation".

REFERENCE BOOKS:

- 1. John D. Kraus, Ronald J Marhefka. "Antenna for all Appplications" Tata McGraw Hill 3nd Edition,2007.
- 2. A.R.Harish, M. Sachidanada, "Antenna and wave propagation", Oxford university press, 2007.
- 3. W.L.Stutzman and G.A. Thiele, "Antenna analysis and design", John willey, 2000.

9Hrs

9Hrs

9Hrs

9Hrs





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Subject Cod	e: Sul TH	bject N ELECO	ame : MMU	NICAT	TION S	WITC	HING	Ty E	7 / Lb/ FL/IE	L	T/SL r	P/R	C
	SY	STEM											
EBEC22E05	5 Pre	erequis	ite: Co	mpute	r Netw	orks		Ty	7	3	0/0	0/0	3
L : Lecture T T/L/ETL : Th	: Tutoria	al SL1 b/Embe	: Supe	rvised l heory a	Learnin nd Lab	g P:P	roject	R : Res	earch C	: Cred	its		
OBJECTIV	E :												
	• T	o under	stand th	e work	ing of s	imple t	elephor	ne netv	orks.				
	• T	o establ	ish the	signific	ance of	netwo	rk paraı	neters	in traffi	c engir	neering.		
	• T	o demo	nstrate	the tran	smissic	on of da	ta in ne	tworks					
COURSE O The Students	UTCON will be a	IES (C able to	Os): (1	3- 5)									
CO1	CO1 Describe and apply the fundamentals of telecommunication systems and associated												
	technologies.												
CO2	CO2 Understand and explain the reasons for switching and the relative merits of the various												
	modes of switching.												
<u>CO3</u>	Analyze and design systems related to traffic engineering.												
CO4	Analyze the internal design and operation of telephone networks with regard to key signaling										aling		
~~~ <b>~</b>	systems	s used in	n teleco	mmuni	cation 1	network	s.						
CO5	Unders	tand an	d analyz	ze the s	witchin	g techr	iques u	sed in	data net	works.			
Mapping of Course Outcomes with Program Outcomes (POs)													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	) PO1	1 PO	12
CO1	3	3	1	3	3	1	1	1		1	1		
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CO3	3	3	3	3	1	1							
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CO5	1	3	3	3	3	1	1	<u> </u>	1				2
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ory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component Practical / Project					
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**Subject Code:** Subject Name : Tv / Lb/ L T/SL P/R C **TELECOMMUNICATION SWITCHING** ETL/IE r **SYSTEM EBEC22E05** 3 0/0 0/0 **Prerequisite:** Computer Networks Тy 3

#### **UNIT I INTRODUCTION**

Evolution of Telecommunications, Simple Telephone Communication, Manual switching system, major telecommunication Networks, Strowger Switching System, Crossbar Switching

#### SWITCHING CONCEPTS **UNIT II**

SPC-its categorization, Enhanced Services, Two stage networks, Three stage networks, n-stage networks

Time multiplexed Space Switching, Time Multiplexed time switching, combination Switching, Three stage combination switching, n-stage combination switching.

#### **UNIT III TRAFFIC ENGINEERING**

Network Traffic load and parameters, Grade of service and blocking probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay systems.

#### **UNIT IV TELEPHONE NETWORKS**

Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Transmission Systems, Numbering Plan, Charging Plan, Signaling Techniques, In channel signaling, common channel signaling, Cellular mobile telephony.

#### **UNIT V DATA NETWORKS**

EPABX system – block diagram, working – Data transmission in PSTN, data rates in PSTNs – ISO – OSI reference model - Motivation for ISDN - Networks and protocol architecture, ISDN standards, broadband ISDN, voice data integration.

#### Practical component P: Include case studies / application scenarios

#### **Research component R: Future trends / research areas / Comparative Analysis**

### **TEXT BOOKS:**

- 1. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks"; PHI Publications.
- 2. J. E. Flood, "Telecommunications Switching, Traffic and Networks", PearsonEducation.
- 3. B.Forouzan "Data Communications and Networking", Pearson Education.

#### **REFERENCE BOOKS:**

- 1. John C. Bellamy, "Digital Telephony", Third Edition; Wiley Publications.
- 2. Andy Valder, "Understanding Telecommunication Networks", IET press

#### AND RESEAR NSTITUTE **TO BE UNIVER** EMED ersity with Grad (An ISO 21001 : 2018 Certified Institution) eriyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

# 9 Hrs

9 Hrs

9 Hrs

# 9 Hrs

**Total Number of Hours: 45** 



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•	To st	udy the	analys	1s of va	rious M	I-band I	ilter ba	nks for	audio	o coding	5					
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CO2	Ana	lvze va	rious tr	ansforn	ns and r	n – ban	d filter	bank fo	r aud	lio codi	ıσ					
CO3	Unc	lerstand	l differe	ent audi	o codin	g and ti	ansforr	n coder	<u>s.</u>		-8.					
CO4	Esti	mate va	arious s	peech p	aramet	ers with	suitabl	e techn	iaues							
CO5	Apr	ly linea	ar predi	ction co	oding to	ol to an	alyze s	peech.	1							
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Subject Code:	Subject Name : AUDIO SIGNAL	Ty / Lb/	L	T/SLr	P/R	С
	PROCESSING	ETL/IE				
EBEC22E06	Prerequisite: Signals and Systems	Ту	3	0/0	0/0	3

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#### **MECHANICS OF SPEECH AND AUDIO UNIT I**

EMED

ersity with Grad

Introduction - Review Of Signal Processing Theory-Speech production mechanism - Nature of Speech signal - Discrete time modeling of Speech production - Classification of Speech sounds - Phones -Phonemes - Phonetic and Phonemic alphabets - Articulatory features. Absolute Threshold of Hearing -Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Non simultaneous Masking - Perceptual Entropy - Basic measuringphilosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

#### UNIT II TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS 9 Hrs

Introduction -Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree- Structured QMF and CQF M-band Banks - Cosine Modulated "Pseudo QMF" M-band Banks - Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Preecho Control Strategies.

#### UNIT III AUDIO CODING AND TRANSFORM CODERS

Lossless Audio Coding-Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advanced, 4Audio Coding -Optimum Coding in theFrequency Domain - Perceptual Transform Coder -Brandenburg-Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding -Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization -MDCT with Vector Quantization.

#### UNIT IV TIME AND FREOUENCY METHODS FOR SPEECH PROCESSING

Time domain parameters of Speech signal - Methods for extracting the parameters: Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis Formant extraction _ Pitch Extraction using time and frequency domain methods HOMOMORPHIC SPEECH ANALYSIS: Cepstral analysis of Speech - Formant and Pitch Estimation - HomomorphicVocoders.

#### UNIT V LINEAR PREDICTIVE ANALYSIS OF SPEECH

Formulation of Linear Prediction problem in Time Domain - Basic Principle - Auto correlation method -Covariance method - Solution of LPC equations - Cholesky method - Durbin's Recursive algorithm lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters - Formant analysis - VELP - CELP.

Practical component P : Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

#### **TEXTBOOKS:**

1. Digital Audio Signal Processing, Second Edition, UdoZölzer, A John Wiley& sons Ltd Publicatioons 2. Applications of Digital Signal Processing to Audio And Acoustics Mark Kahrs, Karlheinz Brandenburg, Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow.

#### **REFERENCE:**

1. Digital Processing of Speech signals – L. R. Rabiner and R.W. Schaffer - Prentice Hall – 1978

9 Hrs

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**Total Number of Hours: 45** 

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### **Elective -2 Electronics stream**

Subject Co	de:	Su IN	bject N STRUN	lame : MENT	ame : INTELLIGENT IENTATION				T E	y / Lb/ TL/IE	L	Γ/ S.Lr	P/ R	C
EBEC22E	)7	Pr	erequis	ite: E	lectron	ic Circ	uit		T	y	3	0/0	0/0	3
L : Lecture	T : 1	Futor	rial SI	Lr : Su	bervised	l Learn	ing P:	Project	t R:R	esearch	C: Cre	dits		1
T/L/ETL : 7	Гheo	ry/L	ab/Emt	bedded	Theory	and La	ıb	Ũ						
OBJECTI	VES	:												
•	Intr	oduc	e stude	nts to t	he use	of vario	us elec	trical/el	lectroni	c instru	iments,	their		
	con	struc	ction, ap	oplicati	ons, pri	nciples	of ope	ration, s	standar	ds and u	units of	measur	ement	ts
	.Ba	sic n	neasure	ment ai	nd trans	ducers	concep	ts		•		6 1		
•	Pro	vide	student	ts with	opporti	inities t	o devel	op basi	c skills	in the c	design o	of electro	onic	
COUDSE				$\frac{\log PLC}{CO_{c}}$										
The student		l be r	wieð (U		( 3- 3)									
CO1	I es	arn fl	ie conc	ents of	transdu	icers								
	Un	deret	and the	epts of transducers.					enerato	re and a	naluzor	·c		
CO2 CO3	Gai	in kn	owlede	e ahou	t Inetru	mentati	on etan	dard pr	otocole		inary ZCI			
CO3	Use	e var	ious lat	orator	v instru	ments 1	ike cath	ode ra	v oscill	oscone	functio	n gener	ators	
004	and	and analyze various patterns.												
CO5	CO5 Develop basic skills in designing of computer controlled instrumentation.													
Mapping of Course Outcomes with Program Outcomes (POs)														
COs/POs	P	01	PO2	PO3	PO3 PO4 PO5 PO6 PO					PO9	<b>PO10</b>	<b>PO1</b>	PO	D12
C01		3	1	1	2	2	1	1	2	3		2		
CO2		3	3	3	3	3	3	3	2	2		2		
CO3		3	1	1	2	3	3	2	1	3		2		
CO4		3	3	3	2	2	2	3	1	2		2		
CO5		3	3	3	2	2	2	3	1	2		2		
COs /		PS	01	PS	02	PS	03	PS	04					
PSOs														
CO1		3	3	1	2		3							
CO2		3	3		3	3	3							
CO3	_	3	3	1	2		3						_	
CO4			5	•	5	2	2							
CO5		3	3		3	3	3							
3/2/1 indica	ates	Stre	ngth of	^c Corre	lation	3- Hi	gh, 2- I	Mediun	n, 1-Lo	W				
Ory	Racio Sciences	Dasic Buldles	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project				
Categ						$\checkmark$								

#### **Subject Code:** Subject Name : INTELLIGENT Tv / Lb/ L Τ/ **P**/ **INSTRUMENTATION ETL/IE** S.Lr R

**IONAL AND RESEARCH** 

DEEMED TO BE UNIVERSIT

#### **UNIT I TRANSDUCERS**

**EBEC22E07** 

EDUCAT

Transducer definition, classification, and performance characteristics. Potentiometer and its types, loading effect, sensitivity, piezo-resistive, equivalent circuits, charge and voltage sensitivity. Measurements, Instrumentation, Errors in Measurements, Calibration and Standard.

#### UNIT II SIGNAL GENERATOR AND SIGNAL ANALYZERS

**Prerequisite: Electronic Circuit** 

A.F. Generator, Pulse Generator, AM / FM Signal Generator, Function Generator, Sweep Frequency Generator, Wave Analyzers, Spectrum Analyzers, Logic Analyzer, Distortion Analyzers, Network Analyzer.

#### UNIT III **INSTRUMENTATION STANDARD PROTOCOLS** 9 Hrs

Definition of protocol, HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Foundation Field bus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

#### **UNIT IV** DATA DISPLAY AND RECORDING SYSTEM

CRO, Single Beam, Dual Trace, Double Beam CRO, Digital Storage and Analog Storage Oscilloscope, Sampling Oscilloscope, Power Scope, Curve Tracer, Analog, Digital Recorders and Printers - Case Study on Lissajous Pattern.

#### UNIT V **COMPUTER CONTROLLED TEST SYSTEM**

Programmable logic controllers (PLC) Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PLC design, study of at least one industrial PLC. Practical component P : Include case studies / application scenarios

#### Research component R : Future trends / research areas / Comparative Analysis

### **TEXT BOOKS:**

- 1. Rangan C.S. "Instrumentation Devices and Systems", Tata McGraw Hill, 1998.
- 2. SandeepRedkar, "Foundation Fieldbus control system", Rockwell Automation, 2010,
- 3. K. Shawney "Electronics and Electrical Instrumentation", Tata McGraw Hill, 1975.

### **REFERENCES BOOKS:**

- 1. Bouwels A.J., "Digital Instrumentation", McGraw Hill, 1986.
- 2. Barney .C, "Intelligent Instrumentation", Prentice Hall of India, 1985.
- 3. Oliver and Cage, "Electronic Measurements and Instruments and Instrumentation", McGraw Hill, 1975.
- 4. Deobelin, "Measurements Systems", McGraw Hill, 1990.
- Cooper, "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 5. 1988.

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9 Hrs

9 Hrs

### **Total Number of Hours: 45**



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# 9 Hrs



EBEC22E08 Prerequisite: Microprocessor and Lb 3 0/ Microcontrollers	)	0/0 3	;
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits			
T/L/ETL : Theory/Lab/Embedded Theory and Lab			
OBJECTIVES :			
• To introduce the concepts in internal programming model of Intel family of mi	roproces	sors.	
• To learn the functions of ARM processor and their applications To introduce the	e architec	ture	
programming and interfacing of 16 bit microcontrollers.			
• To introduce the concepts and architecture of RISC processor			
COURSE OUTCOMES (COs):			
The Students will be able to			
CO1 Explain the generalized architecture of advanced microprocessor			
CO2 Apply their understanding to do a project to develop an application using ARM r	cocessor.		
CO3 Appreciate the microprocessor based system design			
CO4 Analyze the MOTOROLA MC 68000 family			
COS Describe about the various RISC processors			
Mapping of Course Outcomes with Program Outcomes (POS)	<b>DO11</b>	DO12	
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COs/ PSO1 PSO2 PSO3 PSO4	-		
PSOs			
CO1 3 2 1			
CO2 3 2 3 3			
CO3 3 2 2 1			
CO4 3 1 2			
CO5         3         1         2			
3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low			
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Subject code:	Subject Name : ADVANCED MICROPROCESSORS	Ty/Lb/ ETL/IE	L	T/SLr	P/R	С
EBEC22E08	Prerequisite: Microprocessor and Microcontrollers	Lb	3	0/0	0/0	3

#### UNIT I **THE INTEL X86 FAMILY**

The Intel X86 Family Architecture, 32 bit Processor Evolution Systems Connections and Timing, Instruction and Data Formats, Instruction set of X86 Processors, Addressing Modes.

#### UNIT II INTRODUCTION TO ARM PROCESSOR

EMED

ARM Architecture -ARM programmer's model- ARM development tools-memory hierarchy-ARM assembly language programming-Simple Examples-Architectural support for operating system- ARM instruction Set-Embedded ARM Applications

#### SYSTEM DEVELOPMENT UNIT III

Microprocessors Based System Design, TMS 320 Series DSP Based Signal Processing, Microcontroller 8096, architecture, addressing mode and system design.

#### **UNIT IV THE MOTOROLA MC 68000 FAMILY**

The MC 68000 Architecture, CPU Registrars, Data Formats, Addressing Modes, Instruction Set and Assembler Directors, Memory Management Instruction and Data, Caches, Exception Processing.

#### **RISC PROCESSORS** UNIT V

RISC vs CISC, RISC Properties and Evaluation, Advanced RISC Microprocessors, DEC ALPHA, The Power PC family. The SUN SPARC Family, the MIPS RX 100 Family, the Intel 960 Family. The Motorola M88110 Family, HP Precision Architecture.

### Practical component P : Include case studies / application scenarios

### Research component R : Future trends / research areas / Comparative Analysis

### **TEXT BOOKS:**

- 1. B.B. Bery, "The Intel Microprocessors 8086 / 8088, 80186 / 80188, 80286, 80386, 80486, PENTIUM, and PENTIUM Processors", Prentice Hall, 1997.
- 2. K Udayakumar, B.S. Uma Shankar, "Advanced Microprocessors and IBM PC Assembly Language Programming", Tata McGraw Hill, 1996
- Andrew N.Sloss, Dominic Symes and Chris Wright "ARM System Developer"s Guide : 3. Designing and Optimizing System Software", First edition, Morgan Kaufmann Publishers, 2004

#### **REFERENCES:**

- 1. Daniel Tabak, "Advanced Microprocessors", McGraw Hill, 1995.
- 2. Douglas V. Hall, "Microprocessors and Interfacing Programming Hardware", McGraw Hill, 1992.
- 3. Steve furber "ARM Systems on chip Architecture", Second Edition Addison Wesley trade computer publication,2000.
- 4. W.A. Tribel& A. Singh, "The 68000 and 68020 Microprocessors Architecture, Software and Interfacing Techniques", Prentice hall of India, 1991
- 5. Rifiquzzaman, "Microprocessors Theory and Applications: Intel and MotorolaPrentice Hall, 1992.
- 6. Kenneth J. Ayala, "The 8051 Microcontroller, Architecture, Programming and Application", Penram International Publishing (India), 1996.6. John Peatman, "Design with Microcontrollers", McGraw Hill International, 1988

#### 9 Hrs

# 9 Hrs

9 Hrs

9 Hrs

# 9 Hrs

89

### **Total Number of Hours: 45**





Subject Code	: Su	Subject Name :NANO ELECTRONICS						TY E1	/ Lb/ L/IE	L	T/SL r	P/R	(	С
EBEC22E09	Pro	erequis	ite: Eng	gineeri	ng Phy	sics		Ty		3	0/0	0/0	) (	3
L : Lecture T	: Tutori	al SL1	: Supe	rvised l	Learnin	g P:P	roject ]	R : Res	earch C	: Credi	ts			
T/L/ETL : The	eory/La	b/Embe	dded T	heory a	nd Lab	-	-							
OBJECTIVE	<b>ZS :</b>													
• To	) learn a	nd und	erstand	basic c	oncepts	of Nar	no electi	ronics.						
• 10	) know 1	now the techniques of fabrication and measurement.												
COURSE OI		IES (C)	(1)	3-5)	structur			logic de	vices.					
The Students	will be a	able to	05) • ( •	5 5)										
CO1	Intro	luce the	concep	ots in na	anoparti	icles								
CO2	Demo	onstrate	fabrica	tion and	d chara	cterizat	ion tech	niques						
CO3	Descr	ibe the	propert	ies of N	Jano ma	aterials								
CO4	Categ	orize th	e Nano	structu	re devi	ces								
CO5	Unde	Understand and explain the principle and application of Nano devices.												
Mapping of C	Course	Outcon	nes witl	h Prog	ram Ou	itcome	s (POs)							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO1	11	PO12	2
CO1	3	2	3	2	3	3	3	3	1	3	1		3	
CO2	3	3	3	3	3	3	2	2	3	3	3		3	
CO3	3	3	3	3	3	3	3	2	1	3	2		3	
CO4	3	3	3	3	3	3	3	3	2	3	2		3	
CO5	3	3		$\frac{2}{2}$	3 DC	$\frac{3}{2}$	3 DC	3	3	3	2		3	
COS / PSOs	PS	<u>01</u>	PS	$\frac{02}{2}$	PS	03	PS	04						
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CO5		3		3		3		3						
3/2/1 indicate	s Stren	gth of (	Correla	tion	3- High	n, 2- M	edium,	1-Low						
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Subject Code:	Subject Name :NANO ELECTRONICS	TY / Lb/	L	T/SL	P/R	С
		ETL/IE		r		
EBEC22E09	Prerequisite: Engineering Physics	Ту	3	0/0	0/0	3

#### UNIT I INTRODUCTION TO NANOELECTRONICS

EMED

Nano-scale electronics; Foundation of nano-electronics- Size & Scale Units Scaling Atoms, Molecules, Clusters and Supramolecules; Wave mechanics- Schrödinger wave equation; Chemical Bonds (types and strength).

#### **UNIT II** SYNTHESIS AND MEASUREMENT TECHNIQUES

Nanomaterial Synthesis- Sol-gel methods, Mechanical methods: ball milling, mechanical attrition, Thin films methods: chemical vapor deposition, physical vapor deposition; Characterization techniques for nanomaterials and nano structures - FTIR, XRD, AFM, SEM, TEM, Analysis by Diffraction and Fluorescence Methods-Scanning Probe Techniques

#### NANO MATERIALS & ITS PROPERTIES UNIT III

Classifications of nanomaterials - Zero dimensional, one-dimensional and two dimensional nanostructures; Carbon nanomaterials: nanotubes and fullerenes; Properties- Dielectrics-Ferroelectrics-Electronic Properties Quantum Effects- Magneto transport in Layered Structures-Organic Molecules - Electronic and Structures, Properties, and Reactions.

#### NANO STRUCTURE DEVICES **UNIT IV**

Density of states of electrons in nanostructures- Electron transport in nanostructures- Electrons in quantum wells, Electrons in quantum wires, Electrons in quantum dots; Nanostructure devices- Resonant- tunneling diodes- Field-effect transistors- Single-electron-transfer devices- Potential-effect transistors- Light-emitting diodes and lasers- Nano-electromechanical system devices- Quantum-dot cellular automata

#### **APPLICATIONS OF NANOELECTRONICS** UNIT V

in Diagnostics applications, Environmental, Agriculturaland Food, Nanosensors- Nanoelectronics Nanoelectronics for energy systems- batteries, solar cells.

# Practical component P : Include case studies / application scenarios

#### Research component R : Future trends / research areas / Comparative Analysis **Total Number of Hours: 45**

### **TEXT BOOKS:**

- 1. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press 2011
- 2. Supriyo Datta,"Lessons from Nanoelectronics: A New Perspective on Transport", World Scientific2012
- 3. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson 2009

### **REFERENCES:**

- 1. Korkin, Anatoli; Rosei, Federico (Eds.), "Nanoelectronics and Photonics", Springer 2008
- 2. Mircea Dragoman, Daniela Dragoman, "Nanoelectronics: principles and devices", CRC Press 2006
- 3. Karl Goser, Peter Glösekötter, Jan Dienstuhl, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices",
- 4. Springer 2004
- 5. W. R. Fahrner, Nanotechnology and Nan electronics: Materials, Devices, Measurement Techniques(SpringerVerlag Berlin Heidelberg 2005)
- 6. Mark A. Reed, Takhee Lee, "Molecular nanoelectronics", American Scientific Publishers 2003
- 7. Jaap Hoekstra, "Introduction to Nanoelectronic Single-Electron Circuit Design", Pan Stanford Publishing 2010



9 Hrs

9 Hrs

9 Hrs

## 9 Hrs



### **Elective -2** Communication stream

Subject Code	e: Sul ITS	oject Na S APPL	ame : IN ICATI	NTERN ONS	ET O	FTHI	NGS AI	ND	Ty / Lb/ ETL/IE	L	T/S Lr	P/R	2	С
EBEC22E11	Pre	erequisi	te:: Int	ernet of	f Thing	gs			Ty	3	0/0	0,	/0	3
L : Lecture T	: Tutoria	al SLr	: Super	vised L	earning	g P:Pi	oject F	R : Re	esearch C:	Credits	5			
T/L/ETL : Th	eory/La	b/Embe	dded Th	eory an	d Lab									
<b>OBJECTIVES :</b>														
To stu	• To study basics of IoT.													
• To stu	idy IoT with Cloud environment.													
• To stu	idy loT	applicat	tions.											
The students	JICON	IES (CO ble to	Js): (3)	- 5)										
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C03	Manage					iment								
CO4	Interfac	e embe	dded sy	stem wi	th IoT									
CO5	Learn r	iew app	lication	s based	on IoT	•								
Mapping of O	Course	Outcom	es with	Progra	am Ou	tcomes	(POs)							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	8 PO9	PO10	PO PO	011	PO	012
CO1	3	3	3	3	3	2	3	2	2	2	3	3	3	3
CO2	3	2	2	3	3	2	2	2	2	2	3	3	3	3
CO3	3	2	3	3	3	2	2	2	2	2	3	3		3
<b>CO4</b>	3	3	2	3	3	2	2	2	2	2	3	3	3	3
CO5	3	2	3	3	3	2	2		3	2	3	3		<u>,</u>
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Subject Name : INTERNET OF THINGS AND T/S P/R **Subject Code:** Tv / Lb/ L

#### UNIT I INTRODUCTION TO INTERNET OF THINGS

**Prerequisite:: Internet of Things** 

**ITS APPLICATIONS** 

Definition and Characteristics of IoT - Things in IoT - IoT Protocols - Logical Design of IoT - IoT enabling technologies - IoT Levels.

#### **UNIT II DOMAIN SPECIFIC IoT**

**EBEC22E11** 

EDUCAT

Home Automation - Cities - Environment - Energy - Retail - Logistics - Agriculture - Industry - Health and Life style-SDN and NFV for IoT.

### UNIT III IoT SYSTEM MANAGEMENT AND CLOUD

Need for IoT System Management - SNMP - NETOPEER - IoT design methodology - Xively - Django-Amazon Web for IoT – SkyNetIoT.

#### **IoT PHYSICAL DEVICES** UNIT IV

Raspberry Pi - Raspberry Pi Interfaces - Arduino boards - Other IoT devices - Intel Galileo Arduino board Specification.

#### UNIT V **IoT APPLICATIONS**

Applications based on IoT - Smart Cities -Smart Home and Buildings -Smart Energy and the Smart Grid -Smart Health- Smart Transportation and Mobility

#### Practical component P : Include case studies / application scenarios

#### **Research component R : Future trends / research areas / Comparative Analysis**

#### **TEXTBOOKS:**

- 1. ArshdeepBahga.Vijaymadisetti, "Internet of things A hands- on approach", Universities press, First Editon, 2015.
- 2. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", Wiley, First edition 2014.
- 3. C HillarGastn, "Internet of Things with Python", Packt publishing, first edition, 2016.

#### **REFERENCE BOOKS:**

- 1. Dominique D. Guinard and Vlad M. Trifa "Building the Web of Things With examples in Node.js and Raspberry Pi", June 2016 ISBN 9781617292682
- 2. CharalamposDoukas, "Building Arduino" Internet of Things with the ISBN/EAN13:1470023431 / 9781470023430
- 3. Gastón C. Hillar, "Internet of Things with Python", May 2016, PACKT Publishing limited.
- 4. Marco Schwartz "Internet of Things with the Raspberry Pi: Build Internet of Things Projects Using the Raspberry Pi Platform", Kindle Edition.

9 Hrs

**Total Number of Hours: 45** 

<b>DEEMED TO BE UNIVERSITY</b> University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.	Dr. M.G.R. IONAL AND RESEARCH INSTITUTE DEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) EV.8. High Road, Maduravoyal, Chennai-95, Taminadu, India.	SALACT
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## 9 Hrs

9 Hrs

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Subject	Subject Name : NEURAL NETWORKS AND						Ту	Lb/	L	Τ/	P/	R	С	
Code	TTS.	APPLI	CATIO	NS				]	ETL		S.Lr			
EBEC22E13	Prer	equisite	e: nil						Ту	3	0	0	)	3
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Ty/Lb/ETL : Th	neory/	Lab/Em	bedded	Theory	and La	b								
OBJECTIVES	5:													
The student sl	nould	be mad	le to: To	o study	ral netw	ork alg	orithms a	nd its	applica	tion i	n			
pattern recognit														
COURSE OU	UTCOMES (COs) :							-						
COI	Describe the basic concepts of artificial neural network						vorks.	orks.						
CO2	Explain about BPN and BAM													
CO3	Implement the concept of simulated annealing and						CPN							
CO4	Inter	pret the	concept	ts of SO	M and	ART.								
CO5	Desc	ribe De	ep learr	ning.										
Mapping of Co	ourse	Outcon	nes with	Progra	am Out	comes	(POs)							
COs/POs	PO	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	<b>PO8</b>	PO9	PO	10 PC	D11	PO	12
	1													
CO1	3	2	2	2	1	1	1	1	1	2	2		3	
CO2	3	3	2	2	1	1	1	1	2	2	1		2	
CO3	3	3	3	3	3	2	2	2	3	2	3		2	
CO4	3	2	3	3	2	1	1	1	1	2	2		2	
CO5	3	3	3	3	2	1	2	1	1	1	1		1	
	3	2	2	2	1	1	1	1	1	1	2		3	
COs / PSOs		PSO1			PSO2			PSO	3		Р	SO4		
CO1	1			2			2			3				
CO2	1			2			3			1				
CO3	3			2			3			1				
CO4	1			1			3			2				-
CO5	1			2			1			3				
3/2/1 Indicates	Stren	gth Of	Correla	ation, 3	– High	, 2- Me	dium, 1	- Low						
		ses				ĺ								
		cienc	b ss		ives	s	lary	ent	ject					
ý	JCe	ad ad	s an	ore	lect	ive	olin	one	Pro					
g01	cier	Lin.	Scie	Ŭ	ΠΞ	ect	scil	dup	1/]					
ate	Sc	nee	ani 1 S	ran	ran	Ε	Di	Co	ica					
C	asic	lgi	um Sci8	130.	1 <u>6</u> 0.	pen	ter	cill	act.					
	B;	Б	H SC	Pr	Pr	Ō	In	Sţ	Pr					
					$\checkmark$									

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**IONAL AND RESEARCH** 

Subject Code	Subject Name : NEURAL NETWORKS AND ITS APPLICATIONS	Ty/Lb/ ETL	L	T/ S.Lr	P/R	С
EBEC22E13	Prerequisite: nil	Ту	3	0	0	3

INSTITUTE

#### UNIT I INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS

Neuro – Physiology – General Processing Element – ADALINE – LMS Learning Rule – MADALINE – Perception Networks

### UNIT II BPN AND BAM

EDUCAT

Back Propagation Network – Updating of Output and Hidden Layer Weights – Application of BPN – Associative Memory – Bi-Directional Associative Memory - Hopfield Memory – Traveling Sales Man Problem

### UNIT III SIMULATED ANNEALING AND CPN

Annealing, Boltzmann Machine – Learning – Application – Counter Propagation Network – Architecture – Training – Application.

### UNIT IV SOM AND ART

Self-Organizing Map – Learning Algorithm – Feature Map Classifier – Applications – Architecture of Adaptive Resonance Theory – Pattern Matching in ART Network. Neocognitron: Architecture of Neocognitron – Data Processing and Performance of Architecture of Spacio – Temporal Networks for Speech Recognition

#### UNIT V DEEP LEARNING

Deep Feed Forward network, regularizations, training deep models, dropouts, Training Deep Neural Networks using Back Propagation-Setup and initialization issues, vanishing and exploding Gradient problems, Gradient- Descent Strategies

#### Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

### **Total Number of Hours: 45**

#### **TEXT BOOKS:**

**1.** Laurence Fausett, "Fundamentals of Neural Networks: Architecture, Algorithms and Applications", Prentice Hall, 1994.

**2.** J.A. Freeman and B.M.Skapura, "Neural Networks, Algorithms Applications and Programming Techniques", Addison-Wesley, 1990.

3. CharuC.Aggarwal "Neural Networks and Deep learning" Springer International Publishing, 2018

#### **REFERENCE BOOKS:**

1. Martin T. Hagan, Howard B. Demuth "Neural Networks Design", 2 ndEdition, Martin Hagan, 2014

2. Simon Haykin, "Neural Networks and Learning Machines" -3/E - Pearson/ Prentice Hall 2009

#### **9 Hrs** ALINE –

9 Hrs

9 Hrs

9 Hrs

9 Hrs

# 95

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Subject C	ode:	S N	Subject Name :RADAR AND NAVIGATIONAL AIDS							Y /Lb/ TL/IE	L	T/ SLr	P/R	(	С
EBEC22E	E14	P	rerequis	ite: Eng	gineeri	ng Ph	ysics		r	Гу	3	0/0	0/0		3
L : Lectu	re T :	Tutori	al SLr	: Superv	vised Le	earnin	g P : P	roject	R : Re	search	C: Cr	edits			
T/L/ETL	: The	ory/La	lb/Embec	lded The	eory and	d Lab									
OBJEC	<b>FIVE</b>	S :													
	•	To b	ecome fa	miliar w	vith fun	damei	ntals of	RAD	DAR						
	•	<ul> <li>To gain in-depth knowledge about the different types of RADAR and their operations</li> <li>Need for signal detection in RADAR and various detection techniques</li> </ul>													
	<ul> <li>Need for signal detection in RADAR and various detection techniques</li> <li>To become familiar with RADAR navigation techniques</li> </ul>														
	To become familiar with RADAR navigation techniques COURSE OUTCOMES (COs) : (3-5)														
COURS	RSE OUTCOMES (COs) : ( 3- 5) Students will be able to														
The Stud	ents v	will be able to Vistinguish the various types of radar													
<u>CO1</u>	Dis	tinguis	sh the van	10us typ	$\frac{1}{6}$ es of ra	adar	•	1							
<u>CO2</u>	Und	ierstar	a the op	eration of	of high i	treque	ency sig	gnal g	enerato	ors.					
<u>CO3</u>	Ide	ntify th	ne targete	d radar	signals	in no	ise		6	1					
CO4	Ana	alyze t	he propa	gation of	t radar	waves	s and fo	ormati	on of c	lutter					
CO5         Exhibit the different navigational aids           Mapping of Course Outcomes with Program Outcomes (POs)															
Mapping of Course Outcomes with Program Outcomes (POs)         COs/Pos       PO1       PO3       PO4       PO5       PO7       PO8       PO10       PO11       PO12															
COs/Pos PO1			PO2	PO3	<u>PO4</u>	PO:		1	<u>PO/</u>	PO8	1		0 PO	11	2
		2	1	1	1			1	1		1	1			2
		<u> </u>	3	2	2	2		2	2	2	2	2	1		
		1	2	2	2	2		2	2	2	2	2	1		1
C04		1	<u> </u>	<u>2</u> 1	<u> </u>	1		2	4	<u> </u>	<u></u> 1	2			2
COs/		PS	01	PS	$\frac{1}{02}$	-	PSO3	-	P	504	1				4
PSOs		10	01	15	02		1505		1)	504					
CO1			)	2			3		2	2					
			2	3			$\frac{3}{2}$		1	/ }					
CO3		1	- 1	3			2		<u> </u>	,					
CO4		]	1	2			2		2						
CO5		1	l	2			3		2	}					
3/2/1 ind	licates	Stren	gth of C	orrelati	ion 3-	- Higł	n, 2- M	ediun	n, 1-Lo	)W		<b>I</b>			
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		S		nd es		tive	se	nar	leni	ojec					
	nce s an light link link link link link link link link					por	Pro								
Scie				n C	пE	llec	isci	om	al /						
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ate						$\checkmark$									
	'					•									_



Subject Code:	Subject Name :RADAR AND NAVIGATIONAL AIDS	TY /Lb/ ETL/IE	L	T/ SLr	P/R	С
EBEC22E14	Prerequisite: Engineering Physics	Ту	3	0/0	0/0	3

### UNIT I RANGE AND TYPES OF RADAR

Range Parameters, Pulsed Radars, Signal to Noise Ratio, Integration of Pluses Beam Parameters, System Losses and Propagation Effects MTI; CW and Pulse-Doppler Radar, Delay Lines Tracking Radar, Mono pulse, Sequential, Simultaneous, Conical Scan and Monopulse Trackers, Beacons.

#### UNIT II TRANSMITTERS, RECEIVERS AND ANTENNA 9 Hrs

Klystron, Magnetron, TWT Amplifiers and Oscillators, Crossed Fields Devices, Parabolic Cassegrainian, Coefficient, Squares Antennas, Radomes, Feeds, Receivers, Performance Figures, Displays Scope and PPI Duplexers.

#### UNIT IIIDETECTION OF RADAR SIGNALS IN NOISE9 Hrs

MF, Correlation Detection, Detector Characteristics, Automatic Detection, CFAR Receiver, Pulse Compression and Classification of Targets with Radar.

### UNIT IVPROPAGATION OF RADAR WAVES AND CLUTTER9 Hrs

Plane Earth and Spherical Earth Problem, Refraction and Diffraction, GTD Analyzers, Surface and Sea Clutter, Detection of Targets, Effects of Weather on Radar.

#### UNIT V RADAR TOPICS AND NAVIGATIONAL AIDS 9 Hrs

Synthetic Aperture, Over the Horizon Radar, ARSR, ASR, Bistatic and Monostatic Radars, LORAN, ILS, GCA, Direction Finder, VOR Concepts, Airborne Doppler Navigation.

### Practical component P: Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

#### **Total Number of Hours: 45**

#### **TEXT BOOKS:**

- 1. M.I. Skoinik "Introduction to Radar Systems:, McGraw Hill 1981.
- 2. N.S. Nagaraja, Elements of Electronic Navigation Systems, 2nd Edition, TMH, 2000.

#### **REFERENCES:**

- 1. F.E. Terman, "Electronics and Radio Engineering" McGraw Hill
- 2. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004
- 3. J.C Toomay, " Principles of Radar", 2nd Edition PHI, 2004



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Subject Code:		Su	ıbject N	Name :	EMBE DESI	EDDED IGN	SOFT	WARI	E Ty E	7 / Lb/ FL/IE	L	T/SL r	P/R	C			
EBEC22E	16	Pre	requisi	ite: Bas	sic C P	rogran	ming			7	3	0/0	0/0	3			
L : Lecture	T : '	Tuto	rial S	Lr : Su	pervise	d Learn	ing P:	Projec	t R : R	esearch	C: Cre	dits	0/0	Ŭ			
T/L/ETL :	Theo	ory/L	.ab/Eml	bedded	Theory	and La	ab	J									
OBJECTI •	VE: Toi	mple	ment s	oftware	e desigr	n for an	embed	ded sys	stem us	ing C ar	nd asser	nbly le	vel prog	rams			
COURSE The Studen		ts will be able to															
	IIS W	Understand the concept of basic embedded system															
	Wr	ite a	simnle	progra	m usina	$\frac{1}{2}C$ and	asseml	hlv									
		foror		progra	ada of	$\frac{10}{10}$ prod	rommi	ng usin	aintor	mata							
				ie metn	$\frac{1}{1}$				g meri								
CO4	Ap	ply s	cheduli	ing met	nods fo	or multi	-thread	ed prog	rammi	ng							
CO5	Der	mons	strate th	ne princ	iple of	shared	memor	y and n	nemory	manage	ement						
Mapping of	of Co	ourse	e Outco	omes w	ith Pro	gram (	Outcon	nes (PC	)s)								
COs/POs	PO	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12												012			
C01	1	1	1	1			2	1	1					2			
CO2	1	1	2	2	2	3	1	1	1		2	3		2			
<u>CO3</u>	]	1	3	2	3	3	1	1	1	1	2						
CO4 CO5	1	1	3	3	3	3	1	1	2	3	2	2		<u>,</u>			
		I PSC	<u>2</u>	J PS	$\frac{3}{02}$	J PS	$\frac{2}{03}$	2 PS	<u> </u>			3		2			
PSOs		150	/1	15	02	15	05	15									
CO1		1		1	L	1	1		1								
CO2		2		2	2	3	3		1								
CO3		1		2	2	3	3		1								
CO4		2		2	2	3	3		2								
CO5	- 4	1			<u> </u>	2 11	3		2								
3/2/1 indic	ates	Stre	ingth o	I Corre		3- HI	<b>gn, 2-</b> 1	viediur	n, 1-Lo	DW							
sory		Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project							
Cates																	

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**ONAL AND RESEARCH** 

EMED

Subject	Subject Name : EMBEDDED SOFTWARE	Ty / Lb/	L	T/SL	P/R	С
Code:	DESIGN	ETL/IE		r		
EBEC22E16	Prerequisite: Basic C Programming	Ту	3	0/0	0/0	3

INSTITUTE

#### INTRODUCTION TO EMBEDDED SYSTEM AND DATA REPRESENTATION& ARM UNIT I PROCESSOR 9hrs

Embedded system-Design goals for embedded software- Real time and multi-tasking-Embedded processors and languages-Building an embedded application-Data Representation-Fixed precision binary numbers-Binary representation of Integers and real numbers-ASCII and BCD number.

ARM Architecture Versions - ARM Architecture - Instruction Set - Stacks and Subroutines - Features of the LPC 214X Family - Peripherals - The Timer Unit - Pulse Width Modulation Unit - UART - Block Diagram of ARM9 and ARM Cortex M3 MCU.

#### UNIT II **EMBEDDED PROGRAMMING**

Components for embedded programs- Models of programs- Assembly, linking and loading - compilation techniques- Program level performance analysis - Software performance optimization - Program level energy and power analysis and optimization - Analysis and optimization of program size- Program validation and testing

### UNIT III INPUT OUTPUT PROGRAMMING

I/O instructions - synchronization, transfer rate and latency - polled waiting loops - interrupt driven I/Ointerrupt service routine-Buffers and queues –ISR in assembly and C – Non-maskable interrupts - Software interrupts - Exceptions - direct memory access - comparison of methods.

### UNIT IV CONCURRENT SOFTWARE AND SCHEDULING

Foreground/background systems - Multi threaded programming - shared resources and critical sections thread states – pending threads – context switching – round-robin scheduling – priority-based scheduling – assigning priorities - deadlock -watchdog timers.

#### UNIT V MEMORY MANAGEMENT AND SHARED MEMORY

Objects in C - scope - lifetime -automatic allocation - static allocation - Dynamic allocation- recognizing shared objects – reentrant functions – read only data – accessing shared memory.

### Practical component P: Include case studies / application scenarios

#### **Research component R: Future trends / research areas / Comparative Analysis Total Number of Hours: 45**

#### **TEXT BOOKS:**

1. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education. 2002.

2. Steve Heath, "Embedded system design", Elsevier, 2003.

3. Marilyn Wolf, —Computers as Components - Principles of Embedded Computing System Design, Third Edition — Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

4. Jane W.S. Liu, Real Time Systems, Pearson Education, Third Indian Reprint, 2003.

### **REFERENCES:**

1. Lyla B.Das, —Embedded Systems : An Integrated Approach Pearson Education, 2013.

2. Jonathan W.Valvano, -Embedded Microcomputer Systems Real Time Interfacing, Third Edition Cengage Learning, 2012.

3. David. E. Simon, -An Embedded Software Primerl, 1st Edition, Fifth Impression, AddisonWesley Professional, 2007.

4. Raymond J.A. Buhr, Donald L.Bailey, -An Introduction to Real-Time Systems- From Design to Networking with C/C++I. Prentice Hall, 1999.

5. C.M. Krishna, Kang G. Shin, -Real-Time Systems, International Editions, Mc Graw Hill 1997

6. K.V.K.K.Prasad, -Embedded Real-Time Systems: Concepts, Design & Programming, Dream Tech Press, 2005

7. Sriram V Iyer, Pankaj Gupta, —Embedded Real Time Systems Programming, Tata Mc Graw Hill, 2004.

#### 9hrs

9hrs

9hrs

9hrs



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Subject Code	: Su	Subject Name :QUANTUM COMPUTING							Ty/ Lb/ ETL/IE	L	T/	r P/	C		
EBEC22E17	Pr	erequis	ite: En	gineeri	ng Phys	sics			Ty	3	0/0	$\frac{1}{0}$	) 3		
L : Lecture T	: Tutor	ial SL	r : Supe	rvised I	Learning	g P:Pr	oject R	: Resea	arch C: Cre	edits	1				
T/L/ETL : The	eory/La	ab/Embe	edded T	heory a	nd Lab		-								
OBJECTIVE	CS:														
	Του	indersta	nd the b	ouilding	blocks	of a qua	antum c	ompute	r. • •, ,•	c			, <b>.</b>		
	10 t	indersta	nd the j	principle	es, quan	itum ini	ormatio	on and I	imitation (	of qu	antur	n opera	tions		
•	То и	indersta	nd the v	various o	quantun	n algorit	thms.								
COURSE OU	URSE OUTCOMES (COs) : ( 3- 5) Students will be able to														
The Students	will be	/ill be able to Demonstrate the importance of quantum computing and superposition states.													
		Demonstrate the importance of quantum computing and superposition states.           Explain Quantum operators and its applications.													
		Build quantum circuits with the knowledge of various quantum gates													
003		sund qu	antum c	arcuits v	with the	KNOWI	euge of	various	quantum g	gates	•				
CO4	A	Apply th	e conce	pt of di	ferent c	luantun	n algorit	thms and	d have the	insig	ght of	QKD.			
CO5	I	dentify	Quantui	n errors	and co	rrect it	using Q	uantum	error corre	ectin	g cod	les.			
Mapping of Course Outcomes with Program Outcomes (POs)															
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO	10	PO11	PO 12		
CO1	3	2	1	1	2	2	1	2	2	1		2	3		
CO2	3	3	2	2	1	1	1	2	2	1		2	3		
CO3	3	3	3	2	3	1	1	2	2	2		3	3		
CO4	2	2	2	3	3	1	1	2	2	2		2	2		
CO5	3	3	3	2	3	2	2	2	2	2		2	2		
COs / PSOs	PS	501	PS	02	PS	03	PS	504							
CO1		3		3		3	2								
		3		3		3		2							
		<u>3</u>		5	4	2		<u>3</u> 2							
C04 C05		<u> </u>		<u>,</u> २		2		<u> </u>							
3/2/1 indicate	s Strei	ngth of (	Correla	tion 3	- 3- High	- , 2- Me	dium, 1	l-Low							
ıry	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project						
Catego					$\checkmark$										

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Subject Code:	Subject Name :QUANTUM COMPUTING	Ty/ Lb/ ETL/IE	L	T / S.Lr	P/ R	С
EBEC22E17	Prerequisite: Engineering Physics	Ту	3	0/0	0/0	3

INSTITUTE

### UNIT I INTRODUCTION

Introduction to Quantum Computing- Power of Quantum Computing- Quantum Information- Quantum Computers. The Wave and the Corpuscular Nature of Light Photon Behavior, State Description, Measurement in Multiple Bases, Superposition States – The Superposition probability Rule.

### UNIT II QUANTUM MECHANICS

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Quantum Postulates – State space, Evolution, Quantum Measurement, Distinguishing Quantum states, Projective measurements, POVM measurements -Quantum Mechanics-Hilbert Space-Linear Operators Tensor and Outer Products-Quantum Operators- Application Quantum mechanism: Super dense Coding - Double Silt Experiments.

### UNIT III QUBITS AND QUANTUM GATES

Qubits. Bloch Sphere Representation-Rotation Operation-The Measurement of a Single Qubits-A Pair of Qubits- Bell States- Qubits as Spin Half- Integer Particles- Qubits as Polarized Photon-Entanglement, Exchange of Information / Teleportation – Quantum Coping Circuit - The Non-Cloning Theorem-Quantum Gates – Universal Quantum Gate Gates – Matrix Representation – Quantum Circuits- Single and Multiple Qubit Controlled Operations.

### UNIT IV QUANTUM ALGORITHM

Turing Machine - Quantum Parallelism-Deutsch's Problem, Deutsch – Jozsa Algorithm -QFT(Quantum Fourier Transform)-Short's Factoring Algorithm-Simon's Algorithm-Quantum Search Algorithm- Quantum key distribution - Mathematical Models of Quantum Computers - Introduction Different implementations of quantum computer.

#### UNIT V QUANTUM ERROR CORRECTION

Quantum error correction and simple examples – The Three Qubit flip code, Three Qubit Phase flip code, The Shor Code - Brief Introduction to Quantum Computing Software - Quantum error-correcting codes:Error models, Criteria for a good code: reversible operations.

### Practical component P : Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

#### **TEXT BOOKS :**

- 1. Dan C. Marinescu, Gabriela M. Marinescu, "Approaching Quantum Computing", Pearson Education 2008-09.
- 2. M.A. Neilson and I.L .Chuang "*Quantum computing and Quantum information*", Cambridge University Press, 2009.
- 3. Vishal Sahani "Introduction to Quantum Computing", TATA McGraw-Hill Publishing Company Limited.

#### **REFERENCE BOOKS:**

- 1. A.Yu.Kitaev, A.H.Shen, M.N.Vyalyi, "Classical and Quantum Computation", American Mathematical Society.
- 2. Mark.M.Wilde, "Quantum information theory" Cambridge university press.
- 3. J.A.Jones, "Quantum information, computation and communication" Cambridge University Press.
- 4. Scott Aaronson, "Quantum computing since Democritus", Cambridge University Press 2013.

#### 9 Hrs

#### 9 Hrs

**Total Number of Hours: 45** 

# 9 Hrs

9 Hrs

## 9 Hrs

# 9 Hrs



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Subject	Code	: Su	Subject Name : POWER ELECTRONICS								L	T/	]	P/	C	
FRFC2	2F18	Pr	oroquis	ite: Soli	d State	Device	c				3	5.L		K //)	3	
	ro T	• Tutori			u State	oorning	$\frac{\mathbf{b}}{\mathbf{D} \cdot \mathbf{D}_{ro}}$	ioct D	Docon	$\mathbf{I}\mathbf{y}$	J	0/0		0	5	
T/L/ETI	$\cdot Th$	eory/La	ai SLi b/Embe	dded Tł	viseu L	d Lab	F . FIU	ject K.	. Resear	ch c. ch	Juits					
OBJEC	TIVE	$\frac{\cos y}{2S}$ :			leory un	Luc										
02020	•	To st	udy abo	ut powe	er electro	onic cire	cuits for	voltage	e and cu	rrent con	trol a	ind pi	rotecti	on.		
	•	To le	arn the	switchir	ng chara	cteristic	s of trai	nsistors	and SC	Rs. Serie	s and	para	llel fu	nctio	ons of	
		SCR	s, Progra	ammabl	e trigge	ring me	thods of	SCR.				•				
	•	To le	arn cont	rolled r	ectificat	tion AC	supplie	s.								
	•	To st	udy of c	onverte	rs and i	nverters	•									
	•	To le	arn abou	ut motor	r contro	l, charge	es, SMF	PS and U	JPS.							
	$\frac{1}{1}$															
COURS	RSE OUTCOMES (COs) : ( 3- 5)															
The Stud	lents	will be able to lerstand the operation of power electronic devices.														
<u>CO1</u>	Und	erstand	the ope	ration o	f power	electro	nic devi	ces.								
CO2	App	ly the ti	the triggering of SCR for natural and forced commutation.													
CO3	Desi	ign phas	n phase controlled convertors using power diodes.													
<b>CO4</b>	Dev	blop different types of inverters and choppers.														
CO5	CO5   Apply the concepts of power electronics in industries and HVDC system.															
Mappin	g of (	Course	Outcom	es with	Progra	am Out	comes (	(POs)	1							
COs/P	Os	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	PO9	PO	10	PO11	P	<b>PO12</b>	
CO	1	3	2	3	2	2	2	2	1	2	2		1		2	
CO2	2	3	2	3	3	2	2	2	2	1	2		1		2	
CO	3	3	3	3	3	3	1	2	1	1	2		2		1	
CO4	1	2	3	3	3	1	1	1	1	1	2		1		2	
CO	5	3	3	3	3	1	1	1		1	2	2	1		2	
COs / P	SOs	PS	601	PS	02	PS	03	PS	504							
<b>CO</b> 1	1		3	2	2	1	2		2							
CO2	2		2		3	1	2		2							
CO.	3		3	2	2	2	2		1	_						
CO ²	1		3		3	2	2		1	_						
CO	5		3	2	2		2		1							
3/2/1 inc	dicate	s Stren	gth of (	Correlat	tion 3	- High,	2- Med	lium, 1-	Low			-				
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Subject Code:	Subject Name : POWER ELECTRONICS	Ty / Lb/	L	Τ/	<b>P</b> /	С
		ETL/IE		S.Lr	R	
EBEC22E18	Prerequisite: Solid State Devices	Ту	3	0/0	0/0	3

#### UNIT I **POWER ELECTRONIC DEVICES**

EDUCAT

Characteristics of Power Devices - Characteristics of SCR - Two Transistor Model of SCR, Characteristics of TRIAC, BJT, MOSFET, IGBT, GTO both Static and Switching Characteristics - Protection of Thyristors against Over Voltage - Over Current, dv/dt and di/dt.

#### UNIT II **TRIGGERING & COMMUTATION TECHNIQUES**

EMED

Turn on Circuits for SCR - Triggering with Single Pulse & Train of Pulses - Triggering with Microprocessor - Different Techniques of Commutation - Natural and Forced Commutation - Series & Parallel Operations.

#### UNIT III PHASE CONTROLLED CONVERTERS

Converters - Single Phase - Three Phase - Half Controlled and Fully Controlled Rectifiers with R, RL and RLE Loads - Waveforms of Load Voltage and Line Current - Harmonic Factor, Power Factor, Ripple Factor, Distortion Factor - Operation with Freewheeling Diode - Effect of Source Inductance - Dual Converter.

#### **UNIT IV INVERTERS & CHOPPERS**

Voltage and Current Source Inverters, Resonant, Series Inverter - Basic Series Inverter, Modified, Improved - PWM Techniques - Single Phase AC Choppers with R and RL Load - Half Wave and Full Wave - DC Choppers - Various Classes of Operation - Buck, Boost and Buck - Boost Type Choppers -Merits and Applications.

UNIT V **AC VOLTAGE CONTROLLERS & INDUSTRAIL APPLICATIONS** 9 Hrs Single-Phase and Three-Phase AC Voltage Controllers - Sequence Control of AC Voltage Regulators.Cycloconverters - Single-Phase and Three-Phase Cycloconverters, SMPS & UPS - Static Compensators - HVDC Transmission System.

#### Practical component P: Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

# **TEXT BOOKS:**

- 1. Rashid, M.H., "Power Electronics Circuits Devices and Applications", Prentice Hall of India, 3 rd Edition, 2004.
- 2. Singh.M.D and Kanchandani, "Power Electronics", Tata McGraw Hill & Hill publication Company Ltd, New Delhi, 2002.

#### **REFERENCES:**

- 1. Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., "Thyristorised Power Controllers", Wiley Eastern Limited, 1986.
- 2. Lander, W., "Power Electronics", McGraw Hill and Company, Third Edition, 1993. 3. P.S. Bimbhra, "Power Electronics", Khanna Publishers, 3rd Edition, 1999.

### 9 Hrs

**Total Number of Hours: 45** 

9 Hrs

9 Hrs





Subject	Code	: Su AF	bject N RCHIT	ame : H ECTUR	HGH S RE	PEED	SWITC	HING	Ty E1	/ Lb/ TL/IE	L	T / S.L	r H	?/ R	C
EBEC2	2E19	Pr	erequis	ite: Cor	nputer	Networ	:ks		Ту	r	3	0/0	0	)/0	3
L : Lectu	ıre T :	Tutori	al SLr	: Super	vised L	earning	P:Pro	ject R :	Resear	ch C: Ci	edits				
T/L/ETI	L: The	eory/La	b/Embe	dded Th	neory an	d Lab		-							
OBJEC	TIVE	:													
	•	To e	quip the	student	ts with t	he conc	epts of I	high spe	eed swit	ching te	chniq	ues i	in ATI	Μ	
		netwo	orks			c									
	•	To ur	nderstan	d the sig	gnifican	ce of qu	ivering	In ATN	1 Modu	les.					
COUDS			mpare	$\frac{1}{2}$	$\frac{1}{5}$	interent	nign sp	eed swi	tching s	systems.					
The Stur	The Students will be able to														
CO1	CO1         Describe the basic concepts of High speed switching newtwork														
CO1	CO2 Interpret the switching concepts and LAN switching technology														
CO3	Clas	sifv blo	cking &	$n_{\rm g}$ non – 1	blocking	archite	ecture.		lology						
CO4	Oper	rate qui	vering r	nethods	in ATN	I switch	nes.								
CO5	Expl	ain add	ressing	model &	& switcl	ning top	ologies.								
Mappin	Iapping of Course Outcomes with Program Outcomes (POs)														
COs/P	Os	<b>PO1</b>	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12												
CO1 3			2	2	2	1	2	1	1		,	2	2		2
CO2	2	3	3	3	3	2	1	3	3	1			3		
CO	3	2	3	2	1	1	1	2	2			1			
CO4	1	3	3	3	3	1	2	1	1						
CO	5	3	3	3	2	1	2	2	2	1		2	3		1
COs / P	SOs	PS	01	PS	02	PS	03	PS	<b>SO4</b>						
CO	1	,	2	1	1		1		1						
CO2	2		3		3		3		2						
CO.	3		3	2	2		3		1		_				
	<u>+</u> -		3		3				1	-					
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3/2/1 Inc	ncate	s Stren	gin of C	Jorreia	uon s	- Hign,	Z- Med	1um, 1-	LOW						
		ic Sciences	ineering Sciences	nanities and Social ences	gram Core	gram Electives	an Electives	r Disciplinary	ll Component	ctical / Project					
	Hur Scie	Pro	▲ Proį	Ope	Inte	Skil	Pra								

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Subject Code:	Subject Name : HIGH SPEED SWITCHING	Ty / Lb/	L	Τ/	<b>P</b> /	С
	ARCHITECTURE	ETL/IE		S.Lr	R	
EBEC22E19	Prerequisite: Computer Networks	Ту	3	0/0	0/0	3

### UNIT I HIGH SPEED NETWORK

Introduction-LAN, WAN, Network evolution through ISDN to B-isdn, Transfer mode and control of B-ISDN, SDH multiplexing structure, ATM standard, ATM Adaption layers

### UNIT II LAN SWITCHING TECHNOLOGY

Switching concepts, Switch forwarding techniques, Switch path control, LAB switching, cut through forwarding, Store and forward, Virtual LANS

### UNIT III ATM SWITCHING ARCHITECTURE

Switch models, blocking networks-Basic-and-enhanced banyan networks, sorting networks merge sorting, Re-arrange able networks-full-and-partial connection networks, Non-blocking networks-Recursive network construction, comparison of non-blocking network, Switches with deflection routing-shuffle switch, Tandem banyan

### UNIT IV QUEUES IN ATM SWITCHES

Internal Queuing-Input, Output and shared queuing multiple queuing networks Combined input, Output and shared queuing-performance analysis of Queued Switches

### UNIT V IP SWITCHING

Addressing model, IP Switching types-flow driven and topology driven solutions, IP over ATM address and next hop resolution, Multicasting, Ipv6 over ATM

### Practical component P: Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

#### **Total Number of Hours: 45**

### **TEXT BOOKS:**

- 1. Ranier Handel, Manfred N Huber, Stefan Schroder, "ATM Networks- concepts protocols applications", 3rd Edition, Addison Wesley, New York, 1999
- 2. AchillePattavina, "Switching Theory: Architecture and performance in broadband ATM Networks", John Wiley & Sons Ltd., New York. 1998

### **REFERENCE BOOKS:**

- 1. Ranier Handel, Manfred N Huber, Stefan Schroder, "ATM Networks- concepts protocols applications", 3rd Edition, Addison Wesley, New York, 1999
- 2. AchillePattavina, "Switching Theory: Architecture and performance in broadband ATM Networks", John Wiley & Sons Ltd., New York. 1998
- 3. Christopher Y Metz, "Switching protocols & Architectures", McGraw Hill Professionals publishing, NewYork. 1998.

### 9 Hrs

9 Hrs

9 Hrs

# 9 Hrs

### 9 Hrs





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Subject Code	: S	Subject Name :INFORMATION CODING						Ty /	/ Lb/ [ /IF	L	T/ SIr	P/ P	C	
EBEC22E20	P	rereauis	ite: Dig	rital Co	mmuni	cation			Tv		3	0/0	0/0	3
L : Lecture T	: Tuto	rial SL	r : Supe	rvised I	Learning	P:Pr	oiect R	: Re	esear	ch C: Ci	redits			
T/L/ETL : Theory/Lab/Embedded Theory and Lab														
OBJECTIVES :														
• To have a complete understanding of error-control coding.														
• To understand encoding and decoding of digital data streams.														
<ul> <li>To introduce methods for the generation of these codes and their decoding techniques.</li> <li>To have a detailed knowledge of compression and decompression techniques.</li> </ul>														
<ul> <li>To have a detailed knowledge of compression and decompression techniques.</li> <li>To introduce the concepts of multimedia communication</li> </ul>														
• To introduce the concepts of multimedia communication.														
COURSE OUTCOMES (COs) : (3-5) The Students will be able to														
	will be	Recogniz	e the ve	arious c	oding th	eorema	in info	rmat	ion t	heory				
		Interpret	the digi	tal mod	ulation	toohnia		digit		ding				
	-				1.					ung				
CO3	CO3 Analyze the different coding methods and apply it for error correction													
CO4	]	Demonst	rate the	differen	nt comp	ression	techniq	ues						
CO5	]	Develop	a code	for aud	io/video	signals	5							
Mapping of (	Mapping of Course Outcomes with Program Outcomes (POs)													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO	)8	PO9	PO10	PO11	PO	)12
CO1	3	3	3	3	2	3	2	2	2	2	3	3		2
CO2	3	3	3	3	3	2	2	1	L	2	3	3		3
CO3	3	3	3	3	3	3	1	1	L	2	3	3		3
CO4	3	3	3	3	2	3	1	2	2	2	3	3		3
CO5	3	3	3	2	2	3	1	2	2	2	3	3		3
COs/PSOs	P	<u>soi</u>	PS	02	PS	03	PS	504					_	
		3		3		3		2						
<u>CO2</u>		3		<u>5</u>		<u>s</u>		2					-	
<u> </u>		3		<u>)</u>		2		1 2						
C04		3		2		<u></u>		<u>2</u> 1						
3/2/1 indicate	s Stre	<u>s</u> ngth of (	Correla	tion 3	A-High	<u>-</u> . 2- Me	dium. 1	1 -Lov	w					
	5 DHC		Correia			, _ 1110								
gory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project					
Cate					$\checkmark$									

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Subject Code:	Subject Name :INFORMATION CODING	Ty / Lb/	L	Т/	<b>P</b> /	C
	TECHNIQUES	<b>ETL/IE</b>		S.Lr	R	
EBEC22E20	Prerequisite: Digital Communication	Ту	3	0/0	0/0	3

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#### UNIT I **INFORMATION ENTROPY FUNDAMENTALS**

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Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding - Discrete Memory less channels - channel capacity - channel coding Theorem - Channel capacity Theorem.

#### UNIT II DATA AND VOICE CODING

Differential Pulse code Modulation - Adaptive Differential Pulse Code Modulation - Adaptive sub band coding - Delta Modulation - Adaptive Delta Modulation - Coding of speech signal at low bit rates (Vocoders, LPC).

#### UNIT III ERROR CONTROL CODING

Linear Block codes - Syndrome Decoding - Minimum distance consideration - cyclic codes - Generator Polynomial - Parity check polynomial - Encoder for cyclic codes - calculation of syndrome -Convolutional codes.

#### **UNIT IV COMPRESSION TECHNIQUES**

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression - Graphics Interchange format - Tagged Image File Format - Digitized documents -Introduction to JPEG standards.

#### UNIT V AUDIO AND VIDEO CODING

Linear Predictive coding - code excited LPC - Perceptual coding, MPEG audio coders - Dolby audio coders - Video compression - Principles - Introduction to H.261 & MPEG Video standards.

#### Practical component P : Include case studies / application scenarios

#### **Research component R : Future trends / research areas / Comparative Analysis**

#### **Total Number of Hours: 45**

#### **TEXTBOOKS:**

- 1. Simon Haykin, "Communication Systems", John Wiley and Sons, 4th Edition, 2001.
- Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002; Chapters: 3,4,5.

#### **REFERENCES BOOKS:**

- Mark Nelson, "Data Compression Book", BPB Publication 1992. 1.
- Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995. 2.

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9Hrs

9Hrs

9Hrs

# 9 Hrs



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Subject Code	e: Su SV	Subject Name :OPTICAL NETWORK AND						Ty / ETI	Lb/ /IE	L	T / S.L.r	P/ R	C	
EBEC22E21	Pr	erequis	site: nil		QULD				Ty	<b>1</b> / <b>1 1</b>	3	0/0	0/0	3
L : Lecture T	: Tutor	ial SL	r : Supe	rvised I	Learning	g P:Pr	oject R	: Re	search	n C: C	redits	I		1
T/L/ETL : Th	T/L/ETL : Theory/Lab/Embedded Theory and Lab													
OBJECTIVES :														
• To learn basic elements of optical communication														
• To understand networks and switching techniques														
COURSE O	UTCO	MES (	COs) : (	(3-5)										
The Students	s will b	ill be able to												
CO1		Underst	and the	basic e	lements	of option	cal fibei	r.						
CO2		Underst	and the	concep	t of swi	tching r	network	in O	SI lay	ver				
CO3		Explain	n all typ	es of op	otical ne	tworks.								
CO4		Analyze	e multip	le acces	ss metho	ods in W	VDM.							
CO5		Underst	and the	all opti	cal swit	ches.								
Mapping of	Cours	e Outco	omes wi	th Prog	gram O	utcome	s (POs)							
COs/POs	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO	8 F	PO9	PO10	PO11	PO	)12
CO1	3	2	1	3	1	1	1	1		1	1	1		2
CO2	3	3	2	2	1	2	3	3	6	1	3	2		2
<u>CO3</u>	1	3	3	1	1	3	1	1		1	3	1	_	1
<u>CO4</u>	1	3	3	1	3	1	3	2	2	1	3	1		$\frac{2}{2}$
	3 D	<u>2</u>		$\frac{3}{3}$	D		3 D	<u> </u>		1	2	1		2
PSOs	1	501	1.	502	1,	505	1.	504						
CO1		2		2		1		1						
CO2		3		2		<u> </u>		2						
CO3		2		3		2		2						
CO4		1		3		2		2						
CO5		3		2		1		2						
3/2/1 indicate	es Strei	ngth of	Correla	tion .	3- High	,2- Med	lium,-L	ωw						
sgory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project					
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Subject Code:	Subject Name : OPTICAL NETWORK AND	Ty / Lb/	$\mathbf{L}$	Τ/	<b>P</b> /	С
	SWITCHING TECHNIQUES	ETL/IE		S.Lr	R	
EBEC22E21	Prerequisite: nil	Ту	3	0/0	0/0	3

#### UNIT I **INTRODUCTION**

Optical communication – Basics of sources, transmitters, Modulators, Optical fiber, photo detectors, and receivers - Switching in networks - circuit switched - Packet switched - cell switched - Virtual circuit switched – Burst switched (fast circuit switched) – Transmission /Asynchronous – synchronous. 9 Hrs

#### **UNIT II** SWITCHING NETWORKS

Layering in packet switched networks – motivation – commonly used abstraction: Physical layer – Data link layer - Network layer - Transport layer - Application layer - Layering in circuit switched networks -Physical layer – Multiplexing standards – Signaling – CAS, CCS, SS7 concept – Data plane – management plane - control plane - concept.

#### **OPTICAL TRANSMITTER AND RECEIVERS** UNIT III

EMED

First generation networks - SDH/SONET - Computer interconnections - ESCON - Fiber channel - HIPPI - FDDI - ATM - DQDB - Components - description - Mode locked laser (for ps pulses) - Tunable filters multiplexers - De-multiplexers - Tunable wavelength convertors - Optical amplifiers.

Fiber – EDFA – SOA – Tunable transmitters – Tunable receivers – Dispersion compensating fibers – Multiplexing techniques - SDM - TDMA - WDMA (OFDMA) - DWDM - SCM - CDMA - Protocols for single channel broadcast networks - ALOHA, CSMA/CD - Problems with CSMA/CD - Definition of high speed network.

#### MULTIPLE ACCESS METHODS **UNIT IV**

Classifications of multiple access methods – Random access – Reserved access – Scheduled access – Multichannel multiple access protocols - Desirable characteristics of protocol - Scalability - Fairness -TTTR - TTFR - FTTR - FTFR - Problem of wavelength stability - Multi hop WDM network - Shuffle net - MSN - Wavelength routed networks - Mesh - Ring - Traffic grooming problem - IP over optical framework - ASON - MpeS - Burst switched network (buffer less networks).

#### **OPTICAL SWITCHES** UNIT V

All -optical circuit switches - All-optical packet switches - Broadcast and select - Wavelength routed -Spaced switch based - Discussion on various switch architectures - Packet buffering techniques: Travelling type – Recirculating type: Protection and restoration – Restoration mechanism: Restoration timing issues – Path protection- Span protection – P –cycles.

#### Practical component P : Include case studies / application scenarios

#### **Research component R : Future trends / research areas / Comparative Analysis**

#### **Total Number of Hours: 45**

#### **TEXT BOOKS:**

- 1. Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4 th Edition., 2010.
- 2. Hussein T.Mouftah and Jaafar M.H.Elmirghani, "Photonic Switching Technology Systems and Networks ",IEEE Press, New York -10016-5997,ISBN - 0-7803-4707-2.
- 3. C.Siva Rama Murthy and Mohan Gurusamy, "WDM Optical Networks Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi -2002.

#### **REFERENCE BOOKS:**

- 1. John M. Senior, "Optical Fiber Communication", Second Edition, Pearson Education, 2007.
- 2. Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2009.
- 3. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3 rd Edition, 2008.
- 4. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
- 5. Uyless Black, " Optical Network: Third Generation Transport System", Pearson Education, Ist edition,2002.
- 6. Rajiv Ramaswamy and Kumar N.Sivarajan, "Optical Networks A Practical Persepctive", Morgan Kauffman, 2004

### 9 Hrs

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9 Hrs


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Subject	Code	: Su	ıbject N	ame : I	DEVICI	E MOD	ELING	r	]	Гу / Lb/ ГТІ /IF	L	T/	r P	/	C
EBEC2	2E23	Pr	ereanis	ite: Soli	id State	Device	S		1	rv	3	0/0		/0	3
L·Lectu	ire T	• Tutori	al SL r		vised I	earning	$\mathbf{P} \cdot \mathbf{Prc}$	iect R	· Rese	arch C· Ci	redits	0/0		0	U
T/L/ETI	$\therefore$ The	eorv/La	b/Embe	dded Tł	neorv an	d Lab	1.110	jeet it	. 1050		cuits				
OBJEC	TIVE	'S :													
•	To un	derstan	d passiv	e device	es and s	tructure	s								
•	To un	derstan	and the integrated BJT and MOS devices												
• '	To im	plemen	t solid s	tate circ	uits usi	ng SPIC	E mode	eling							
COURS	SE OU	JTCON	AES (C	Os):(3	<b>3- 5</b> )										
The Stud	dents	will be	able to												
CO1	Disc	uss the	types an	nd struc	tures of	resistor	rs & cap	acitors i	in IC.						
CO2	Criti	cize th	ze the dynamic & static behavior of integrated diodes.												
CO3	Lean	n diffe	rent mod	lels of i	ntegrate	d BJT.									
<b>CO4</b>	Stud	y the n	nodeling	of MO	SFETS	&their o	characte	ristics.							
CO5	Ana	nalyze the small signal & large signal modeling of devices using SPICE.													
Mappin	g of (	Course	Outcon	nes with	Progra	am Out	comes (	(POs)							
COs/P	Os	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	PO	8 PO9	PO	<b>D10</b>	PO11	. ]	PO12
CO	1	3	3	2	2	1	2	3		3	2	2	3		
CO	2	3	3	3	3	3	2	3	3		2	2	3		
CO.	3	3	3	3	3	3	1		2	3			3		
CO	1	3	3	3	3	3	2	3	3		2	2			
CO	5	3	3	3	3	3	2			3	2	2			
COs / P	SOs	PS	501	PS	02	PS	03	PS	<b>SO4</b>						
CO	1		3		3		1		3		_				
CO	2		3		3				3		_				
CO.	3		3	1	2	-	1		3		_				
CO	1		3		3				3						
CO	5		3		3		1		3						
3/2/1 inc	dicate	s Stren	igth of (	Correla	tion 3	- High,	2- Med	lium, 1-	Low						
	egory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project					
	Caté					$\checkmark$									

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Subject Code:	Subject Name : DEVICE MODELING	Ty / Lb/	L	Τ/	<b>P</b> /	С
		ETL/IE		S.Lr	R	
EBEC22E23	Prerequisite: Solid State Devices	Ту	3	0/0	0/0	3

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## UNITI INTEGRATED PASSIVE DEVICES

Types and Structures of Resistors and Capacitors in Monolithic Technology – Dependence of Model Parameters on Structure.

## UNIT III NTEGRATED DIODES

EDUCAT

Junction and Schottky Diodes in Monolithic Technologies – Static and Dynamic Behavior – Small and Large Signal Models – SPICE Models.

## UNIT III INTEGRATED BIPOLAR TRANSISTOR

Types and Structures in Monolithic Technologies – Basic Model (Eber Moll_-Cunmel – Poon Model – Dynamic Model, Parasitic Effects – SPICE Model –Parameter Extraction.

## UNIT IV INTEGRATED MOS TRANSISTOR

n-MOS and p-MOS Transistor – Threshold Voltage -Threshold Voltage Equations – MOS Device Equations – Basic DC Equations Second Order Effects – MOS Models Small Signal AC Characteristics – MOSFET SPICE Model Level 1,2,3,4

## UNIT V SPICE MODELLING

Advanced Concepts of Large Signal & Low Signal Modeling

## **Practical component P : Include case studies / application scenarios**

## **Research component R : Future trends / research areas / Comparative Analysis**

## TEXT BOOKS:

- 1. Daniel Foty, "MOSFET Modeling with Spice" prentice hall, 1997.
- 2. Neil Weste and Kamran Eshranghian "Principles of CMOS VLSI Design, A System Perspective", "Addition – Wesley, 1993.

## **REFERENCES BOOKS:**

- 1. Jacob Millman& Arvin Millman, "Micro Electronics", McGraw Hill (Second Edi) 1987.
- 2. M. Satyagi, John Wiley "Introduction to Semi-conductor materials and devices", New Edition.



9 Hrs

9 Hrs

9 Hrs

9 Hrs

**Total Number of Hours: 45** 



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Subject	Code	: Su	bject N	ame : V	/LSI TI	ECHNC	OLOGY	7	]	Fy / Lb/ ETL/IE	L	T/ S.L	r R	/	C
EBEC22	2E24	Pr	erequis	ite: Soli	id State	Device	S		-	<u>Гу</u>	3	0/0	0	/0	3
L : Lectu	ire T	: Tutoria	al SLr	1 SLr : Supervised Learning P : Project R : Research C: Credits											
T/L/ETL	L: The	eory/La	b/Embe	dded Th	neory an	d Lab		5							
<b>OBJEC</b>	TIVE	:													
To enabl	e the	students	s to und	erstand	various	design	flow in	VLSI ai	nd the	ir applicat	tions	in fu	zzy sys	tem	18
COURS	ΕΟ	TCON	IES (CO	(3)	3-5)										
The Stuc	lents	will be a	able to		,										
CO1	Stud	y the fa	bricatio	n of CM	1OS tra	nsistors	& its la	yout de	sign rl	es.					
CO2	Inter	pret the	e interco	nnectio	n resista	unce & c	capacita	nce & tl	heir e	xtraction8	zestir	natio	n.		
CO3	Lear	n the di	stributio	on of clo	ock sign	als in a	chip, he	encefort	h the	system tin	ning.				
CO4	Illus	trate VI	LSI imp	lementa	tion of I	FLC, tes	sting tec	chniques	sand t	he CAD a	utom	nation	for the	e sai	me.
CO5	Desi	gn diffe	erent typ	bes of ac	ders an	d multip	olier.								
Mappin	g of (	Course	Outcom	es with	Progra	am Out	comes (	POs)	r -		-			_	
COs/P	Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	8 PO9	P	010	<b>PO1</b> 1		PO12
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CO2	2	3	3	2	3	3							1		3
CO3	3	3	3	3	2	3							1		3
CO4	Ļ	3	3	3	3	3							1		3
COS	5	3	3	3	3	3							3		3
COs / P	SOs	PS	01	PS	02	PS	03	PS	<b>SO4</b>						
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CO2	2		3		3		2		3						
CO3	3		3		3		3		3						
CO4	Ļ		3		3	2	2		3						
COS	5		3		3		3		3						
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Subject Code:	Subject Name : VLSI TECHNOLOGY	Ty / Lb/	L	Τ/	<b>P</b> /	С
		ETL/IE		S.Lr	R	
EBEC22E24	Prerequisite: Solid State Devices	Ту	3	0/0	0/0	3

### UNIT I VLSI DESIGN FLOW

Design hierarchy concepts of regularity, modularity & locality VLSI Design styles - CMOS Fabrication Technology- Introduction, Fabrication Process flow- basic steps, CMOS n-well process, p-well process, twin tub process, layout design rules-Introduction-CMOS Layout design rules - CMOS inverter Layout design -Layout of CMOS NAND & NOR gates - Complex CMOS Logic gates

### **PARASITIC EXTRACTION & PERFORMANCE ESTIMATION FROM** UNIT II 9 Hrs PHYSICAL STRUCTURE

Introduction – Reality with inter connection –MOSFET capacitances-interconnect capacitance estimation – interconnect resistance estimation

### UNIT III **CLOCK SIGNALS & SYSTEM TIMING**

On chip clock generation & distribution using ring & pierce crystal oscillator - non - overlapping clock signals and gate level implementation – H-tree clock distribution N/W – clock skew reduction – Zero -Skew clock routing N/W- Clock distribution N/W for DEC alpha µp chips

#### **UNIT IV TESTABILITY OF INTEGRATED SYSTEMS-VLSI FOR FUZZY** 9Hrs LOGIC SYSTEMS

Design constraints – Testing – The rule of ten – terminology – Failures in CMOS – Combinational Logic Testing - Practical Ad-Hoc DFT guidelines - Scan design techniques- Integrated implementations of FLC, Digital implementation of FLC's, Analog implementation of FLC's, Mixed digital / analog implementations of Fuzzy systems, CAD automation for FLC DESIGN, NN implementing fuzzy systems.

### UNIT V **ARITHMETIC FOR DIGITAL SYSTEMS**

Introduction – notation systems – Principles of generation & propagation – 1 bit full adder – Enhancement Techniques for Adders - multi operand - Adders - Multiplication - Addition and Multiplication in Galois Fields GF(2n)

Practical component P: Include case studies / application scenarios

## Research component R: Future trends / research areas / Comparative Analysis

## **Total Number of Hours: 45**

## **TEXT BOOKS:**

1. Cheng., SZE., "VLSI Technology"., Prentice Hall of India,

2. Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt Ltd., 1993.

## **REFERENCES:**

1. Cheng., SZE., "VLSI Technology"., Prentice Hall of India,

2. Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt Ltd., 1993.

3. Horspool., Gorman., "The ASIC Handbook", Tata McGraw Hill Publications., 1999

4. Randall .L. Geiger and P. E. Allen, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Company, 1990



9 Hrs

9Hrs



Subject Code	Ie:     Subject Name :     Ty / Lb/     L     T /       BIOMEDICAL INSTRUMENTATION     ETL/IE     S.L												C	
EBEC22E25	Pr Ins	erequisi strumen	te: Mea tation,	sureme	ent and Systen	ıs		T	Y	3	0/0	0/0	3	
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T/L/ETL : Th	eory/La	ab/Embe	dded Th	eory an	nd Lab		-							
OBJECTIVI	ES :													
• To st	udy the	methods	s of reco	rding v	arious b	io pote	ntials							
• To st	udy hov	y how to measure biochemical and various physiological information												
• To ur	nderstar	id the use	orking o of radi	ation fo	vilicii w vr diagn	ostic an	d therar		inal functi	oning				
• To ur	nderstar	id the us	ed and t	echniau	ie of ele	ctrical s	safetv in	n Hosi	oitals					
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The students	will abl	e to	••••											
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	depart	ment and	d labora	tories of	f a hosp	ital and	thereby	reco	gnize their	limitati	ons.			
CO2	Interp	ret techn	ical asp	ects of 1	nedicin	e.								
CO3	Famili	iarize st	udents	with v	various	medic	al equi	pmen	t's and t	heir teo	chnical	aspe	ects.	
	Under	Understand medical diagnosis and therapy.												
CO4	Introd	Introduce students to the measurements involved in some medical equipment's.												
CO5	Under	Understanding the problem and ability to identify the necessity of equipment's to a specific problem												
Mapping of	problem. ng of Course Outcomes with Program Outcomes (POs)													
	DO1	DOA	DOJ	DO4	DO5	DOC		DO		<b>DO10</b>	<b>DO11</b>	D	010	
COs/POs	POI	PO2	PO3	PO4	P05	PO6	PO7	PO	8 PO9	POIO	POII	P	J12	
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CO2	1	1	1	2	1	3	3	2	3	1	2		2	
CO3	1	2	1	2	1	3	3	3	3	2	3		2	
<u>CO4</u>	1	1	1	1	2	3	3	3	3	2	2	_	2	
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# DEEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) E.V.R. High Road, Maduravoyal, Chennal-95. Tamilnadu, India.

**ONAL AND RESEARCH** 

Subject Code:	Subject Name : BIOMEDICAL INSTRUMENTATION	Ty / Lb/ ETL/IE	L	T / S.Lr	P/ R	С
EBEC22E25	Prerequisite: Measurement and Instrumentation, control Systems	Ту	3	0/0	0/0	3

### UNIT I **BASIC PHYSIOLOGY**

Cells and their Structures – Transport of Ions Through Cell Membrane – Resting and Excited State – Trans membrane Potential – Action Potential – Bio-Electric Potential – Nervous System – Physiology of Muscles - Heart and Blood Circulation - Respiratory System - Urinary System.

#### **UNIT II BASIC TRANSDUCER PRINCIPLES AND ELECTRODES** 9 Hrs

The Transducer Principles – Active Transducers – Passive Transducers – Transducer for Bio-Medical Application – Electrode Theory- Bio-Potential Electrode – Bio-Chemical Transducer.

### **UNIT III** CARDIOVASCULAR SYSTEM

The Heart and Cardiovascular System – Blood Pressure – Characteristics of Blood Flow – Heart Sounds - Electro Cardiograph – Measurements of Blood Pressure – Measurement of Blood Flow and Cardiac O/P Plethysmography – Measurements of Heart Sounds

#### **X-RAY AND RADIOISOTOPE INSTRUMENTATION:** 9 Hrs **UNIT IV**

X-ray Imaging Radiography – Fluoroscopy – Image Intensifiers – Angiography - Medical use of Radioisotopes – Beta Radiations – Detectors – Radiation Therapy.

### UNIT V **BIO-TELEMETRY**

Introduction to Bio-Telemetry – Physiological Parameters Adaptable to Bio-Telemetry – The Components of Bio-Telemetry Systems - Implantable Units - Applications of Telemetry in Patient Care - Application of Computer in Bio-Medical Instrumentation, Anatomy of Nervous System – Measurement from the Nervous System – EEG – EMG.

## Practical component P: Include case studies / application scenarios Research component R: Future trends / research areas / Comparative Analysis

### **Total Number of Hours: 45**

## **TEXT BOOKS:**

- 1. M. Arumugam, "Bio-medical Instrumentation" Anuradha Agencies Publishers, 1992.
- 2. Khandpur," Handbook on Biomedical Instrumentation" Tata McGraw Hill Co Ltd., 1989.

### **REFERENCE BOOKS:**

- 1. Leusis Cromwell Fred, J. Werbell and Erich A.pfraffer, "Biomedical instrumentation and Measurements" – Prentice Hall of India, 1990.
- 2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 1997



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9 Hrs

9 Hrs



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eriyar E.V.R. High	Road, Maduravoyal,	Chennai-95.	Tamilnadu, India.

Subject Code	: Subject Name :								T y/ Lb/	L	T/	P/	С
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	Stud	y of ear	th segm	ent and	space s	egment	compo	nents					
	<ul> <li>Study of early segment and space segment components</li> <li>Study of satellite access by various users</li> </ul>												
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COURSE OI		$\frac{y \text{ of } D \text{ f}}{\text{MES}(C)}$	$(\mathbf{Os})$	ompres	51011 514	ildul u.s.							
The students	will be able to												
CO1	Recognize various element of orbital Mechanics												
CO2	Interpret various multiple access and switching techniques.												
CO3	Illustrate the concepts involved in satellite link design												
CO4	Analy	Analyze the principles, concepts and operation of satellite communication systems											
CO5	Exami	Examine the various process of earth station design.											
Mapping of	Course Outcomes with Program Outcomes (POs)												
COs/POs	PO1         PO2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12												
CO1	3	3	2	2	2	2	2	2		2	1	2	
CO2	3	3	3	2	3	2	2	3	3	3	3	3	
CO3	3	3	3	3	2	2	2	1	2	3	2	2	
CO4	3	3	3	3	2	2	1		2	3		2	
CO5	3	3	3	2	3	2	2		3	2		3	
COs / PSOs	PSO1	L	PSO2		PSO3		PSO4						
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gory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project				
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Subject Code:	Subject Name :	T y/ Lb/	L	Τ/	<b>P</b> /	С
	SATELLITE COMMUNICATION	ETL/IE		S.Lr	R	
EBEC22E28	Prerequisite: Communication Systems	Ту	3	0/0	0/0	3

INSTITUTE

### UNIT I **ELEMENTS OF ORBITAL MECHANICS**

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ersity with Grad

Equation, Orbital Elements, Orbital Perturbation, Tracking and Orbital Determination, Orbital Correction Control.

ELEMENTS OF COMMUNICATION SATELLITE DESIGN

Space Environment, Spacecraft Configuration, Spacecraft Subsystem, Payload, Reliability Consideration Spacecraft Integration and Testing.

### UNIT II MULTIPLE ACCESS TECHNIOUES

FDM - FM - FDMA, TDMA, SSMA / CDMA, RANDOM MULTIPLE Access Techniques; Packet Switching and Packet Satellite Networks Satellite on Board Processing and Switching.

### UNIT III SATELLITE LINK DESIGN

Types of System: BSS, Performance Requirements and Standards for Telephony, TV and DATA, Performance Impairments, Noise, Interference, Inter modulation, Design of Typical Satellite Links.

### **UNIT IV** DOMESTIC SATELLITE SYSTEMS

The INSAT System, International System, INTELSAT, IMMARSAT, Satellite Based Personal Communication LEO, ICO, GEO Systems.

### UNIT V EARTH STATION DESIGN

Earth Station Configuration, Site Selection, Antenna and Tracking Systems, Receiver and Transmitter Subsystems, Terminal Equipment: Telephone / Video Interface, Rearward Links, Miscellaneous Facilities Like Echo Suppressor, FM Digitizers, Ground Station Measurements, Elements of Frequency Coordination and Control, VSAT Networks and Terminals - Satellite Broadcasting, Satellite TV Systems.

## Practical component P: Include case studies / application scenarios

### Research component R: Future trends / research areas / Comparative Analysis **Total Number of Hours: 45**

## **TEXT BOOKS:**

- 1. T. Pratt and C.W. Bostian, "Satellite Communication" John Wiley & Son, 1986.
- 2. Abdul Namith, "Satellite Communication"-Lakshmi Publications.

## **REFERENCES:**

- 1. B.N. Agarwal, "Design of Geosynchronous Spacecraft" Prentice Hall, 1986.
- 2. D. Roddy, "Satellite Communication" Prentice Hall, 1989
- 3. M. Richharia, "Satellite Communication SystemsDesign Principles", Macmillan Press Ltd. Second Edition 2003.

# 9 Hrs

## 9 Hrs

9 Hrs

# 9 Hrs

9 Hrs



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T/L/ETL : The	eory/La	ab/Embed	ded The	ory and	Lab						-			
OBJECTIVE	:													
• To lea	rn the	Basics of	5G and	Beyond	Wirele	ss comn	nunicati	on						
<ul> <li>To pro</li> </ul>	ovide a	basic und	lerstand	ing of th	e key te	s of 50	3 be	yond cor	nmunicat	ion				
systen	ns		. 1 1											
• 10 stu	ay 5G	wireless	channel	models										
COURSE OU	ITCO	MES (CO	<b>s</b> ):(3-	5)										
Upon the com	pletior	of the co	urse the	students	s will be	e able to	_							
CO1		Distingu	ish the 1	najor ce	llular c	ommuni	cation s	tandards	5					
CO2		Underst	and the 5	5G techn	iques									
CO3		Analyze	various	modula	tion and	d multip	lexing t	echnique	es					
CO4		Demons	emonstrate the key enablers of 6G Communication											
CO5		Apply N	pply Machine Learning in 5G Wireless Communications											
Mapping of C	Course	Outcom	outcomes with Program Outcomes (POs)											
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO	9	PO10	PO11	PO12	
CO1	2	1	2	2	2	1	1		1		1	1	1	
CO2	2	1	2	2	3	1	1		1		1	1	1	
CO3	2	3	3	3	3	1			1					
CO4	2	3	3	3	3	1							2	
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CO2	3		3		1		2							
CO3	3		3				3							
CO4	3		3				3							
CO5	3		3				3							
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Subject Code:	Subject Name : NEXT GENERATION COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SL r	P/R	С
EBEC22E29	Prerequisite: nil	Ту	3	0/0	0/0	3

## UNIT I INTRODUCTION TO FUNDAMENTALS OF WIRELESS COMMUNICATION 9 Hrs

Evolution of cellular systems-Requirements, goals, and vision of the next generation wireless communication systems- Fading-Digital modulations-Performance Metrics

## UNIT II KEY CONCEPTS IN 5G

Small cells: Past, present, and future trends of cellular networks coverage and capacity of small cell networks-Interference management, D2D architecture Towards IoT Spectrum sharing. Massive MIMO: Point-to-point MIMO, Virtual MIMO (relaying), multiuser MIMO Massive MIMO, propagation channel model, channel estimation, uplink and downlink data transmission-capacity bounds- achievable rate- energy and spectral efficiency trade-off

## UNIT III mmWAVE TECHNOLOGY AND MULTIPLE ACCESS TECHNIQUES 9 Hrs Applications-Radiowave propagation-Physical layer design and algorithms- mmWave MIMO challengeschannel modeling- channel estimation- Beamforming. Multiple access techniques: OFDM, filter banks, GFDM, OTFS, NOMA

## UNIT IV TRANSITION TO 6G

Wireless energy harvesting-Machine learning, visible light communication, Intelligent reflecting surface (IRS)- Extremely Large Aperture Massive MIMO- Energy-rate trade-off- Simultaneous wireless information and power transfer (SWIPT)- time-switching- power splitting- Wireless powered communication networks -Outage probability and throughput.

## UNIT V APPLICATIONS OF MACHINE LEARNING

Channel modeling and estimation Spectrum sensing and sharing Resource allocation (NOMA, mmWave massive MIMO).

Practical component P : Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis Total Number of Hours: 45

## **TEXT BOOKS:**

1. R. Vannithamby and S. Talwar, *Towards 5G: Applications, Requirements and Candidate Technologies.*, John Willey & Sons, West Sussex, 2017.

2. Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology

## **REFERENCES:**

1.T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock, *Millimeter Wave Wireless Communication.*, Pearson Education, 2015.

2.M. Vaezi, Z. Ding, and H. V. Poor,, *Multiple Access techniques for 5G Wireless Networks and Beyond.*, Springer Nature, Switzerland, 2019

## 9 Hrs

9 Hrs

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• To e	expose t	he stude	ent to the	e evolvi	ng next	generatio	on wirele	ess netv	vorks a	nd th	eir as	ssociated	t	
chal	lenges				-	-								
COURSEC	DUTCO	MES (	$\overline{COs}$ : (	3-5)										
The Student	s will b	e able to	)	0 0)										
CO1	]	Describ	e the bas	ics of t	he softw	are defir	ed radio	os.						
CO2	,	To learr	the har	dware a	nd softw	are arch	itecture	of softv	vare de	fined	l radi	0		
CO3		Design	the wire	ess net	works ba	sed on f	he cogni	tive rac	lios					
CO4	,	To unde	erstand c	ognitive	e radio a	rchitectu	ire							
C04		Eveloie	the conv	ogniti v	hind the	wirolog	notwor	ka and i	novt go	norot	ion n	otuvorla		
005		Explain	the conc			wireless	s networ	ks and l	liext ge	nerat	юп п	etworks	•	
Mapping of	Cours	e Outco	omes wit	h Prog	ram Ou	tcomes	(POs)							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	10	PO11	PO	012
CO1	3	1	1	1	3	1	3	1		2	2			
CO2	3	1	2	3	2	3	2	3	1			2		
CO3	2	1	3	1	2	2	2	1	1	2	2			
<u>CO4</u>	2	3	2	3	2	3	3	1		3	3	3		
	3		2		3	$\frac{3}{2}$		$\frac{2}{104}$	2		5			
	P	501	Pa	502	PS	003	PS	004						
CO1		3		2				\$		-				
CO2		3		3		2		, }						
CO3		3		3			3	;						
CO4		3				3	3	;						
CO5		3		2			3	;						
H/M/L indi	cates St	trength	of Corr	elation	H- Hi	<b>gh, M-</b>	Medium	n, L-Lo	W					
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		Ices	ocie											
		cier	d S		ives		ary	ant	ect					
	seou	ы S	an	ore	lecti	ive	olin	one	Proj					
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Subject Code:	Subject Name : COGNITIVE RADIO	Ty / Lb/	L	T/S	P/R	С
		ETL/IE		Lr		
EBEC22E30	Prerequisite: Communication Theory	Ту	3	0/0	0/0	3

#### UNIT I **INTRODUCTION TO** SDR

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

### **SDR ARCHITECTURE** UNIT II

Essential functions of the software radio, architecture goals, quantifying degrees of Programmability, top level component topology, Computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

## UNIT III INTRODUCTION TO COGNITIVE RADIOS

EMED

Making radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

### UNIT IV **COGNITIVE RADIO ARCHITECTURE**

Primary Cognitive Radio functions, Behaviors, Components, A-Priori Knowledge taxonomy, observe phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide, act phases; knowledge representation, design rules.

### NEXT GENERATION WIRELESS NETWORKS UNIT V

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

## Practical component P : Include case studies / application scenarios **Research component R : Future trends / research areas / Comparative Analysis**

**Total Number of Hours: 45** 

## **TEXT BOOKS:**

- 1. Alexander M. Wyglinski, MaziarNekovee, and Y. Thomas Hou, "Cognitive Radio Communications And Networks - Principles And Practice", Elsevier Inc., 2010.
- 2. E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, "Principles of Cognitive Radio", Cambridge University Press, 2013.

3. Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & Sons Ltd., 2009. **REFERENCES:** 

- 1. Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, "Cognitive Radio Networks From Theory to Practice", Springer Series: Analog Circuits and Signal Processing, 2009.
- 2. J. Mitola, "Cognitive Radio: An Integrated Agent Architecture for software defined radio", Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.
- 3. Simon Haykin, "Cognitive Radio: Brain -empowered wireless communications", IEEE Journal on selected areas in communications, Feb 2005.
- 4. Ian F. Akyildiz, Won Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "NeXt generation /dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.
- 5. Joseph Mitola, "Software Radio Architecture: A Mathematical Perspective" IEEE Journal on Selected Areas in Communication, Vol. 17, No. 4, April 1999.
- 6. HasariCelebi ,Huseyin Arslan, "Enabling location and environment awareness in cognitive radios", Elsevier Computer Communications, January 2008.

## 9 Hrs

9 Hrs

## 9 Hrs

9 Hrs

9 Hrs



## **ELECTIVE V - Electronics Stream**

Subject	Cod	e: Su M	bject N EMS S	lame : YSTEN	INTRO M DES	ODUCT IGN	FION T	] F	Fy / I ETL/	Lb/ TE	L	T/S	Lr	P/R	C	
EBEC2	2E31	Pr	erequi	site: Ele	ectroni	c Circu	its		]	Γу		3	0/	0	0/0	) 3
L : Lect	ure T	: Tutor	ial Sl	Lr : Sup	ervised	Learni	ng P:l	Project	R:F	Resea	urch C	: Cre	edits			
T/L/ET	L:Tł	neory/L	ab/Emt	bedded '	Theory	and Lal	b									
OBJEC	TIV	E :														
•	To er	hable th	e stude	nts to le	earn the	basic c	oncepts	s of ME	MS d	lesig	n and	their	r appl	licat	ions	
COURS	SE O	UTCO	MES (	COs):	(3-5)											
The Stu	dents	will be	able to	)	. ,											
CO1	Be f	familiar	with c	oncepts	of ME	MS, ser	sors an	d fabric	ate te	echni	iques.					
CO2	Тоа	analyze	differe	nt prope	erties of	f MEM	S, syste	ms.								
CO3	Тοι	understa	and and	l analyz	e electr	ostatic o	design p	properti	es of	MEI	MS.					
CO4	Тоа	analyze	and un	derstan	d differ	ent issu	es relat	ed to de	sign	of M	IEMS	circ	uit ar	ıd sy	stem.	
CO5	Wil	l be exp	osed to	o the op	tical an	d RF ba	sed ME	EMS sys	stem.							
Mappir	ng of	Course	Outco	mes wi	th Prog	gram O	utcome	es (POs	)			-		1		1
COs/P	Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO	8	PO9	P	D10	PC	<b>)</b> 11	PO12
CO	l	1	3	3	1	3	1	1	1		1		1		1	2
CO2	2	3	1	3	3	1	1	1	1		1		1		1	2
CO	3	3	1	3	3	1	1	1	1		1		1		1	1
CO ²	1	3	1	3	1	3	1	1	1		1		1		1	2
CO	5	1	3	1	3	1	1	3	1		1		1		1	1
COs	/	PSO1		PSO2		PSO3		PS	<b>SO4</b>							
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Subject Code:	Subject Name : INTRODUCTION TO	Ty / Lb/	L	T/SLr	P/R	С
	MEMS SYSTEM DESIGN	ETL/IE				
EBEC22E31	Prerequisite: Electronic Circuits	Ту	3	0/0	0/0	3

### UNIT I **INTRODUCTION TO MEMS**

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication

### UNIT II **MECHANICS FOR MEMS DESIGN**

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics - actuators, force and response time, Fracture and thin film mechanics.

### UNIT III ELECTRO STATIC DESIGN

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. Bi stable actuators.

### **UNIT IV** CIRCUIT AND SYSTEM ISSUES

Electronic Interfaces, Feedback systems, Noise, Circuit and system issues, Case studies - Capacitive accelerometer, Peizo electric pressure sensor, Modeling of MEMS systems, CAD for MEMS.

### UNIT V INTRODUCTION TO OPTICAL AND RF MEMS

Optical MEMS, - System design basics - Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes - design basics, case study - Capacitive RF MEMS switch, performance issues.

## Practical component P : Include case studies / application scenarios

## Research component R : Future trends / research areas / Comparative Analysis

## **TEXT BOOK:**

1. Stephen Santuria, "Microsystems Design", Kluwer publishers, 2000.

2. NadimMaluf, "An Introduction to Micro Electro Mechanical System Design", Artech House, 2000

3. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC pressBaco Raton, 2000.

## **REFERENCES:**

- 1. Stephen Santuria, "Microsystems Design", Kluwer publishers, 2000.
- 2. NadimMaluf, "An Introduction to Micro Electro Mechanical System Design", Artech House, 2000
- 3. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC pressBaco Raton, 2000.
- 4. Tai Ran Hsu, "MEMS & Micro Systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

## 9 Hrs

**Total Number of Hours: 45** 

## 9 Hrs

9Hrs

9 Hrs



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Subject Co	ode:		Sub D	ject Na ESIGN	me : Al OF AN	NALYS NALOC	SIS ANI G IC'S	)	Ty /I ETL	Lb/ /IE	L	T/S Lr	P/R	C
EBEC22E	32		Р	rerequ	isite: So	lid Sta	te Devid	es	]	v	3	0/0	0/0	3
L : Lectur	e T : Tu	torial	1 SL	r : Supe	rvised L	earning	g P : Pro	ject R : I	Researc	h C: 0	Credi	its		
T/L/ETL	: Theory	/Lab	/Embe	edded T	heory a	nd Lab		5						
OBJECT	IVE :				•									
	• Т	o kno	ow the	fundar	nentals o	of Anal	og Desig	gn and cu	irrent n	nirrors	5			
	• T	o illu	istreste	e the op	erstions	of Op -	-amp an	d noise.						
	• T	o une	erstsnd	l the wo	orking p	rinciple	of Anal	og multi	plier ar	d PLI	Ĺ.			
	• T	o des	sign M	OS ana	log Ic's	and the	e workin	g of swit	ched ca	apacit	or fil	ters.		
COURSE	E OUTC	OM	ES (C	Os):(	3- 5)									
The Stude	ents will	be al	ble to	1		• 1	<u> </u>	10						
CO1	Know	the g	genera	l opera	ting prin	ciple of	t analog	ICs.	11					
CO2	Analy	ze th	e char	acterist	$\frac{1}{1}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	oles wit	h nodes,	source fo	ollower	s and	N018	se		
CO3	Illust	ate th	$\frac{100}{100}$	cepts to	or design	of ana	log mult	aplier an	a PLL					
CO4	Exam		$\frac{105}{20}$ at	ampillers										
05	5 Design MOS switched capacitor filters. Mapping of Course Outcomes with Program Outcomes (POs)													
	DO		Po2 po2 po4 po5 po6 po7 po8 po0 po10 po11 po1											
COS/POS	PO	P	02	P03	PU4	P05	PO6	P07	PUð	PO	9	POIU	POII	2
C01	3		3	3 3		3	2	3	2	2	2	1	3	2
CO2	3		3	3	3	3	3	2	1	3	}	1	3	1
CO3	3		3	3	3	3	3	3	1	3	;	1	2	2
CO4	3		3	3	3	3	2	3	1	2	2	1	2	2
CO5	3		3	3	3	2	3	3	1	2	2	1	1	2
COs /		PS	01	I	PSO2	]	PSO3	I	PSO4					
PSOs					_		_							
C01		3		3	3		3	3	<b>)</b>					
CO2		3			3		2	3	<b>)</b>					
C03		3			3		2	2						
C04		3			<u>s</u>		2	2						
05		3 3/2/1	1 india	otos St	rongth	of Corr	4 ·olation	3. Hio	h 2_N	lodim	m 1.	Low		
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	6	N N	gin	rani	al S grau	am	пE	Disc	Jon	cal /				
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Subject Code:	Subject Name : ANALYSIS AND	Ty /Lb/	L	T/S	P/R	С
	DESIGN OF ANALOG IC'S	ETL/IE		Lr		
EBEC22E32	Prerequisite: Solid State Devices	Ту	3	0/0	0/0	3

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## UNIT I INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS 9 Hrs

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascade current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

### UNIT II OPERATIONAL AMPLIFIERS AND NOISE

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascade stage- Differential pair. Noise- Statistical characteristics of noise-Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth

### UNIT III ANALOG MULTIPLIER AND PLL

Analysis of four Quadrant and Variable Trans-conductance Multiplier, Phase Locked Loops-Simple PLL-Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

## UNIT IV MOS ANALOG ICS

Design of MOS Operational Amplifier, MOS Power Amplifier. CMOS Operational Amplifier: Introduction and analysis of Cascade Amplifier and Telescopic Cascade Amplifier. Design of CMOS op-amps, Compensation of op-amps, Design of Two stage op-amps, Cascade op-amps.

## UNIT V SWITCHED CAPACITOR CIRCUITS

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback.

## Practical component P : Include case studies / application scenarios Research component R : Future trends / research areas / Comparative Analysis

**Total Number of Hours: 45** 

## **TEXTBOOKS:**

- 1. Behzad Razavi, —Design of Analog CMOS Integrated Circuits^{II}, Tata McGraw Hill, 2001, 33rd reprint, 2016.
- 2. Grey and Meyer, "Analysis and Design of Analog Ics." Wiley International, 1996.

### **REFERENCES:**

- 1. Kenneth R.Laker, Willy M.C.Sansen, William M.C.Sansen, "Design of Analog Integrated Circuits and Systems", McGraw Hill, 1994
- 2. Grey, Wolley, Brodersen, "Analog MOS Integrated Circuits", IEEE Press, 1989.
- 3. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009

## 9 Hrs

9 Hrs

9 Hrs

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EBEC22E	33		Prerea	uisite:	Basic I	Engine	ering		Tv	3	0/0	0/	0	3
L : Lectur	e T : Tu	torial	SLr:S	upervis	ed Lear	ning P	: Proje	ct R : R	esearch (	C: Crea	lits		_	
T/L/ETL :	: Theory	/Lab/En	nbedde	d Theor	y and I	Lab	5							
OBJECT	IVES :													
•	To ma	ake then	n learn	the basi	cs of c	yber ph	ysical s	system.						
•	To im	plement	t a cybe	r-physi	cal syst	tem for	automa	ated co	ntrol.					
•	To de	velop sa	fety an	d secur	e metho	ods for	CPS.							
COURSE	C OUTC	OMES	(COs)	: (3-5)	)									
The Stude	nts will	be able	to											
CO1	Unde	erstand	the basi	cs of cy	ber ph	ysical s	system.							
CO2	Desi	gn a dyı	namic s	table co	ontrol s	ystem.								
CO3	Impl	ement a	CPS ir	n contro	ol syster	n.								
CO4	App	ly forma	al metho	ods for	safety o	of CPS.								
CO5	Depl	loy a sec	cured er	nvironn	nent for	CPS.								
		Mapp	oing of	Course	Outco	mes w	ith Pro	gram (	Outcome	s (POs	s)			
COs/P	PO1	PO2	PO	PO	PO5	PO	PO	<b>PO8</b>	PO9	PO1	0 PC	)11	POI	2
Os			3	4		6	7							
CO1	3	1	3	3	1	1	2	1	1	1				2
CO2	1	3	3	3	3	1	1	1	2					
CO3	3	1	3	3	1	1		2	1			2		
CO4	1	3	3	3	1	2		1		1		1		2
CO5	1	1	1		1	1	1	1		2				1
COs /	l l	2801	l	2802	1	2803	PSO4							
PSOs CO1		>		2		<u>,</u>		1						
	1	<u>)</u> 1		3 2		<u>2</u> 1		1 2						
		2		3		2		23						
CO3	1	, 		3		<u>-</u> 1		2						
CO5		3		<u>-</u> 3		2		2						
	3/	/2/1 ind	icates S	Strengt	h of Co	orrelati	ion 3.	- High,	2- Media	um, 1-	Low			
		S	al											
	ş	nce	oci	(D	ves	S								
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Subject Code:	Subject Name : CYBER PHYSICAL SYSTEM	T y/ Lb/ ETL/IE	L	T/SL r	P/R	С
EBEC22E33	Prerequisite: Basic Engineering	Ту	3	0/0	0/0	3

### UNIT I **INTRODUCTION TO CPS**

Basic Principles of Design and validation – Industry 4.0 – IOT Implications – Processors, Sensors and Actuators - Wireless HART, CAN, Automotive Ethernet-RTOS

### **UNIT II** AUTOMATED CONTROL DESIGN

Dynamic System and Stability – Controller Design Techniques – CLFs, MLFs under slow switching -Performance under Packet drop and noise

#### **UNIT III CPS IMPLEMENTATION**

Mapping of features to software to ECUs –Effect of scheduling – Bus Latency – sense and actuation faults on control performance-network congestion-Control, Bus and Network Scheduling

### **UNIT IV** FORMAL METHODS FOR SAFETY

Advanced Automata based Modeling and Analysis - Introduction, Timed and Hybrid Automata, Trajectories and zenoness, and formal analysis, CPS software-weakest Pre-conditions and bounded model checking

### UNIT V SECURE DEPLOYMENT

Secure Task Mapping and Partitioning – State Estimation for attack detection – Case Study – Automated Lighting and AC control in green buildings

## Practical component P: Include case studies / application scenarios

## **Research component R: Future trends / research areas / Comparative Analysis**

### **Total Number of Hours: 45**

## **TEXT BOOKS:**

1. Rajeev Alur, "Principles of Cyber Physical Systems", MIT Press@2015,ISBN:0262029111 9780262029117

2. Marwedel, Peter "Embedded System Design Embedded Systems Foundations of Cyber-Physical Systems, and the Internet of Things "SpringerISBN 978-3-319-56045-8

## **REFERENCES:**

1. Rolf Dreschler, Ulrich Kuhne, "Formal Modeling and Verification of Cyber Physical System",. 2. DhandaP.Rawat, Joel JPC Rodrigues, Ivan StojMenovic "Cyber Physical Systems : From Theory to Practice", CRC Press, 2016

## 9 Hrs

9 Hrs

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## 9 Hrs

## 127

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## **ELECTIVE V – Communication Stream**

Subject Code: Subject N ELECTR				ame : OMAC	GNETI(	C INTE	ERFER	ENCE	Ty ET	/ Lb/ L/IE	L	T/SL	r P/I	R	C
FBFC2	2F35	AN Pr	D CO	MPAT	BILIT	Y anotic	fields		Tv		3	0/0	0	/∩	3
L · Lect	ure T	• Tutor	ial SI	$r \cdot Sup$	ervised	I earnir	$\frac{11000}{10} P \cdot F$	Project	R · Re	search C:	Cree	dite	U	U	5
T/L/ETI	L: Th	eorv/La	ab/Emb	edded 7	Theory	and Lab	15 I . I )	Tojeet	K . KC	searen e.	CICC	ans			
OBJEC	TIV	ES :			<u> </u>		-								
	•	To u	ndersta	nd EM	[Source	es, EMI	proble	ms and	their so	olution m	etho	ds in F	CB lev	vel /	
Subsystem and system level design.															
	•	To n	neasure	the em	ission I	mmunit	y level	from di	fferent	systems	to co	ouple v	with the	e	
	prescribed EMC standards														
COURSE OUTCOMES (COs) : ( 3- 5)															
The Stu	dents	will be	able to												
<u>CO1</u>	Ren	nember	the sou	rces of	EMI an	d its sta	indards								
CO2	Und	erstand	the cou	ipling p	rinciple	$\frac{1}{10} \frac{1}{10} \frac{1}{10}$	/11								
	Iest	ne EN	11 meas	uremen	us and 1	of vor	ration		11						
C04	Desi	ign PCF	$\frac{1}{2}$ s for y	arious s	phicat	ions in	EML co	ntrol	11						
CO3 Mannin	CU5     Design PCBs for various applications in EMI control       Manning of Course Outcomes with Program Outcomes (POs)														
								$\mathbf{D}\mathbf{O}7$	, DO8	<b>D</b> O0	DC	10	DO11	Т	0012
CO5/F	US	FUI	rU2	F03	FU4	105	FUU	F0/	rUa	F09	гu	10	ron	ſ	012
COI	L	1	1	1	2	1	2	2	3		1	2			3
CO2	2	3	2	1	2	2	2	2	2			3			2
CO3	3	2	2	3	2	2	3	2	3	3 2 3		3	3		2
CO4	1	1	2	3	3	3	2	2	2	2 3		3	2		2
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Subject Code:	Subject Name :	Ty/ Lb/	L	T/SLr	P/R	С	
	ELECTROMAGNETIC INTERFERENCE	ETL/IE					
	AND COMPATIBILITY						
EBEC22E35	Prerequisite: Electromagnetic fields	Ту	3	0/0	0/0	3	1

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## UNIT I EMI ENVIRONMENT

Sources of EMI, Conducted and Radiated EMI, Transient EMI, EMI-EMC Definitions and Units of Parameters.Units of Specification, Civilian Standards Military Standards.

## UNIT II EMI COUPLING PRINCIPLES

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, and Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply Coupling.

## UNIT III EMI MEASUREMENTS

EMI Test Instruments Systems. EMI Test, EMI Shielded Chamber, Open Area Test Site, TEM Cell Antennas, Conductors Sensors / Injectors / Couplers. Military Test Method and Procedures, Calibration Procedures.

## UNIT IV EMICONTROL TECHINQUES

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

## UNIT V EMI DESIGN OF PCBs

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning Motherboard Design and Propagation Delay Performance Models.

## **Practical component P: Include case studies / application scenarios**

## Research component R: Future trends / research areas / Comparative Analysis

## **Total Number of Hours: 45**

## **TEXT BOOKS:**

1. V.P. Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.

2. Clayton R. Paul - Introduction to Electromagnetic compatibility - Wiley & Sons - 1992

## **REFERENCES:**

Bernhard Keiser. "Principles of Electromagnetic Compatibility", Artech House, #rd Ed, 1986.
 Henry W. Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, Newyork, 1988.



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Subject Code: Subject N ADVANC				lame : CED CO	ONCEI	PTS IN	] E	Ty / Lb/ ETL/IE	L	T/SI	Lr.	P/R	C					
EBEC2	2E36	5 Pr	Prerequisite: Digital Signal Processing Ty 3 0/0 0/0								0							
L : Lect	ure T	: Tutor	ial SI	_r : Sup	ervised	Learni	ng P:H	Project	R : F	Research C	: Cre	edits						
T/L/ETI	_ : Tl	neory/La	ab/Emb	edded 7	Theory	and Lal	5											
OBJEC	OBJECTIVES :																	
•	• The student learns important theorems and algorithms relate											nal pro	oces	sing.				
• The student knows estimation, prediction and filtering concepts & techniques.																		
COURSE OUTCOMES (COs) : ( 3- 5)																		
The Stu	dents	will be	able to		)													
CO1	Ana	alyze the	e charac	terstics of random signal processing.														
CO2	Lea	rn diffe	rent typ	es of sp	bectrum	estima	tors & t	heir mo	dels.									
CO3	Unc	lerstand	the con	ncept of	f predic	tive filt	ers.											
CO4	Des	ign diff	erent ty	pes of a	adaptive	e filters	for diff	erent ap	oplica	ations								
CO5	Lea	rn multi	rate sig	gnal pro	cessing	& imp	lementa	tion of	filter	banks.								
Mappin	ig of	Course	Outco	mes wi	th Prog	gram O	utcome	es (POs	)									
COs/PO	Os	<b>PO1</b>	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	PC	08 PO9	P	010	PO	D11	PO12			
CO1		3	3	2	3	3	3	2	2	3		2		3	1			
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CO4		3	3	3	3	3	2	2	3	2		3		3	2			
CO5		3	3	3	3	3	2	3	3	3	3		3			3	3	
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Subject Code:	ADVANCED CONCEPTS IN SIGNAL PROCESSING	ETL/IE	L	1/5Lf	r/ĸ	C
EBEC22E36	Prerequisite: Digital Signal Processing	Ту	3	0/0	0/0	0

### UNIT I DISCRETE RANDOM SIGNAL PROCESSING

EMED

Discrete Random Process, Expectation, Variance, Co-Variance, Scalar Product, Energy of Discrete SignalParseval's Theorem, Wiener Khintchine Relation-Power Spectral Density -Periodogram - Sample AutocorrelationSum Decomposition Theorem, Spectral Factorization Theorem – Discrete Random Signal Processing by Linear Systems-Simulation of White Noise – Low Pass Filtering of White Noise.

### **UNIT II** SPECTRUM ESTIMATION

EDUCAT

Non-Parametric Methods-Correlation Method - Co-Variance Estimator - Performance Analysis of Estimators - Unbiased, Consistent Estimators - Periodogram Estimator - Barlett Spectrum Estimation -Welch Estimation – Model based Approach – AR, MA, ARMA Signal Modeling – Parameter Estimation using Yule-Walker Method.

### UNIT III LINEAR ESTIMATION AND PREDICTION

Maximum likelihood criterion-efficiency f estimator – Least mean squared error criterion – Wiener filter – Discrete Wiener Hoff equations – Recursive estimators-Kalman filter – Linear prediction, prediction errorwhitening filter, inverse filter - Levinson recursion, Lattice realization, and Levinson recursion algorithm for solving Teoplitz system of equations.

### **ADAPTIVE FILTERS UNIT IV**

9 Hrs FIR adaptive filters - Newton's steepest descent method-adaptive filter based on steepest descent method -Widrow Hoff LMS adaptive algorithm – Adaptive channel equalizations – Adaptive echo chancellor – Adaptive noise cancellation – RLS adaptive filters –Exponentially weighted RLS – sliding window RLS – Simplified IIR LMs adaptive filter

### MULTIRATE DIGITAL SIGNAL PROCESSING UNIT V

Mathematical description of change of sampling rate - Interpolation and Decimation -continuous time model - Direct digital domain approach -Decimation by an integer factor - Interpolation by an integer factor – single and multistage realization - Poly phase realization – Application to sub band coding – Wavelet transform and filter bank implementation of wavelet expansion of signals.

## **Practical component P: Include case studies / application scenarios** Research component R: Future trends / research areas / Comparative Analysis

**Total Number of Hours: 45 hrs** 

## **Text books:**

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., New York, 1996

2. Sopocles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 1990.

## **References:**

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., New York, 1996

2. Sopocles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 1990. .

3. John G. Proakis, Dimitris G. Manolais, "Digital Signal Processing", Prentice Hall of India, 1995

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EBEC22E	37	Prereq	uisite: Optical Communication						Ту	3	0/0	0/0	3	
L : Lectur	e T : Tu	torial S	Lr : Sup	ervise	d Learn	ing P	: Proj	ect R :	Research	C: Crea	lits			
T/L/ETL :	Theory	/Lab/Em	bedded	Гheory	and La	ab	5							
OBJECT	IVES :													
• Te	o learn t	he basic	operation	n of U	WB sys	stem								
T	o design	a UWB	transmit	ter and	l receiv	er								
T	o study	about the	characte	eristics	of UW	/B ant	ennas							
COURSE	OUTC	COMES (	(COs) : (	(3-5)										
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CO1	Unde	rstand the	e operati	on of l	Jltra W	1de Ba	and S	ystems	8					
CO2	Learn	the prop	erties of	UWB	antenn	as								
CO3	Desig	gn a UWE	B transm	itter										
CO4	Desig	Design a UWB receiver												
CO5	Develop a multi-carrier UWB receiver													
Mapping	Mapping of Course Outcomes with Program Outcomes (POs)													
COs/	PO1	PO2	PO3	PO4	PO	5 P	06	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12	
POs														
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gory	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project					
Cate					$\checkmark$									

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AND RESEARCH

Subject Code:	Subject Name : ULTRA WIDE BAND COMMUNICATION	Ty /Lb/ ETL/IE	L	T/SL r	P/R	С
EBEC22E37	Prerequisite: Optical Communication	Ту	3	0/0	0/0	3

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## UNIT I INTRODUCTION TO UWB SYSTEMS

EDUCAT

Overview of UWB - UWB Concept - UWB Signals: Impulse (I) and Multi-Carrier (MC) Signals, Uniqueness of UWB Systems; I-UWB System Model; MC-UWB System Model. Advantages of UWB Systems - Challenges in UWB Systems - Single Band Vs. Multi Band - Applications of UWB Systems - Regulatory, Legal & Other Controversial Issues.

## UNIT II INTERFERENCE, COEXISTENCE & UWB ANTENNAS

Interference of UWB on NB: UWB Pulse Model - Effect of NB Receive Filter - BER Analysis - Time-Hopped Case - Aggregate of UWB Interference Modeling: Received Power - Asymptotic PDF of Aggregate Noise - Amplitudes: Aggregated PDF - Bernoulli and Poisson Models - Interference Analysis: NB on UWB, UWB on UWB - Basic Properties of UWB Antennas.

## UNIT III UWB TRANSMITTER DESIGN

IUWB Signal Generators: Avalanche Pulse Generators - Step Recovery Diode Pulse Generators- Tunnel Diode Pulsars - Pulse Circuits Suitable for Integrated Circuits – Modulators- I-UWB Transmitters: TH-PPM and TH(A-PAM) UWB Signals - OOC-PPM UWB Signals - DSUWB Signals - TR UWB System-MC-UWB Transmitters: CI-UWB Signals - FH-UWB Systems - OFDM-UWB Systems - Spectral Encoded UWB Communication System.

## UNIT IV IUWB RECEIVER DESIGN

System Model- Threshold/Leading Edge Detection - Correlation Detection (CD) Receivers - RAKE Receivers - Multi-User Detection (MUD) UWB Receivers- Hybrid RAKE IMUD Receivers - Auto Correlation TR UWB Receivers- Synchronization and Timing Issues - Digital I-UWB Implementation.

## UNIT VUWB COMMUNICATION STANDARDS AND ADVANCED TOPICS9 Hrs

standardization in wireless personal area networks – DS-UWB proposal – MB-OFDM UWB proposal – IEEE proposals for UWB channel models – UWB ad-hoc and sensor networks – MIMO and Space-time coding for UWB systems – Self interference in high data-rate UWB communications – Coexistence of DS-UWB with WIMAX.

## Practical component P: Include case studies / application scenarios

### Research component R: Future trends / research areas / Comparative Analysis Total Number of Hours: 45 hrs

## Text books:

- 1. Jeffrey H. Reed, "An Introduction to UWB Communication Systems, Prentice Hall, 2005.
- Robert Aiello and Anuj Batra, "UWB Systems: Technologies and Applications", Newnes- Elsevier, 2006.
- 3. FaranakNekoogar, "UWB Communications: Fundamentals and Applications", Prentice Hall, 2005.

## **References:**

- 1. Ultra Wideband Antennas: Design, Methodologies, and Performance BY (Author), Marco Antonio Peyrot- Solis (Author), HildebertoJardón Aguilar
- Design of CMOS RFIC Ultra-Wideband Impulse Transmitters and Receivers Book by Cam Nguyen and Meng Miao 3.Ultra-Wideband Antennas and Propagation: For Communications, Radar and Imaging 1st Editionby BenAllen (Editor), Mischa Dohler (Editor), Ernest Okon (Editor), WasimMalik (Editor), Anthony Brown (Editor), David Edwards

## 9 Hrs

9 Hrs

9 Hrs

## 9 Hrs