KNOWLEDGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, Chennai. Accredited by NBA (CSE, ECE, EEE & MECH), Accredited by NAAC with 'A' Grade KIOT Campus, Kakapalayam (PO), Salem – 637504, Tamil Nadu, India.



Beyond Knowledge

M.E/M.Tech Regulations 2023

M.E. – VLSI Design

Curriculum and Syllabi

(For the Students Admitted from the Academic Year 2023 -,24 Onwards)

CHAIRPERSON **Board of Studies** Faculty of Electronics & Communication Engg Knowledge Institute of Technology KIOT Campus, Kakapalayam, Salem-637 504

Version:1.0

Date:06.07.2024



KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM -637504

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Accredited by NAAC and NBA (B.E.: Mech., ECE, EEE & CSE)

Website: www.kiot.ac.in

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CHAIRPERSON Board of Studies Faculty of Electronics & Communication Engg Knowledge Institute of Technology KIOT Campus, Kakapalayam, Salem-637 504

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M.E. / M.Tech. REGULATIONS 2023 (R2023)

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

M.E. VLSI DESIGN

VISION OF THE INSTITUTE

To be a world class institution to impart value and need based professional education to the aspiring youth and carving them into disciplined world class professional who have the quest for excellence, achievement orientation and social responsibilities.

MISS	ION OF THE INSTITUTE
A	To promote academic growth by offering state-of-art under graduate, post graduate, and doctoral programs and to generate new knowledge by engaging in cutting – edge research
В	To nurture talent, innovation, entrepreneurship, all-round personality, and value system among the students and to foster competitiveness among students
С	To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry
D	To pursue global standards of excellence in all our endeavors namely teaching, research, consultancy, continuing education and support functions

VISION OF THE DEPARTMENT

To produce competent Electronics and Communication Engineers by imparting quality education to meet the industry requirements and for serving the societal needs

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MISSI	ON OF THE DEPARTMENT
M1	To develop appropriate facilities for promoting research activities
M2	To inculcate leadership qualities among students for self and societal growth
М3	To nurture students on emerging technologies for serving industry needs through industry institute interface
M4	To enrich teaching learning process by transforming young minds to be resourceful engineers

IRPERSION

Board of Studies Faculty of Electronics & Communication Engg Knowledge Institute of Technology KIOT Campus, Kakapalayam, Salem-637 504

PROGR	AM EDUCATIONAL OBJECTIVES (PEOs)
PEO1	To critically analyze and understand the principles involved in the designing and testing of electronic circuits relevant to industry and society.
PEO2	To appreciate the concepts in the working of electronic circuits
PEO3	To take up socially relevant and challenging projects and to provide Innovative solutions through research for the benefit of the society with latest hardware & software related to VLSI and also to develop the capacity to protect Intellectual Property.
PEO4	To Progress and Develop with Ethics and Communicate effectively.
PEO5	To become entrepreneurs to develop indigenous solutions

PROGR	AM OUTCOMES (POs)
P01	An ability to independently carry out research/investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document
P03	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
P04	Understand the fundamentals involved in the Designing and Testing of electronic circuits in the VLSI domain.
P05	Provide solutions through research to socially relevant issues for modern Electronic Design Automation (EDA) tools with knowledge, techniques, skills and for the benefit of the society
P06	Interact effectively with the technical experts in industry

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	KNOWLED	GE INSTITUTE OF TECHNOL	OGY (AUT	ONO	100	5), S	ALE	M - 63	7504	-		
		M.E. VLSI DESIG	N		121			1.0	Ve	rsion:	1.0		
	Courses o	f Study and Scheme of Asse	ssmen	t (Re	egula	tions	s 202	3)	Date:06.07.2024				
		SEM	ESTER	I		1.18	2.2	81					
SI.	Course			Pe	riods	/ W	eek		Max	imum	Marks		
No.	Code	Course litle	CAT	СР	L	T.	Р	С	IA	ESE	Total		
	THEORY		10.5	M.						and a	1 05		
1	ME23MA102	Graph Theory and Optimization Techniques	FC	4	3	1	0	4	40	60	100		
2	ME23RM201	Research Methodology and IPR	RM	З	2	1	0	3	40	60	100		
3	ME23VL301	Analog IC Design	PC	3	3	0	0	3	40	60	100		
4	ME23VL302	Digital CMOS VLSI Design	PC	3	3	0	0	3	40	60	100		
5	ME23VL303	Advanced Digital System Design	PC	3	3	0	0	3	40	60	100		
6	ME23VL304	RFIC Design	PC	3	3	0	0	3	40	60	100		
7	ME23AC7XX	Audit Course – I	AC	2	2	0	0	0	100		100		
	PRACTICAL				19	14			14.2		1. S.		
8	ME23VL305	FPGA Laboratory	PC	4	0	0	4	2	60	40	100		
9	ME23VL306	Analog IC Design Laboratory	PC	4	0	0	4	2	60	40	100		
EMP	LOYABILITY	ENHANCEMENT		14		11	10						
10	ME23PT801	Technical Seminar / Case study presentation	EEC	2	0.	0	2	0	100	-	100		
			Total	31	19	2	10	23	560	440	1000		

		SEM	ESTER	11			4	Ξ.	1.1		1	
SI.	SI. Course No. Code	P.0	1181	Peri	ods /	Wee	k	4	Maximum Marks			
No.		Code Course Title	CAT	СР	L	Т	Ρ	С	IA	ESE	Total	
THE	ORY	See 197 2 Provide Automatic							1	- 1.		
1	ME23VL307	Design for Verification using UVM	PC	3	3	0	0	3	40	60	100	
2	ME23VL308	Low Power VLSI Design	PC	3	3	0	0	3	40	60	100	
3	ME23VL309	VLSI Testing	PC	3	3	0	0	3	40	60	100	
4	ME23VL4XX	Professional Elective – I	PE	3	3	0	0	3	40	60	100	
5	ME23VL4XX	Professional Elective – II	PE	3	3	0	0	3	40	60	100	
6	ME23XX5XX	Open Elective - I	OE	3	3	o	0	3	40	60	100	
7	ME23MC701	Universal Human Values and Ethics	мс	3	. 2	1	0	3	40	60	100	
8	ME23AC7XX	Audit Course – II*	AC	2	2	0	0	0	100	-	100	
PR/	CTICAL							11.	1 1	- 1 A	12	
9	ME23VL310	Verification using UVM Laboratory	PC	4	0	0	4	2	60	40	100	
EMI	PLOYABILIT	ENHANCEMENT										
10	ME23PT802	Research Paper Review and presentation	EEC	2	0	0	2	1	100	1	-100	
	COLUCIONADO I IC	NUCT Campage Ka	Total	29	22	1	6	24	546	460	1000	

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		SEI	MESTER	III		4.81			125 1 1	a day	and the second
SI.	Course			Peri	ods /	Wee	ek		Max	cimum	Marks
No.	Code	Course litle	CAT	СР	L	Т	P	С	IA	ESE	Total
THE	ORY				1		-				
1	ME23VL311	VLSI Signal Processing	PC	3	3	0	0	3	40	60	100
2	ME23VL4XX	Professional Elective – III	PE	3	3	0	0	3	40	60	100
3	ME23VL4XX	Professional Elective – IV	PE	3	3	0	0	3	40	60	100
4	ME23XX5XX	Open Elective - II	OE	3	3	0	0	3	40	60	100
PRA	CTICAL					3.4.1	Q. 1.				
5	ME23VL601	Project Work - I	PW	12	0	0	12	6	60	40	100
- 14, 14	5 m (* 1997) **		Total	24	12	0	12	18	220	280	500
		SE	MESTER	IV							
SI.	Course			Peri	ods /	Wee	ek		Max	cimum	Marks
No.	Code	Course Title	CAT	СР	L	Т	Р	С	IA	ESE	Total
PRA	CTICAL								See 24	Al	
1	ME23VL602	Project Work - II	PW	24	0	0	24	12	60	40	100
	and the second	N.	Total	24	0	0	24	12	60	40	100
	1.2	17.5	<u>an s</u>	0	T	Т	otal	No.	of Cr	edits	77

		PROFESSIO	NAL E	LECT	IVES						
		SEME (Professiona	STER I Elect	– II ivesI	& II)).					
SI.	Course			Peri	ods /	Wee	k		Max	kimun	n Marks
No.	Code	Course little	CAT	СР	L	₫ T	P	C	IA	ESE	Total
THE	ORY					1	1 Stage St			-84	he see
1	ME23VL401	ASIC Design	PE	3	3	0	0	3	40	60	100
2	ME23VL402	Medical Imaging Systems	PE	3	3	0	0	3	40	60	100
3	ME23VL403	Principles of Sensors and Signal Conditioning	PE	3	3	0	0	3	40	60	100
4	ME23VL404	Hardware Software Co- Design for FPGA	PE	3	3	0	0	3	40	60	100
5	ME23VL405	DSP Structures for VLSI	PE	3	3	0	0	3	40	60	100
6	ME23VL406	Bio - Signal Processing	PE	3	3	0	0	3	40	60	100
7	ME23VL407	Reconfigurable Architectures	PE	3	3	0	0	3	40	60	100
8	ME23VL408	Advanced Wireless Sensor Networks	PE	3	3	0	0	3	40	60	100
9	ME23VL409	Edge and Fog Computing	PE	3	3	0	0	3	40	60	100
10	ME23VL410	System On Chip	PE	3	3	0	2	U3.	40/	60	100

M.E/M.Tech Regulations - 2023

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		SEM Professiona	ESTER	– III ives I	11 8	IV)					
SI.	Course			Per	iods	5 / V	Vee	k	12	Max	cimum	Marks
No.	Code	Course Title	CAT	СР	L		Τ.	Ρ	С	IA	ESE	Total
THE	ORY								01			
1	ME23VL411	MEMS and NEMS	PE	3	3	5	0	0	3	40	60	100
2	ME23VL412	Network on Chip	PE	3	3		0	0	3	40	60	100
3	ME23VL413	Evolvable Hardware	PE	3	3	.	0	0	3	40	60	100
4	ME23VL414	Soft Computing and Optimization Techniques	PE	3	3		0	0	3	40	60	100
5	ME23VL415	CAD for VLSI Design	PE	3	3	:	0	0	3	40	60	100
6	ME23VL416	VLSI Architectures for Image Processing	PE	3	3		0	0	3	40	60	100
7	ME23VL417	System Verilog	PE	3	3		0	0	3	40	60	100
8	ME23VL418	Adaptive Signal Processing	PE	3	3		0	0	3	40	60	100
9	ME23VL419	Machine Learning	PE	3	3	;	0	0	3	40	60	100
10	ME23VL420	Advanced Digital Image Processing	PE	3	3		0	0	3	40	60	100
	No. of Concession, Name	A CARLES AND AN	TUT.			No. of Lot of Lo					-	
		OPEN	I ELEC	TIVES	5							
sı.	Course Code	Course Title		1	Pe	rioc	Is /	We	ek	Ma	ximun	n Marks
No.	ept M.E. Com	outer Science and Engine	eerina	CAT	CP	I L	<u> T</u>	P	C	IA	ESE	Total
1	ME23CP501/ ME23CP310	Security Practices		OE	3	3	0	0	3	40	60	100
2	ME23CP502/ ME23CP401	Cloud Computing Techno	logies	OE	3	3	0	0	3	40	60	100
3	ME23CP503/ ME23CP415	Blockchain Technologies	Ľ,	OE	3	3	0	0	3	40	60	100
4	ME23CP504/ ME23CP414	Deep Learning		OE	3	3	0	0	3	40	60	100
5	ME23CP505	Design Thinking		OE	3	3	0	0	3	40	60	100
6	ME23CP506	Principles of Multimedia		OE	3	3	0	0	3	40	60	100
Exc	ept M.E. Indu	strial Safety Engineering	6	2.1				$\mathcal{C}_{\mathcal{C}}$. e 1			
7	ME23IS501/ ME23IS302	Environmental Safety		OE	3	3	0	0	3	40	60	100
8	ME23IS502/ ME23IS309	Electrical safety	4.5	OE	3	3	́о	0	3	40	60	100
9	ME23IS503/ ME23IS413	Safety in Engineering Ind	lustry	OE	3	3	0	0	3	40	60	100
10	ME23IS504	Design of Experiments	1	OE	3	3	0	0	3	40	60	100
11	ME23IS505	Circular Economy		OE	3	3	0	0	3	40	60	100
Exc	ept M.E. Embe	dded System Technologi	es									
12	ME23ET501/ ME23ET310	IoT for Smart Systems	- 9 ⁻²⁴	OE	3	3	0	· 0	3	40	,60	100
13	ME23ET502/ ME23ET408	Machine Learning and De Learning	ер	OE	3	3	0	0	3	240	60	P100
	ACCEN.	MARANJ.							Door		tudioo	

KIOT via adaptivate 3.2 to object to date? 5 (resonated to addited appendent) (mayalege in 2. overme 3.1 OD) 403 CDP-mara3

ME23ET503	Renewable Energy Technology	OE	3	3	0	0	3	40	60	100
ME23ET504/ ME23ET423	Smart Grid	OE	3	3	0	0	3	40	60	100
pt M.E. VLSI	Design									
ME23VL501	Big Data Analytics	OE	3	3	0	0	3	40	60	100
ME23VL502	Internet of Things and Cloud	OE	3	3	0	0	3	40	60	100
ME23VL503	Medical Robotics	OE	3	3	0	0	3	40	60	100
ME23VL504	Embedded Automation	OE	3	3	0	0	3	40	60	100
	ME23ET503 ME23ET504/ ME23ET423 Pt M.E. VLSI I ME23VL501 ME23VL502 ME23VL503 ME23VL504	ME23ET503Renewable Energy TechnologyME23ET504/ ME23ET423Smart GridSpt M.E. VLSI DesignME23VL501Big Data AnalyticsME23VL502Internet of Things and CloudME23VL503Medical RoboticsME23VL504Embedded Automation	ME23ET503Renewable Energy TechnologyOEME23ET504/ ME23ET423Smart GridOEPt M.E. VLSI DesignME23VL501Big Data AnalyticsOEME23VL502Internet of Things and CloudOEME23VL503Medical RoboticsOEME23VL504Embedded AutomationOE	ME23ET503Renewable Energy TechnologyOE3ME23ET504/ ME23ET423Smart GridOE3ept M.E. VLSI DesignME23VL501Big Data AnalyticsOE3ME23VL502Internet of Things and CloudOE3ME23VL503Medical RoboticsOE3ME23VL504Embedded AutomationOE3	ME23ET503Renewable Energy TechnologyOE33ME23ET504/ ME23ET423Smart GridOE33ept M.E. VLSI DesignME23VL501Big Data AnalyticsOE33ME23VL502Internet of Things and CloudOE33ME23VL503Medical RoboticsOE33ME23VL504Embedded AutomationOE33	ME23ET503Renewable Energy TechnologyOE330ME23ET504/ ME23ET423Smart GridOE330ept M.E. VLSI DesignME23VL501Big Data AnalyticsOE330ME23VL502Internet of Things and CloudOE330ME23VL503Medical RoboticsOE330ME23VL504Embedded AutomationOE330	ME23ET503Renewable Energy TechnologyOE3300ME23ET504/ ME23ET423Smart GridOE3300ept M.E. VLSI DesignME23VL501Big Data AnalyticsOE3300ME23VL502Internet of Things and CloudOE3300ME23VL503Medical RoboticsOE3300ME23VL504Embedded AutomationOE3300	ME23ET503Renewable Energy TechnologyOE33003ME23ET504/ ME23ET423Smart GridOE33003ept M.E. VLSI DesignME23VL501Big Data AnalyticsOE33003ME23VL502Internet of Things and CloudOE33003ME23VL503Medical RoboticsOE33003ME23VL504Embedded AutomationOE33003	ME23ET503Renewable Energy TechnologyOE3300340ME23ET504/ ME23ET423Smart GridOE3300340ept M.E. VLSI DesignME23VL501Big Data AnalyticsOE3300340ME23VL502Internet of Things and CloudOE3300340ME23VL503Medical RoboticsOE3300340ME23VL504Embedded AutomationOE3300340	ME23ET503Renewable Energy TechnologyOE330034060ME23ET504/ ME23ET423Smart GridOE330034060ept M.E. VLSI DesignME23VL501Big Data AnalyticsOE330034060ME23VL502Internet of Things and CloudOE330034060ME23VL503Medical RoboticsOE330034060ME23VL504Embedded AutomationOE330034060

	PRC	DJECT WO	RK									
Course	Course Title	Periods / Week						Maximum Marks				
Code		CAT	СР	L	Т	Ρ	С	IA	ESE	Total		
ORY				1.172		4.3	Aller-	1.1	1	lense.		
ME23VL601	Project Work I	PW	12	0	0	12	6	60	40	100		
ME23VL602	Project Work II	PW	24	0	0	24	12	60	40	100		
	Course Code ORY ME23VL601 ME23VL602	Course Code Course Title ORY ME23VL601 Project Work I ME23VL602 Project Work II	Course Code Course Title Code Course Title ORY ME23VL601 ME23VL602 Project Work II	PROJECT WORKCourse CodeCourse TitlePeriodCodeCATCPORYME23VL601Project Work IPW12ME23VL602Project Work IIPW24	PROJECT WORKCourse CodePeriods / Periods / CATPeriods / Periods / CATORYME23VL601Project Work IPW120ME23VL602Project Work IIPW240	PROJECT WORKCourse CodeCourse TitlePeriods / WeeCodeCATCPLTORYME23VL601Project Work IPW1200ME23VL602Project Work IIPW2400	PROJECT WORKCourse CodePeriods / WeekCodeCourse TitlePeriods / WeekCATCPLTORYME23VL601Project Work IPW120012ME23VL602Project Work IIPW240024	PROJECT WORKCourse CodeCourse TitlePeriods / WeekCATCPLTPCORYME23VL601Project Work IPW1200126ME23VL602Project Work IIPW24002412	PROJECT WORK Course Code Periods / Week N Code Course Title CAT CP L T P C IA ORY ME23VL601 Project Work I PW 12 0 0 12 6 60 ME23VL602 Project Work II PW 24 0 0 24 12 60	PROJECT WORK Course Code Periods / Week Maxim Mark Code Course Title Periods / Week Maxim Mark Code CAT CP L T P C IA ESE ORY ME23VL601 Project Work I PW 12 0 0 12 6 60 40 ME23VL602 Project Work II PW 24 0 0 24 12 60 40		

		FOUND	ATION	COUR	SE						
SI.	Course Course Title Periods / Week Maximu			cimum	ım Marks						
No.	Code	Course litle	CAT	СР	L	- т	Р	С	IA	ESE	Total
THE	ORY	5.0		6		2	21				41.4
1	ME23MA102	Graph Theory and Optimization Techniques	FC.	4	3	1	0	4	40	60	100

100

		RESEARCH	METH	ODOL	.OGY						
SI.	Course		ar an	Peri	ods /	Wee	ek 🦷		Max	imum	Marks
No.	Code	Course little	CAT	СР	T.	Т	Ρ	С	IA	ESE	Total
THE	ORY	Stranger 1	- 1×	Haras	1					1 12	
1	ME23RM201	Research Methodology and IPR	RM	3	2	1	0	3	40	60	100

	1	Registration for any of thes	e cour	ses is	opti	onal	to st	ude	nts	1.1	41516
SI.	Course			Peri	ods /	Wee	ek	1.5	Max	cimun	n Marks
No.	Code	Course litle	CAT	CP	L	т	P	С	IA	ESE	Total
THE	ORY				628	100			10		
1	ME23MC701	Universal Human Values and Ethics	MC	3	2	í	0	3	40	60	100
		EMPLOYABILITY ENH	ANCEM	ENT	COUR	SES	(EEC)			
		Registration for any of thes	e cour	ses is	opti	onal	to st	ude	nts	1.3.1	1.8 2
SI.	Course		1.1.1	Peri	ods /	Wee	ek		Max	cimun	n Marks
No.	Code	Course litle	CAT	СР	L	Т	Р	С	IA	ESE	Total
THE	ORY		1000	11	24.42	14		6.6	12.5	and sta	
1	ME23PT801	Technical Seminar / Case study presentation	EEC	2	0	0	· 2	0	/100	0	100
2	ME23PT802	Research Paper Review and presentation	EEC	2	0	0	2)1/	100	F	100
	二、二、二、二、二、二、二、二、二、二、二、二、二、二、二、二、二、二、二、			in any second			CU	ATD	DED	CON	

KIOT relations (Communication TOIX) Victoric operations of Technology (MICT Computer Transmission) Faddb For Electronics Regularisions Englo23 Knowledge Institute of Technology KIOT Campus, Kakapalayam, Salem-637 504

		AUDIT	OURSE	ES (A	C)						
		Registration for any of the	se cour	ses is	opti	onal	to st	ude	nts	1.1	1946 - 1
SI.	Course	Courses Tible	1.1	Peri	ods /	Wee	k		Max	cimun	n Marks
No.	Code	Course little	CAT	CP	L	Т	P	С	IA	ESE	Total
THE	ORY	terre a l'interretterretterretterretterretterretterretterretterretterretterretterretterretterretterretterretter			-		-	1	1. 10	11	- 1 - L - L - L - L - L - L - L - L - L
1	ME23AC701	English for Research Paper Writing	AC	2	2	0	0	0	100	-	100
2	ME23AC702	Disaster Management	AC	2	2	0	0	0	100		100
3	ME23AC703	Constitution of India	AC	2	2	0	0	0	100	1 - 1	100
4	ME23AC704	நற்றமிழ்இலக்கியம்/ CLASSICAL TAMIL LITERATURE	AC	2	2	0	0	0	100		100

		SPECIAL ELECTIV	ES (Fo	r Ph.C). Scl	nolar	s)				
SI.	Course	Courses Title		Peri	ods /	Wee	k		Max	kimun	n Marks
No.	Code	Course little	CAT	СР	L	Т	P	C	IA	ESE	Total
THE	ORY				1.						8.54
1	ME23VL421	Medical Image Analysis	SE	3	3	0	0	3	40	60	100
2	ME23VL422	Applied Optimization for Wireless and Bigdata	SE	3	3	0	0	3	40	60	100
3	ME23VL423	Medical Image Processing	SE	3	3	0	0	3	40	60	100

Special electives for Ph.D. scholars are determined by the recommendations of the Doctoral Committee for each individual scholar. The syllabus for these electives is also provided by the Doctoral Committee members, subject to approval by the Internal Board of Studies (BOS), and subsequently ratified in the next BOS meeting.

CHAIRPERSON Board of Studies Faculty of Electronics & Communication Engg Knowledge Institute of Technology KIOT Campus, Kakapalayam, Salem-637 504

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			SU	MMARY		i per part i gi pe	
	Course	Cr	edits p	er Semes	ster	Cradite	Credit %
SI. NO.	Category	I	II	III	IV	creates	credit 70
1	FC	4		1	-	04	5.19
2	RM	3	-			03	3.89
3	PC	16	11	3	-	30	38.96
4	PE	1.2	6	6	A DE	12	15.58
5	OE	+	3	3		06	7.79
6	PW		16 (- 27)	6	12	18	23.37
7	EEC	1	1	-		01	1.3
8	MC	-	3	1.20-0-20	-	03	3.89
9	AC*	1	~	-	-		-
	Total	23	24	18	12	77	100

NOM	ENCLATURE	34	1 1 No	4	and the second states of the
CAT	Category of Course	FC	Foundation Courses	PW	Project Work Courses
СР	Contact Period	RM	Research Methodology and IPR Courses	EEC	Employability Enhancement Course
L	Lecture Period	PC	Professional Core Courses	AC	Audit Course
Т	Tutorial Period	PE	Professional Elective Courses	IA	Internal Assessment
Р	Laboratory Period	OE	Open Elective Courses	ESE	End Semester Examination
C	Credits	SE	Special Elective		N. Constant
	mereleased and the	NIGT G			1.0

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ME	23VL311	VLSI SIGNAL PROCESSING	CP L T P C
Prog	ramme &	M.E. VISI DESIGN	3 3 0 0 3
В	ranch	Instructions if any	
	o Objective		nave set of a character in the
J	To introduce	the concerts of DCD placetithms for parallel processing	
1		the concepts of DSP algorithms for parallel processing	and the second
2	To study algo	prithmic strength reduction techniques	
3	To apply last	bmetic algorithms for optimization	
5	To study syn	chronous and asynchronous ninelining methods	- 10 Martin 1 / 2 Ko
UNIT	- I	INTRODUCTION TO DSP SYSTEMS, PIPELINING AND PARALLEL PROCESSING OF FIR FILTERS	9
Introc critica proce	duction to D al path, loop ssing of FIR f	SP systems (L2) – typical DSP algorithms, data flow and depublic bound, iteration bound, longest path matrix algorithm (L3), filters (L3), pipelining and parallel processing for low power (L2)	endence graphs (L2) pipelining and paralle
UNIT	-11	RETIMING, ALGORITHMIC STRENGTH REDUCTION	9
UNIT	- III	FAST CONVOLUTION, PIPELINING AND PARALLEL	9
Fast o parall	convolution (el recursive	PROCESSING OF IIR FILTERS (L2) – Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3)– Look-Ahead pipelining in first-order IIR filters (L3),	hm (L3), Pipelined an , Look-Ahead pipelinin
Fast parall with p (L2), UNIT	convolution (el recursive powerof-2 de combined pip	PROCESSING OF IIR FILTERS (L2) – Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3)– Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel pelining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9
Fast of parall with parall (L2), UNIT Bit-lemand c FIR fi (L3),	convolution (el recursive cowerof-2 de combined pip - IV vel arithmetic arry-save mi lter (L3), CSI Distributed A	PROCESSING OF IIR FILTERS L2) – Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3)– Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel belining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2)– parallel multipliers with sign extension (L ultipliers (L3), design of Iyon's bit-serial multipliers using Horner's c representation (L2), CSD multiplication using Horner's rule for rithmetic fundamentals and FIR filters (L2)	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen
Fast of parall with parall with parall (L2), UNIT Bit-levand c FIR fi (L3), UNIT	convolution (el recursive cowerof-2 de combined pip - IV vel arithmetic arry-save mi lter (L3), CSI Distributed A	PROCESSING OF IIR FILTERS L2) - Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3)- Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel belining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2)- parallel multipliers with sign extension (L ultipliers (L3), design of lyon's bit-serial multipliers using Horner's rule for presentation (L2), CSD multiplication using Horner's rule for rithmetic fundamentals and FIR filters (L2) NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS AND ASYNCHRONOUS PIPELINING	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen 9
Fast of parall with p (L2), UNIT Bit-le and of FIR fi (L3), UNIT Nume iterati single Bundl	convolution (el recursive powerof-2 de combined pip - IV vel arithmeti arry-save mi lter (L3), CSI Distributed A -V erical strength ive matching phase clock ed Data vers	PROCESSING OF IIR FILTERS L2) - Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3)- Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel belining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2)- parallel multipliers with sign extension (L ultipliers (L3), design of lyon's bit-serial multipliers using Horne's rule for c representation (L2), CSD multiplication using Horner's rule for rithmetic fundamentals and FIR filters (L2) NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS AND ASYNCHRONOUS PIPELINING n reduction (L2)- sub-expression elimination (L3), multiple const (L3), synchronous pipelining and clocking styles (L2), clock st us Dual-Rail protocol (L2)	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen 9 tant multiplication (L3) skew in edge triggerer ronous pipelining (L2)
Fast of parall with p (L2), UNIT Bit-le and c FIR fi (L3), UNIT Nume iterati single Bundl	convolution (el recursive combined pip - IV vel arithmetic arry-save mi lter (L3), CSI Distributed A -V erical strength ive matching phase clock ed Data vers	PROCESSING OF IIR FILTERS L2) - Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3)- Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel belining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2)- parallel multipliers with sign extension (L ultipliers (L3), design of lyon's bit-serial multipliers using Home D representation (L2), CSD multiplication using Homer's rule for rithmetic fundamentals and FIR filters (L2) NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS AND ASYNCHRONOUS PIPELINING n reduction (L2)- sub-expression elimination (L3), multiple const (L3), synchronous pipelining and clocking styles (L2), clock st us Dual-Rail protocol (L2)	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen 9 tant multiplication (L3) skew in edge triggered ronous pipelining (L2) TOTAL: 45 PERIODS
Fast of parall with p (L2), UNIT Bit-lee and c FIR fi (L3), UNIT Nume iterati single Bundl	convolution (el recursive powerof-2 de combined pip – IV vel arithmeti arry-save mi lter (L3), CSI Distributed A –V erical strength ive matching phase clock ed Data vers	PROCESSING OF IIR FILTERS L2) - Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3) - Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel belining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2) - parallel multipliers with sign extension (L ultipliers (L3), design of lyon's bit-serial multipliers using Horne D representation (L2), CSD multiplication using Horner's rule for rithmetic fundamentals and FIR filters (L2) NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS AND ASYNCHRONOUS PIPELINING n reduction (L2) - sub-expression elimination (L3), multiple const (L3), synchronous pipelining and clocking styles (L2), clock s ing (L3), Two-phase clocking (L2), wave pipelining (Ł2). Asynchi us Dual-Rail protocol (L2)	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen 9 tant multiplication (L3) skew in edge triggere ronous pipelining (L2) TOTAL: 45 PERIODS
Fast o parall with p (L2), UNIT Bit-le and c FIR fi (L3), UNIT Nume iteratis single Bundl	convolution (el recursive combined pip - IV vel arithmetic arry-save mil lter (L3), CSI Distributed A - V erical strength ive matching phase clock ed Data vers e specific ope as assignmen nation e Out comes	PROCESSING OF IIR FILTERS L2) - Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3) - Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel belining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2) - parallel multipliers with sign extension (L ultipliers (L3), design of lyon's bit-serial multipliers using Horne's rule for or representation (L2), CSD multiplication using Horner's rule for rithmetic fundamentals and FIR filters (L2) NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS AND ASYNCHRONOUS PIPELINING n reduction (L2) - sub-expression elimination (L3), multiple const (L3), synchronous pipelining and clocking styles (L2), clock s ing (L3), Two-phase clocking (L2), wave pipelining (L2). Asynchius Dual-Rail protocol (L2) OPEN ENDED PROBLEMS / QUESTIONS en-ended problems will be solved during the classroom teaching. nts and evaluated as internal assessment only and not for the end	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen 9 tant multiplication (L3) skew in edge triggere ronous pipelining (L2) TOTAL: 45 PERIODS Such problems can be d semester
Fast of parall with p (L2), UNIT Bit-lee and c FIR fi (L3), UNIT Nume iterati single Bundl Course given exami Course	convolution (el recursive powerof-2 de combined pip – IV vel arithmetic arry-save mi lter (L3), CSI Distributed A –V erical strength ive matching phase clock ed Data vers e specific ope as assignmen nation e Out comes completion	PROCESSING OF IIR FILTERS L2) - Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3) - Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel pelining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2) - parallel multipliers with sign extension (L ultipliers (L3), design of lyon's bit-serial multipliers using Horner's c architectures (L2) - parallel multiplication using Horner's rule for rithmetic fundamentals and FIR filters (L2) NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS AND ASYNCHRONOUS PIPELINING n reduction (L2) - sub-expression elimination (L3), multiple const (L3), synchronous pipelining and clocking styles (L2), clock s ing (L3), Two-phase clocking (L2), wave pipelining (L2). Asynchi us Dual-Rail protocol (L2) OPEN ENDED PROBLEMS / QUESTIONS m-ended problems will be solved during the classroom teaching. nts and evaluated as internal assessment only and not for the end for this course the students will be able to:	hm (L3), Pipelined an , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen 9 tant multiplication (L3) skew in edge triggered ronous pipelining (L2) TOTAL: 45 PERIODS Such problems can be d semester
Fast o parall with p (L2), UNIT Bit-lee and c FIR fi (L3), UNIT Nume iterati single Bundl Course given exami course fourse course course	convolution (el recursive combined pip - IV vel arithmetic arry-save milter (L3), CSI Distributed A -V erical strength ive matching phase clock ed Data vers e specific ope as assignmen nation e Out comes completion Apply pipelin for efficiency	PROCESSING OF IIR FILTERS L2) - Cook-Toom algorithm (L3), modified Cook-Toom algorith filters (L3)- Look-Ahead pipelining in first-order IIR filters (L3), composition (L3), Clustered look-ahead pipelining (L2), Parallel belining and parallel Processing of IIR filters (L2) BIT-LEVEL ARITHMETIC ARCHITECTURES c architectures (L2)- parallel multipliers with sign extension (L ultipliers (L3), design of lyon's bit-serial multipliers using Home D representation (L2), CSD multiplication using Homer's rule for rithmetic fundamentals and FIR filters (L2) NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS AND ASYNCHRONOUS PIPELINING n reduction (L2)- sub-expression elimination (L3), multiple const (L3), synchronous pipelining and clocking styles (L2), clock st ing (L3), Two-phase clocking (L2), wave pipelining (L2). Asynchic us Dual-Rail protocol (L2) OPEN ENDED PROBLEMS / QUESTIONS m-ended problems will be solved during the classroom teaching. ins and evaluated as internal assessment only and not for the end ing and parallel processing techniques to alter FIR structures	hm (L3), Pipelined and , Look-Ahead pipelinin processing of IIR filter 9 3), parallel carry-rippl er's rule (L3), bit-seria precision improvemen 9 tant multiplication (L3) skew in edge triggered ronous pipelining (L2) TOTAL: 45 PERIODS Such problems can be d semester BLOOM'S Taxonomy

CO2	Analyse and modify the design equations leading to efficient DSP architectures for transforms apply low power techniques for low power dissipation	L3 – Apply
C03	Develop fast and area efficient IIR structures	L3 – Apply
C04	Develop fast and area efficient multiplier architectures	L3 – Apply
C05	Explain multiplications and build fast hardware for synchronous digital systems	L2 – Understand
REFE	RENCE BOOKS:	
1.	Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and Impl Edition, 2007.	ementation", Wiley, 1 st
2.	U. Meyer – Baese, "Digital Signal Processing with Field Programmable Gate Ar 4 th Edition, 2014	rays", Springer,
VIDE	O REFERENCES:	
1.	https://www.youtube.com/watch?v=UA0hmZU4G0M&list=PLkLMfaSJoziaRdKZ	ZB-4qOHT1ujJgtVSJu
2.	https://www.youtube.com/watch?v=7239zCwfmFU&list=PLkL MfaSJoziaRdKZ gtVSJu&index=4	B4qOHT1ujJ
WEB	REFERENCES:	
1.	NPTEL:: Electronics & Communication Engineering - VLSI Signal processing	and the local sectors and
ONLI	NE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc20_ee44/preview	

	POs									
COs	PO1	PO2	PO3	P04	P05	PO6				
C01	1	SR	2	2	1					
CO2	1	No.	2	2	1					
CO3	1	r art 3	2	2	1					
CO4	1	84, 144 , 84	2	2	1	4.81				
C05	1		2	2	1					
Average	1	1. 14	2	2	1					

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		DEOJECT WORK T	СР	L	Т	Р	С
ME	2371601	PROJECT WORK - 1	12	0	0	12	6
Prog B	ramme & Sranch	M.E. VLSI DESIGN		Ver	sion	1.0	
		Instructions if any		170			
Cours	e Objectives:						
1	To identify relev	ant research problems by searching academic databases and	d litera	ture	2		1
2	To design and co	onduct preliminary studies to explore identified problems	2.9	20		1.15	10.0
3	To conduct, com	pile and present research findings effectively	i nu e		1	<u>i</u> 11	
COU	RSE CONTENT:			1.1	1.0.1		1
Stude mem The r	ents will be eva bers report for PHASE	-I should be submitted by the students at the end of course	ons wil	l be	offe	red t	ру
Cours Upon	e Out comes: completion of t	this course the students will be able to:	BLO	ом'	s Ta	xono	mv
	Idontify the rea						,
C01	I uentity the res	search problem	L3	- A	ply		,
CO1 CO2	Collect, analyz	search problem e the relevant literature and finalize the research problem	L3	- Ar	nalyz	3	,
CO1 CO2 CO3	Collect, analyze Design the exp and conclude	search problem e the relevant literature and finalize the research problem periment, conduct preliminary experiment, analyze the data	L3 L4 L4	– Ar - Ar - Ar	nalyz nalyz nalyz	e e	,

CO -	POs								
COS	PO1	PO2	PO3	P04	PO5	POG			
CO1	2	3	3	1					
CO2	3	3	3	2	2	2.5			
CO3	3	.3	3	3	• 2				
CO4		3				1			
Average	2.6	3	3	2	2	1			

M.E/M.Tech Regulations - 2023

MI	E23VI 602	PROJECT WORK - II	СР	L	Т	Ρ	С
	22312002	TROSLET WORK II	24	0	0	24	12
Prog	gramme & Branch	M.E. VLSI DESIGN	Version: 1.0				
		Instructions if any		6.2			× 1
Cours	se Objectives:						
1	To develop the	e skill of students for analysing VLSI systems		Angel I	119	6	
2	To expose the	students to identify optimization methods and evaluate trade o	off in \	/LSI	syste	ems	1
3	To expose the	students to assess the impact of optimization in VLSI systems		1.1	<u>b</u>		
COL	IRSE CONTEN	F.			1200		_
It is Stud mem	the continuatio ents will be evolution obers	n of Phase I project. Three reviews will be conducted by project valuated by the committee during the review and suggestion should be published by the student in international / national co	t revie ns wil	ew co I be nce	offe	ittee red t	by
It is Stud mem At le The	the continuatio ents will be evolution obers ast one paper s report should b	n of Phase I project. Three reviews will be conducted by project valuated by the committee during the review and suggestion should be published by the student in international / national co e submitted by the students at the end of course	t revie ns wil onfere	ew co I be nce	omm offe	ittee red t	by
It is Stud mem At le The Cours Jpon	the continuatio ents will be evolution obers ast one paper s report should b se Out comes: completion o	n of Phase I project. Three reviews will be conducted by project valuated by the committee during the review and suggestion should be published by the student in international / national co e submitted by the students at the end of course f this course the students will be able to:	t revie ns wil onfere BLO	ew co I be nce OM'S	omm offe	ittee red l	by omy
It is Stud mem At le The Cours Jpon	the continuatio ents will be evolution ast one paper s report should b se Out comes: completion o Conduct inversion systems	n of Phase I project. Three reviews will be conducted by project valuated by the committee during the review and suggestion should be published by the student in international / national co e submitted by the students at the end of course f this course the students will be able to: estigation on sources of delay and power consumption in VLSI	t revie ns wil onfere BLO L2	ew co I be nce OM's - Un	omm offe S Tax ders	ittee red l kono tand	oy omy
It is Stud mem At le The Cours Jpon CO1 CO2	the continuatio ents will be evolution ast one paper s report should b se Out comes: completion o Conduct inversion systems Analyze the analysis of lit	n of Phase I project. Three reviews will be conducted by project valuated by the committee during the review and suggestion should be published by the student in international / national co e submitted by the students at the end of course f this course the students will be able to: estigation on sources of delay and power consumption in VLSI research problem and propose a solution by comprehensive cerature	t revie ns wil onfere BLO L2 L4	ew co Il be nce OM'S - Un - An	omm offe 5 Ta ders	kono tand	by pmy
It is Stud mem At le The Cours Jpon CO1 CO2 CO3	the continuatio ents will be evolution ast one paper s report should b se Out comes: completion o Conduct inversion systems Analyze the analysis of lit Design exper	n of Phase I project. Three reviews will be conducted by project valuated by the committee during the review and suggestion should be published by the student in international / national co e submitted by the students at the end of course f this course the students will be able to: estigation on sources of delay and power consumption in VLSI research problem and propose a solution by comprehensive cerature iment perform optimization of the VLSI system	t revie ns wil onfere L2 L4 L4	ew cc II be nce OM's - Un - An	omm offe 5 Ta ders alyze	kono	by Prmy
It is Stud mem At le The Cours Jpon CO1 CO2 CO3 CO3	the continuatio ents will be evolution ast one paper s report should b se Out comes: completion o Conduct inversion systems Analyze the analysis of lite Design expersion	n of Phase I project. Three reviews will be conducted by project valuated by the committee during the review and suggestion should be published by the student in international / national co e submitted by the students at the end of course f this course the students will be able to: estigation on sources of delay and power consumption in VLSI research problem and propose a solution by comprehensive cerature iment perform optimization of the VLSI system proposed solution with respect to existing literature	t revie ns wil onfere L2 L4 L4 L4 L5	ew co II be nce OM's - Un - An <u>- An</u> - Ev	omm offe 5 Ta ders ialyze alyze alua	kono tand tand	oy omy

CO -	POs						
COs	PO1	PO2	PO3	P04	P05	P06	
CO1	2	3	3	3			
CO2	3	3	3	2	1.1.1	1000	
CO3	3	3	3	3	ŕ 2		
CO4		3			2	1	
Average	2.6	3	3	2.6	2	1	

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	ME23VL411	MEMS and NEMS	3 3 0 0 3				
Prog	gramme & Branch	M.E. VLSI DESIGN	Version: 1.0				
		Instructions if any					
Course	e Objectives:		erene here en en er				
1	To introduce the	e concepts of Micro Electromechanical devices					
2	To know the fat	prication process of microsystems					
3	To know the de	sign concepts of micro sensors and micro actuators					
4	To familiarize concepts of Nano systems						
5	To introduce the	e concepts of Quantum Mechanics					
	-I	OVERVIEW	9				
New t MEMS Silicor	rends in Engin and NEMS, ME 1, Silicon compo	eering and Science: Micro and Nanoscale systems (L2), ir MS and NEMS – applications (L2), devices and structures (L unds (L2), polymers, metals (L2)	ntroduction to design (.2). Materials for MEMS				
	-11	MEMS FABRICATION TECHNOLOGIES	9				
(L2). and Micror Packa	Thin Film Depos Wet Etching, machining, High ging, Essential I	itions: LPCVD, Sputtering, Evaporation, Electroplating (L2); Electrochemical Etching (L2); Micromachining: Bulk M Aspect- Ratio (LIGA and LIGA-Like) Technology (L2); P Packaging Technologies, Selection of Packaging Materials (L2)	Etching Techniques: Di icromachining, Surfac ackaging: Microsystem)				
UNIT	- 111	MICRO SENSORS	9				
and Pi Study	iezo Resistive P : Piezo-Resistive	ressure Sensors (L2)- Engineering Mechanics Behind These Pressure Sensor (L2)-	Microsensors (L2). Cas				
UNIT	- IV	MICRO ACTUATORS	9				
Desigr Actuat Bar, C Actuat	n of Actuators: tion Using Piezo Comb Drive Act tors (L2)	Actuation Using Thermal Forces (L3), Actuation Using belectric Crystals (L3), Actuation using Electrostatic Forces suators) (L3), Micromechanical Motors and Pumps (L2). Ca	Shape Memory Alloys (Parallel Plate, Torsio ase Study: Comb Driv				
UNIT	-V	NANOSYSTEMS AND QUANTUM MECHANICS	9				
Atomi Equati Dynan (L2)	c Structures ar ion and Wave F nics (L3), Electr	d Quantum Mechanics (L2), Molecular and Nanostructure unction Theory (L3), Density Functional Theory (L3), Nanos omagnetic Fields and their Quantization (L2), Molecular Wire	Dynamics: Schrodinge structures and Molecula es and Molecular Circuit				
2	Sectore.		TOTAL: 45 PERIODS				
		OPEN ENDED PROBLEMS / QUESTIONS					
Course given a examir	e specific open-e as assignments nation	ended problems will be solved during the classroom teaching. and evaluated as internal assessment only and not for the er	Such problems can be nd semester				
Course Jpon d	e Out comes: completion of	this course the students will be able to:	BLOOM'S Taxonomy				
CO1	Discuss micro	sensors and its applications	L2 - Understand				
có2	Differentiate v	various MEMS fabrication techniques	/L2 Understand				
CO3	Explain micro	actuators with case study	PDF Understand				
KIC	т	13 M.E9MOTE Faculty of Electronics & Knowledge Institu KIOT Campus,	Studiegulations - 202: Communication Engg te of Technology Kakapalayam,				

C04	Describe function of micro actuators for different applications	L3 - APPLY
C05	Apply wave functions to derive quantum parameters	L3 - APPLY
REFE	RENCE BOOKS:	
1.	Chang Liu, "Foundations of MEMS", Pearson Education India Limited, 2 nd Edit	ion, 2006
2.	Marc Madou, "Fundamentals of Microfabrication", CRC Press, 1st Edition, 199	7
3.	Stephen D. Senturia, "Micro System Design", Kluwer Academic Publishers, 2	nd Edition, 2001
4.	Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Stru Edition, 2002	ictures" CRC Press, 2 nd
VIDE	O REFERENCES:	김 이번 바람이 가지?
1.	https://www.youtube.com/watch?v=w261_0ki6FQ	a sugar and a sugar a sugar
2.	https://www.youtube.com/watch?v=jQF4_hO_2qw	
WEB	REFERENCES:	
1.	https://link.springer.com/book/10.1007/b136111	
2.	https://cse.usf.edu/~haozheng/teach/soc/	
ONLI	NE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc24_ee09/preview	
2.	https://online.stanford.edu/courses/engr240-introduction-micro-and-nano-e systems	lectromechanical-

	POs 💫					
COs	PO1	PO2	PO3	PO4	PO5	POG
C01	1-1-		2	1		
CO2	1	. Se	2	- 1		
CO3	1		2	1	124	A-min
CO4	. Jey	e not s	21.00	ester top	2	1.27
C05	1		2	1		
Average	1	- and the	2	1	2	- Alex

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	ME23VL412	NETWORK ON CHIP	3 3 0 0 3
Pro	ogramme &	M.E. VLSI DESIGN	Version: 1.0
	Brunen	Instructions if any	
our	se Objectives:		
1	To understand	d the concept of Network - on - Chip	
2	To learn route	er architecture designs	
3	To study fault	tolerance Network - on - Chip	Sector Sector
4	To familiarize	concepts of faults in NOC	shipping with the second
5	To introduce th	ne concepts of 3D architectures	
1	UNIT-I	INTRODUCTION TO NOC	9
wite	UNIT-II ching Techniqu munication (L2)	ARCHITECTURE DESIGN es and Packet Format (L2)- Asynchronous FIFO Design - Wormhole Router Architecture Design (L3) - VC Router Ar	9 n (L3)- GALS Style o rchitecture Design (L3)
Adap	tive Router Arcl	hitecture Design (L3)	
Pack Desig Multi	et Routing-QOS gn (L2)- Efficie cast Routing Fo	ROUTING ALGORITHM (L2), Congestion Control and Flow Control (L2) – Router Des ent and Deadlock-Free Tree-Based Multicast Routing Meth or 2D and 3D Mesh Networks (L3) - Fault-Tolerant Routing A	sign (L2) – Network Lin nods (L2) - Path-Base Algorithms (L3)- Reliab
Pack Designed and a Designed of the second s	et Routing-QOS gn (L2)– Efficie cast Routing Fo Adaptive Routing UNIT-IV gn-Security in N Chips-Test and	ROUTING ALGORITHM (L2), Congestion Control and Flow Control (L2) – Router Desent and Deadlock-Free Tree-Based Multicast Routing Methor 2D and 3D Mesh Networks (L3) - Fault-Tolerant Routing A g Algorithms (L2) TEST AND FAULT TOLERANCE OF NOC Networks (L2) - On-Chips - Formal Verification of Communica Fault Tolerance for Networks-On-Chip Infrastructures (L3)-	9 sign (L2) – Network Lin hods (L2) – Path-Base Algorithms (L3)- Reliab 9 htions in Networks (L3) Monitoring Services fo
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C05	Design three dimensional architectures of NOC	L3 - Apply
REFE	RENCE BOOKS:	
1.	Chrysosto MO, Snicopoulos, Vijaykrishnan Narayanan, Chita R.Da Architectures Holistic Design Exploration", Springer, 2 nd Edition, 2012	as "Networks-On-Chip
2.	Fayez gebali, Haytham Elmiligi, Mohamed watheq El-Kharashi "Networks Practice", CRC Press, 1 st Edition, 2009	-On-Chips Theory and
3.	Konstantinos Tatas and Kostas Siozios "Designing 2D and 3D Network-C Springer, 1 st Edition, 2013	Dn-Chip Architectures",
4.	Palesi, Maurizio, Daneshtalab, Masoud "Routing Algorithms in Networks- Edition, 2014	On-Chip", Springer, 1 st
VIDE	O REFERENCES:	
1.	NPTEL:: Electronics & Communication Engineering - Network on Chip	
2.	https://www.youtube.com/watch?v=OArCsk3Dsxc	and a standard and
WEB	REFERENCES:	
1.	What is Network on Chip? Synopsys	
2.	Education Network on Chip	
ONLI	NE COURSES:	
1.	Network on Chip- Course (nptel.ac.in)	ng a kanalashir sa
2.	Network on Chipl Udemy	

	POs 🛃					
COs	PO1	PO2	РОЗ	P04	P05	POG
C01	12		1	3		
CO2	1	. Sa	an1	3	1.00	
CO3	1	- Fry	1	3		
CO4	Acy	i net 1	Tege !	whenty		la l
CO5	1		1	1		E
Average	1		1	2.2		

	ME23VL413	EVOLVABLE HARDWARE	CP 3	L 3	T O	Р 0	C 3
Pro	ogramme & Branch	M.E. VLSI DESIGN		Ver	sion:	1.0	
		Instructions if any	1				
Cours	se Objectives:				3		
1	To study about	the evolvable systems algorithms, multi-objective utility funct	tions				đ
2	To understand t	he concepts of reliability, design-in redundancy, fault tolerand	ce ar	nd de	fect t	olera	ince
2	To design of evo	Ivable systems using Programmable Logic Devices (like FPGA	s)				- 191
4	To familiarize co algorithms	ncepts of modular subsystems with identical components and	gen	eraliz	ed co	ontro	ller
5	To introduce the	concepts of fault-tolerant systems		40			
UNI	г–1	INTRODUCTION		1.1.1	9	- 51	
Tradi Circu (L3),	itional Hardware iits and Systems Applications and	Systems and its Limitations (L2), Evolvable Hardware, Char (L2), Technology-Extrinsic and Intrinsic Evolution (L3), offlir Scope of EHW (L2)	racte ne ar	ristic nd Or	s of nline	Evolv Evolu	abl Itio
UNI	T-11	EVOLUTIONARY COMPUTATION			9		
Algoi imple solut	rithms (L3), gene ementations – ev ions (L2)	tic programming (L3), evolutionary strategies (L3), evolution volutionary design and optimizations (L3), EHW – current	ary probl	prog lems	and	ning (pote	(L3 ntia
UNI.	T- III	RECONFIGURABLE DIGITAL DEVICES			9	, d. 1	
Basic (L3),	c architectures (L using reconfigura	2)- Programmable Logic Devices (L4), Field Programmable able hardware - design phase, execution phase (L4), evolution	e Ga on of	te A digit	rrays al cir	(FPC cuits	GAS (L2
UNI.	T – IV	RECONFIGURABLE ANALOG DEVICES		1	9		
Basic (L2),	c architectures (L using reconfigu its (12)	2) – Field Programmable Transistor Arrays (FPTAS) (L2), ana rable hardware – design phase (L2), execution phase (L2	ilog a 2), e	array volut	s (L2 ion (.), M\ of an	NM alo
circu	UNIT-V	APPLICATIONS OF EHW	3	1	9	1	-
Synt syste (L2)	hesis vs. Adaptat ems (L2), intrinsio	ion (L2), designing self-adaptive systems (L3), fault-tolerant reconfiguration for online systems (L3), EHW based fault re	syste cove	ems (ery ar	(L3), nd ful	real- ture v	tim vor
	is and the second		тот	AL: 4	45 PI	ERIO	DS
Cours given exam Cours	se specific open-e as assignments ination se Out comes:	OPEN ENDED PROBLEMS / QUESTIONS anded problems will be solved during the classroom teaching. and evaluated as internal assessment only and not for the en	Such d ser	n pro meste	blem: er	s can	be
opon	completion of 1	inis course the students will be able to:			514		
C01	Explain the fun	damentals of computational models and evolvable hardware	L3	– Ap	ply	-	
C02	computational	different reconfigurable digital architectures and ite	L3	– Ap	ply	<u>.</u>	<u></u>
CO3	computational	intelligence techniques.	14	An	alyse	Je?	
C04	Analyse the computational	different reconfigurable analog architectures and its intelligence techniques.	1/2	- Un	derst	and	
		CHAIRPE Board of S	udie	5	d • .		
K	ют	17 Faculty of ElectromcsTaco Knowledge Institute KIOT Campus, Ka	of Te	echno alayar	n ti 109 logy m,	5 - 2	023

C05	Summarise the typical applications of bio-inspired and other EHW systems L3 – Apply
REFE	RENCE BOOKS:
1.	Garrison W. Greenwood and Andrew M. Tyhrrell, "Introduction to Evolvable Hardware: a Practical Guide for Designing Self- Adaptive Systems", Wiley-Blackwell Press, 1 st Edition, 2006
2.	Tetsuya Higuchi, Xin Yao and Yong Liu, "Evolvable Hardware", Springer-Verlag, 1st Edition, 2004
3.	Lukas Sekanina, "Evolvable Components: From Theory to Hardware Implementations", Springer Verlag, 1 st Edition, 2004
VIDE	O REFERENCES:
1.	Evolvable Hardware - YouTube
2.	https://www.youtube.com/watch?v=dpszamfrSrU
WEB	REFERENCES:
1.	Evolvable Hardware (cadence.com)
2.	Evolvable Hardware /main/lectures (utexas.edu)
ONLI	NE COURSES:
1.	Evolvable Hardware - Course (nptel.ac.in)
2.	Evolvable Hardware /lectures (msu.edu)

			РО	s		ister ski ustrani
COs	PO1	PO2	PO3	PO4	PO5	POG
C01	1		. 3	1		
CO2	51		- 3	1		
CO3	1		3	2		
CO4	1	1020	1	1		-4 D
CO5	A.	e not "	- Mar	,./. ¹ /.,	ntune ^{de la} ri	
Average	1	A. K.	2.2	1.2		

24

	ME23VL414	SOFT COMPUTING AND OPTIMIZATION TECHNIQUES	CP 3	L 3	Т 0	P 0	С 3		
Pr	ogramme &	M.E. VLSI DESIGN		Ver	sion	1.0			
	Branch	Instructions if any							
Co	co Objectivect								
cour	To classify vario	us soft computing frame works	1. 			1			
1			vetome						
2	To be familiar w	ith the design of neural networks, fuzzy logic, and fuzzy syst	ems		1	1			
3	To learn mather	natical background for optimized genetic programming		1		212			
4	To be exposed t	o neuro-fuzzy hybrid systems and its applications							
5	To introduce the	concepts of optimization techniques					5		
UNI	T-I	FUZZY LOGIC:			9				
(L3) (L3)	 Fuzzy relations Fuzzy logic cont 	, rules, propositions, implications and inferences (L3)- De roller design (L3)- Some applications of Fuzzy logic (L2)	efuzzi	ficati	on te	echni	JUE		
UNI	1-11	AKTIFICIAL NEUKAL NETWORKS	0~~~	ution	9	iont i	12		
Com UNI	ning (L4), Genera iputational Maps: T– III	Kohonen Network (L4) GENETIC ALGORITHM:	g (L3), se	9 9	rgan	211		
tech (L3) color	niques (L3)- Gene – crossover - mu ny optimization (L	tic basic concepts (L2) - operators (L3) – Encoding scheme (tation (L2) - Travelling Salesman Problem (L3), Particle swar 3)	(L3) – m op	Fitn	ess e ation	valua (L3),	ntic Ar		
UNI	T – IV	NEURO-FUZZY MODELING	1		9				
Adap Mode	otive Neuro - Fu eling (L2), framew base Structure Io	zzy Inference Systems (ANFIS) (L2) – architecture (L2) - (ork, neuron functions for adaptive networks (L2) – Data Clus lentification (L2) – Neuro-Fuzzy Control (L2) – the inverted pe	Coact sterin ndulu	ive N g Alg um sy	Veuro Jorith) - F ms (l 1 (L2)	uzz _3)		
Rule		CONVENTIONAL OPTIMIZATION TECHNIOLIES			9 cifica	tion	12		
Rule UNI	T-V	zation techniques (12) Statement of an optimization problem	1 (1 3)	clac		adio	nt		
Rule UNI Intro Unco conju sequ (L2)	T–V oduction to optimi onstrained optimi ugate gradient (uential linear prog	zation techniques (L2), Statement of an optimization problem zation - gradient search method -Gradient of a function L3), Newton's Method (L3), Marquardt Method, (L3), Cons ramming (L3), Interior penalty function method, external p	n (L3), n, st strain penalt	class eepe ed c cy fur	st gr optim nctior	ization n me	tho		
Rule UNI Intro Unco conji sequ (L2)	T–V oduction to optimi onstrained optimi ugate gradient (uential linear prog	zation techniques (L2), Statement of an optimization problem zation - gradient search method -Gradient of a function L3), Newton's Method (L3), Marquardt Method, (L3), Cons ramming (L3), Interior penalty function method, external p	n (L3), n, st strain benalt TOT	clas eepe ed c cy fur AL: 4	st gr optim nctior	ization me ERIO	thc DS		
Rule UNI Intro Unco conji sequ (L2)	T–V oduction to optimi onstrained optimi ugate gradient (uential linear prog	zation techniques (L2), Statement of an optimization problem zation - gradient search method -Gradient of a function L3), Newton's Method (L3), Marquardt Method, (L3), Cons aramming (L3), Interior penalty function method, external p OPEN ENDED PROBLEMS / QUESTIONS	n (L3), n, st strain benalt TOT	clas: eepe ed c cy fur AL: 4	st gr optim nctior 45 PI	ization me	bs DS		
Rule UNI Intro Unco conji sequ (L2) Cour giver exam	T-V oduction to optimi onstrained optimi ugate gradient (iential linear prog se specific open-e n as assignments nination	zation techniques (L2), Statement of an optimization problem zation - gradient search method -Gradient of a function L3), Newton's Method (L3), Marquardt Method, (L3), Cons pramming (L3), Interior penalty function method, external p OPEN ENDED PROBLEMS / QUESTIONS Inded problems will be solved during the classroom teaching. and evaluated as internal assessment only and not for the en	TOT	AL: 4	stica st gr optim nctior 45 Pl blems er	ERIO	be		
Rule UNI Intro Unco conju sequ (L2) Cour giver exam Cour	T-V oduction to optimi onstrained optimi ugate gradient (uential linear prog se specific open-e n as assignments nination se Out comes: n completion of t	zation techniques (L2), Statement of an optimization problem zation - gradient search method -Gradient of a functio L3), Newton's Method (L3), Marquardt Method, (L3), Constraining (L3), Interior penalty function method, external p OPEN ENDED PROBLEMS / QUESTIONS Inded problems will be solved during the classroom teaching. and evaluated as internal assessment only and not for the er	TOT	AL:	sinca st gr pptim nctior 45 Pl blems er S Ta:	ERIO	be my		
Rule UNI Intro Unco conji sequ (L2) Cour giver exam Cour Upon	T-V oduction to optimi onstrained optimi ugate gradient (iential linear prog se specific open-e n as assignments nination se Out comes: n completion of t Apply different network	zation techniques (L2), Statement of an optimization problem zation - gradient search method -Gradient of a functio L3), Newton's Method (L3), Marquardt Method, (L3), Con- gramming (L3), Interior penalty function method, external p OPEN ENDED PROBLEMS / QUESTIONS Inded problems will be solved during the classroom teaching. and evaluated as internal assessment only and not for the er chained problems the students will be able to:	TOT Such Such Such BLC RSOT	AL: 4	sinca st gr optim nctior 45 Pl blems er S Ta: oply	ERIO	be		

CO2	Implement Neuro-Fuzzy and Neuro-Fuzz-GA expert system.	L4 - Analyze
CO3	Apply machine learning algorithms through Neural networks.	L3 – Apply
C04	Explain Neuro Fuzzy system for clustering and classification.	L2–Understand
C05	Apply the optimization techniques to solve the real-world problems	L3 - Apply
REFE	RENCE BOOKS:	
1.	J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", 2 nd Edition, 2004	PHI / Pearson Education,
2.	David E. Goldberg, "Genetic Algorithms in Search, Optimization and Mach Wesley, 1 st Edition, 2009	ine Learning", Addison
3.	George J. Klir and Bo Yuan, "Fuzzy Sets, Fuzzy Logic-Theory and Applicat Edition, 2015	ions", Prentice Hall, 1 st
VIDE	O REFERENCES:	
1.	Soft Computing- YouTube	and the second second second
2.	Optimization Techniques – YouTube	
WEB	REFERENCES:	it is the
1.	Resources-Soft Computing and Optimization Techniques - udemy course	ware
ONLI	NE COURSES:	
1.	Soft Computing and Optimization Techniques – Course (nptel.ac.in)	

	2.5	POs 2					
COs	P01	PO2	PO3	PO4	P05	P06	
C01	1-1-		2	1	2	1	
CO2	1	- 5A	2.00	1	2	1	
CO3	1	S. YY	2	1	2	1	
CO4	. They	s mit s	16-20	ader top	2	1	
C05	1		2	1		1	
Average	1	State Street	2	1	1.8	1	

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	ME23VL415	CAD FOR VLSI DESIGN	CP 3	L 3	T O	P 0	C 3
Pro	gramme &	M.E. VLSI DESIGN		Ver	sion	: 1.0	
	Dialici	Instructions if any					
Cours	se Objectives:		1.23	1750	5		
1	To introduce the	VLSI design methodologies and design methods.					- 1
2	To introduce dat	a structures and algorithms required for VLSI design.			a la		
3	To study algorith	nms for partitioning and placement.		1		Terri	
4	To study algorith	nms for floor planning and routing.			1		
5	To study algorith	nms for modelling, simulation and synthesis.					_
UNI	Г-I	INTRODUCTION		1.1	9	1	
Cycle Revie UNI Intro	(L2) – Physical I w of VLSI Desigr F–II duction to Data plexity (L3) – Tra	Design Cycle (L2) – New Trends in Physical Design Cycle (L2) Automation Tools (L2) DATA STRUCTURES AND BASIC ALGORITHMS Structures and Algorithms (L3)– Algorithmic Graph The ctable and Intractable Problems (L3) – General Purpose Me	2) – D ory a ethods	esigr and s for	9 Comp Comp	les (L outati binat	.2) – onal orial
Optir	nization (L3)						
ME23VL415 CAD FOR VLSI DESIGN CP L T P C Programme & Branch M.E. VLSI DESIGN Version: 1.0 Surse Objectives: Instructions if any 2 To introduce the VLSI design methodologies and design methods. Image: Comparison of the Comparison of th							
Parti	tioning (L3) – Pla	cement (L2) – Placement Algorithms (L3)	raph	Com	расц		.5) -
UNI	τ – Ιν	ALGORITHMS FOR FLOORPLANNING AND ROUTING			9		3.2 m
Floor Rout	ME23VL415 CAD FOR VLSI DESIGN rogramme & Branch M.E. VLSI DESIGN Instructions if any Instructions if any urse Objectives: To introduce the VLSI design methodologies and design methods. To introduce data structures and algorithms required for VLSI design. To study algorithms for partitioning and placement. To study algorithms for modelling, simulation and synthesis. IIT-1 INTRODUCTION roduction to VLSI Design Methodologies (L2) – VLSI Design Cycle (L2) – New Crede (L2) – Physical Design Cycle (L2) – New Trends in Physical Design Cycle (L2) – New Crede (L3) – Tractable and Intractable Problems (L3) – General Purpose Metimization (L3) – Tractable and Intractable Problems (L3) – General Purpose Metimization (L3) – Tractable and Intractable Problems (L3) – General Purpose Metimization (L3) – Problem Formulation (L2) – Algorithms for Constraint Of titloning (L3) – Problem Formulation (L2) – Algorithms for Constraint Of titloning (L3) – Problem Formulation (L2) – Algorithms for Constraint Of titloning (L3) – Problem Formulation (L2) – Algorithms (L3) IIT - IV ALGORITHMS FOR FLOORPLANNING AND ROUTING orplanning (L2) – Problem Formulation (L2) – Algorithms (L3) Iuting (L3) – Global Routing (L2) – Detailed Routing (L2) MODELLING, SIMULATION AND SYNTHESIS nulation (L2) – Gate Level Modeling and Simulation (L3) – Cogic Synthesis and cision Diagrams (L3) – High Level Synthesis (L2) Iuting tual operation of this course the students will be able to: on comple	– Ro	outing	g (L2) - /	Area	
UNI	г-v	MODELLING, SIMULATION AND SYNTHESIS			9		140
Simu Decis	llation (L2)– Gate sion Diagrams (L3	Level Modeling and Simulation (L3) – Logic Synthesis and ') – High Level Synthesis (L2)	Verific	cation	n (L3) – B	inary
	ME23VL415 CAD FOR VLSI DESIGN CP L T P C 3 3 0 0 3 0 0 3 Programme & Branch M.E. VLSI DESIGN Version: 1.0 Version: 1.0 Instructions if any Instructions of any Instructions of any Instructions of any Irree Objectives: To introduce the VLSI design methodologies and design methods. To introduce that structures and algorithms required for VLSI design. To study algorithms for partitioning and placement. To study algorithms for floor planning and routing. To study algorithms for modelling, simulation and synthesis. 9 urdulu (2) INTRODUCTION 9 9 roduction to VLSI Design Methodologies (L2) - VLSI Design Cycle (L2) - New Trends in Physical Design Cycle (L2) - Design Styles (L2) - View of VLSI Design Automation Tools (L2) 9 urdulu (2) Tratable and Intractable Problems (L3) = General Purpose Methods for Combinatorial timization (L3) - Tratable and Intractable Problems (L3) = General Purpose Methods for Combinatorial timization (L3) - Problem Formulation (L2) - Algorithms for Constraint Graph Compaction (L3) - Tratable and Intractable Problems (L2) = Constraint Graph Compaction (L3) - Tratable and Intractable Routing (L2) - Costraint Graph Compaction (L3) - Floor Planning Algorithms (L3) - Routing (L2) - Algorithms (L3) - Routing (L2) - Algorithms (L3) - Routing (L2) - Algorithms (L3) - Routing (L2)						
	in and	OPEN ENDED PROBLEMS / QUESTIONS				41 1 - 1 - 1	8.0
Cours given exam	se specific open-e as assignments ination	nded problems will be solved during the classroom teaching and evaluated as internal assessment only and not for the end	. Such nd ser	n pro mest	blem er	s can	be
Cour: Upon	se Out comes: completion of t	his course the students will be able to:	BLC	юм	'S Ta	xond	omy
C01	Use various VLS	SI design methodologies	L2	2 - U	nders	tand	1
CO2	Understand diff design	erent data structures and algorithms required for VLSI	L3	3 – A	pply		
C03	Analyse partitio	ning and placement efficiency using algorithms	L3	3 – A	pply		1
C04	Develop algorit	nms for floor planning and routing	L3	3 - Aj	pply		•
CØ5	Construct algor	ithms for modelling, simulation and synthesis	1º1		oply		1.0
	a dia tanàna	CHAIRPE	RSON	V	4.	1	

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REF	ERENCE BOOKS:
1.	Sabih H. Gerez, "Algorithms for VLSI Design Automation", Wiley-India, 2 nd Edition, 2017
2.	Naveed a. Sherwani, "Algorithms for VLSI Physical Design Automation", Springer, 3rd Edition, 2017
3.	Charles J. Alpert, Dinesh P. Mehta and Sachin S Sapatnekar, "Handbook of Algorithms for Physical Design Automation", CRC Press, 1 st Edition, 2008
VID	EO REFERENCES:
1.	https://www.youtube.com/watch?v=bNGxSmgo_ic&list=PLrEFqtWVv0o56q3dY2kX14E6_NxKwgWOg
2.	https://www.youtube.com/watch?v=hJTK5nj1iq8
WEB	REFERENCES:
1.	NPTEL:: Electronics & Communication Engineering – CAD for VLSI Design
ONL	NE COURSES:
1.	https://archive.nptel.ac.in/courses/106/106/106106088/

		POs						
COs	PO1	PO2	PO3	P04	P05	POG		
C01	1		12	2				
C02	-1:		1	2		1.200		
CO3	1		\mathcal{I}_1	2	2	10,00		
CO4	-1	-	**1	2	2	1		
C05	-ic.		1	2	2	1		
Average	1		- 1	2	2	1		

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	ME23VL416	VLSI Architectures for Image Processing	3 3 0 0 3			
Pr	ogramme & Branch	M.E. VLSI DESIGN	Version: 1.0			
		Instructions if any				
our	se Objectives:		· · · · · · · · · · · · · · · · · · ·			
1	To introduce the	e VLSI architectures for image processing				
2	To introduce cor	ncepts of 3D image processing				
3	To study algorit	hms for binary image processing				
4	To study VLSI p	ipeline architectures for image processing				
5 To study VLSI subsystems for image analysis						
UN	IIT-I	IMAGE PROCESSING ALGORITHMS AND ARCHITECTURES	9			
Ope Proc	erations (L3), Ima cessors (L2)- MIM -Level Image Prod	age Processor Architecture: Requirements and Classificati D Systems (L2)- SIMD Systems (L2)- Pipelines (L2)- Design cessors (L2)- Design Method for Special Architectures (L2) 3D IMAGE PROCESSING	on (L2)- Uni and Multi gn Aspects of Real-Time			
Ove Ima Algo	erview of 3D Imag age Processing (L prithm of Image O	ge (L2) - Types and Characteristics of 3D Image Processing 2), Continuous and Digitized Images (L2), Models of I Operations (L3) - Smoothing Filter (L3) - Difference Filter (L3)	g (L2) - Examples of 3D mage Operations (L3), 3) - Differential Features			
of a	Curved Surface (E3) - Region Growing (E2)				
of a	IIT- III	3D BINARY IMAGE PROCESSING	9			
of a UN Intr Dist Divi (L3)	iIT – III roduction (L2)- La cance Transformat sion of a Digitized	3D BINARY IMAGE PROCESSING abeling of a Connected Shrinking Surface (L3), Thinning a ion and Skeleton (L2) -Border Surface Following (L2) -Knot d Image (L3) - Algorithms for Processing Connected Compo	9 and Axis Thinning (L3)- and Link (L2) - Voronoi onents with Gray Values			
of a UN Intr Dist (L3) UN	iIT – III oduction (L2)- La cance Transformat ision of a Digitized) IIT – IV	3D BINARY IMAGE PROCESSING abeling of a Connected Shrinking Surface (L3), Thinning a ion and Skeleton (L2) -Border Surface Following (L2) -Knot d Image (L3) - Algorithms for Processing Connected Compo PIPELINED, 2D AND 3D IMAGE PROCESSING ARCHITECTURES	9 and Axis Thinning (L3)- and Link (L2) - Voronoi onents with Gray Values 9			
of a UN Intr Dist Divi (L3) UN Arcl Con Proo Algo UN Con	IIT – III roduction (L2)- La cance Transformat sion of a Digitized IIT – IV hitecture of a Ce trol (L3) - Real cessing Architectur prithms (L3) IIT – V current Systems f ection in VLSI (L3)	3D BINARY IMAGE PROCESSING abeling of a Connected Shrinking Surface (L3), Thinning a ion and Skeleton (L2) -Border Surface Following (L2) -Knot d Image (L3) - Algorithms for Processing Connected Compose PIPELINED, 2D AND 3D IMAGE PROCESSING ARCHITECTURES Illular Logic Processing Element (L2) - Second Decompose Time Pipeline for Low Level Image Processing (L3) - Decompose VLSI SYSTEMS FOR IMAGE PROCESSING for Image Analysis (L2) - VLSI Wavefront Arrays for Image a) - Design of VLSI Based Multicomputer Architecture for Large	9 and Axis Thinning (L3)- and Link (L2) - Voronoi onents with Gray Values 9 sition in Data Path and esign Aspects of Image and Intermediate Level 9 Processing (L3) - Curve Dynamic Scene Analysis			
of a Of a UN Intr Dist Divi (L3) UN Arcl Con Proo Algo UN Con Det (L3)	IIT – III roduction (L2)- La cance Transformat sion of a Digitized IIT – IV hitecture of a Ce trol (L3) - Real cessing Architectu prithms (L3) IIT – V current Systems f ection in VLSI (L3), VLSI-Based Ima	3D BINARY IMAGE PROCESSING abeling of a Connected Shrinking Surface (L3), Thinning a ion and Skeleton (L2) -Border Surface Following (L2) -Knot d Image (L3) - Algorithms for Processing Connected Compo PIPELINED, 2D AND 3D IMAGE PROCESSING ARCHITECTURES Illular Logic Processing Element (L2) - Second Decompose Time Pipeline for Low Level Image Processing (L3) - Decompose VLSI SYSTEMS FOR IMAGE PROCESSING for Image Analysis (L2) - VLSI Wavefront Arrays for Image 8) - Design of VLSI Based Multicomputer Architecture for Image Resampling for Electronic Publish (L3)	9 and Axis Thinning (L3)- and Link (L2) - Voronoi onents with Gray Values 9 sition in Data Path and esign Aspects of Image and Intermediate Level 9 Processing (L3) - Curve Dynamic Scene Analysis			
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C02	Apply Various Processing Techniques of Image and Design Different Architectures for Image Processing	L3 - APPLY
C03	Construct various pipelined hardware architecture for 2D and 3D Image processing	L3 - APPLY
C04	Realize binary image processing algorithm in VLSI systems	L3 - APPLY
C05	Implement filter techniques in 2D and 3D image	L3 - APPLY
REFE	RENCE BOOKS:	
1.	Pieter Jonker, "Morphological Image Processing: Architecture and VLSI Edition, 1992	Design", Springer, 1 st
2.	Junichiro Toriwaki, Hiroyuki Yoshida, "Fundamentals of Three-Dimen Processing", Springer, 1 st Edition, 2010	isional Digital Image
3.	King-Sun Fu, "VLSI for Pattern Recognition and Image Processing", Springer 2012	-Verlag, 1 st Edition
VIDE	O REFERENCES:	in addression
1.	https://www.youtube.com/watch?v=X0eBZUt9NRs&list=PLfMCiCIRnpUnFgNS	Sy0QuOuqIIrG0fe5eD
2.	https://www.youtube.com/watch?v=iG5jqJde5EM	
WEB	REFERENCES:	ent of backing water
1.	https://www.hindawi.com/journals/vlsi/2014/872501/	이 아이는 아이는 것이다.
2.	https://www.sciencedirect.com/science/article/abs/pii/0141933183905367	
ONLI	NE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc24_ee63/preview	
2.	https://onlinecourses.nptel.ac.in/noc19_ee55/preview	denterie burg

	POs							
COs	PO1	PO2	PO3	P04	PO5	P06		
C01	1	and 3	1	. listin	1	14		
C02	1		1	1	1			
CO3	1		1	1	1			
CO4	1		1	1	1			
CO5	1	4435	1	1	1	i <u>rs</u> kh		
Average	1	Spine (S	1	1	1	12/12/1		

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	ME23VL417	SYSTEM VERILOG	3 3	0	0	3			
Pr	ogramme &	M.E. VLSI DESIGN	Ver	sion:	1.0				
	branch	Instructions if any							
Cour	se Objectives:		1. A. A.		1.1				
1	To give insigh	t on System Verilog Concepts - Synthesis, Analysis and Archite	ecture De	sign					
2	To study Syst	em Verilog and SVA for improvements in Verification Efficiency	· 12/10	25	189-				
3	To introduce checking, and	advanced verification features, such as the practical use of coverage	classes,	rando	mizat	ior			
4	To study inter	interprocess communication and test coverage							
5 To give insight on top level design of system verilog									
M.	UNIT-I	VERIFICATION METHODOLOGY		9	- -				
(L2) Laye	, Constrained-R ered Testbench (UNIT-II	andom Stimulus (L2), Functional Coverage (L2), Test ben L2) SYSTEM VERILOG BASICS AND CONCEPTS	ch Com	oonen 9	ts (L2	2),			
with (L2) Fund	Typedef (L3), Procedural Statistics Ctions (L3)	Creating User-Defined Structures (L3), Enumerated Types (L atements and Routines: Procedural Statements (L3), Tasks	.3), Cons , Functio	tants, ons, a	Strin nd Vo	igs bic			
	the second s								
Intro	UNIT-III oduction (L2)- W	OOPS /here to Define a Class (L2)- OOPS Terminology - Creating Net	w Object	9 s (L3)	- Obje	ect			
Intro De a Defin Unde Cou	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildir UNIT-IV	OOPS /here to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class umic Objects (L2) - Copying Objects (L2) - Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION	w Object -Class Ro is Inside te (L2) -	9 s (L3) outine Anoth Stra 9	- Obje s (L2) er (L3 ying (ect) - 3)- Off			
Intro De a Defii Undo Cou	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildir UNIT-IV	OOPS /here to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class mic Objects (L2) - Copying Objects (L2) - Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE	w Object -Class Ro is Inside te (L2) -	9 s (L3) butine Anoth Stra 9	- Obje s (L2) er (L3 ying (ect) - 3)- Dfl			
Intro De a Defin Unde Cou Wor Buile (L2) (L3)	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildir UNIT-IV WIT-IV king With Threa ding a Testbench , Simple Function , Analysing Cove	OOPS /here to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class umic Objects (L2) - Copying Objects (L2) - Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE ads (L3), Inter-Process Communication (L3), Events, Semaple h with Threads and IPC (L3). Coverage Types (L2), Functional coverage Example (L3), Coverage Options (L3), Parameterage Data (L2), Measuring Coverage Statistics (L2)	w Object -Class Ro is Inside te (L2) - hores, Mi al Covera eterized	9 butine Anoth Stra 9 ailbox ge St Cover	- Obje s (L2) er (L3 ying (es (L3 rategi Grou	ect) - 3)- 3), es ps			
Intro De a Defin Undo Cou Wor Builo (L2) (L3)	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildin UNIT-IV king With Threa ding a Testbencl b, Simple Functio b, Analysing Cove UNIT-V	OOPS /here to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class inic Objects (L2) - Copying Objects (L2) - Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE ads (L3), Inter-Process Communication (L3), Events, Semaph h with Threads and IPC (L3). Coverage Types (L2), Functional coverage Example (L3), Coverage Options (L3), Parame erage Data (L2), Measuring Coverage Statistics (L2) COMPLETE DESIGN MODEL USING SYSTEM VERILOG- CASE STUDY	w Object -Class Ro is Inside te (L2) - hores, Mi al Covera eterized	9 butine Anoth Stra 9 ailbox ige St Cover 9	- Obje s (L2) er (L3 ying (es (L3 rategi Grou	ect) - 3)- Off 			
Intro De a Defii Undo Cou Wor Builo (L2) (L3) Syst	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildin UNIT-IV king With Threa ding a Testbencl b, Simple Functio b, Analysing Cove UNIT-V tem Verilog ATM at, Receivers and	OOPS /here to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class inic Objects (L2) - Copying Objects (L2) - Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE ads (L3), Inter-Process Communication (L3), Events, Semaph h with Threads and IPC (L3). Coverage Types (L2), Functional coverage Example (L3), Coverage Options (L3), Parame erage Data (L2), Measuring Coverage Statistics (L2) COMPLETE DESIGN MODEL USING SYSTEM VERILOG- CASE STUDY Example (L3), Data Abstraction (L2), Interface Encapsulation d Transmitters (L3), Test Bench for ATM (L3)	w Object -Class Ro is Inside te (L2) - hores, Mi al Covera eterized (L3), Des	9 s (L3) putine Anoth Stra 9 ailbox ge St Cover 9 sign To	- Obje s (L2) er (L3 ying (es (L3 rategi Grou	ect) - 3)- Off 			
Intro De a Defii Undo Cou Wor Build (L2) (L3) Syst Squ	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildir UNIT-IV king With Threa ding a Testbencl b, Simple Functio b, Analysing Cove UNIT-V tem Verilog ATM at, Receivers and	OOPS There to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - Using One Class (L3) - Scoping Rules (L2)- Using One Class (Dig a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE ads (L3), Inter-Process Communication (L3), Events, Semaph with Threads and IPC (L3). Coverage Types (L2), Functional Coverage Example (L3), Coverage Options (L3), Parameterage Data (L2), Measuring Coverage Statistics (L2) COMPLETE DESIGN MODEL USING SYSTEM VERILOG-CASE STUDY Example (L3), Data Abstraction (L2), Interface Encapsulation d Transmitters (L3), Test Bench for ATM (L3)	w Object -Class Ro is Inside te (L2) - hores, Mi al Covera eterized (L3), Des	9 s (L3) putine Anoth Stra 9 ailbox ge St Cover 9 sign To 45 PE	- Obje s (L2) er (L3 ying (es (L3 rategi Grou op Lev ERIOL	ect) - 3)- 3)- 7 1 3), es ps 			
Intro De a Defin Undo Cou Wor Build (L2) (L3) Syst	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildir UNIT-IV king With Threa ding a Testbench , Simple Function , Analysing Cove UNIT-V tem Verilog ATM at, Receivers and	OOPS There to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class inc Objects (L2) - Copying Objects (L2) - Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE ads (L3), Inter-Process Communication (L3), Events, Semaph h with Threads and IPC (L3). Coverage Types (L2), Functional coverage Example (L3), Coverage Options (L3), Parame erage Data (L2), Measuring Coverage Statistics (L2) COMPLETE DESIGN MODEL USING SYSTEM VERILOG- CASE STUDY Example (L3), Data Abstraction (L2), Interface Encapsulation d Transmitters (L3), Test Bench for ATM (L3)	w Object -Class Ro is Inside te (L2) - hores, Mi al Covera eterized (L3), Des	9 s (L3) putine Anoth Stra 9 ailbox ge St Cover 9 sign To 45 PE	- Obje s (L2) er (L3 ying (es (L3 rategi Grou	ect) - 3)- 3), es ps //el			
Intro De a Defin Unde Cour Buile (L2) (L3) Syst Squ Squ Cour given exan	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildin UNIT-IV Wing With Threa ding a Testbenck b, Simple Function b, Analysing Cove UNIT-V tem Verilog ATM at, Receivers and rse specific open- n as assignments nination	OOPS /here to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class inic Objects (L2) - Copying Objects (L2) - Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE adds (L3), Inter-Process Communication (L3), Events, Semaph h with Threads and IPC (L3). Coverage Types (L2), Functional conal Coverage Example (L3), Coverage Options (L3), Parameterage Data (L2), Measuring Coverage Statistics (L2) COMPLETE DESIGN MODEL USING SYSTEM VERILOG- CASE STUDY Example (L3), Data Abstraction (L2), Interface Encapsulation d Transmitters (L3), Test Bench for ATM (L3) OPEN ENDED PROBLEMS / QUESTIONS ended problems will be solved during the classroom teaching. s and evaluated as internal assessment only and not for the en	w Object -Class Ro is Inside te (L2) - hores, Mi al Covera eterized (L3), Des TOTAL: Such pro	9 s (L3) putine Anoth Stra 9 ailbox ge St Cover 9 sign To 45 Pt blems er	- Obje s (L2) er (L3 ying (es (L3 rategi Grou op Lev s can l	ect) - 3)- Off 3), ies ps /el >S			
Intro De a Defin Unde Cour Buile (L2) (L3) Syst Squ Squ Cour given exan	UNIT-III oduction (L2)- W allocation (L3) - ning Routines Ou erstanding Dyna rse (L2) - Buildin UNIT-IV Wing With Threa ding a Testbenck b, Simple Function b, Simple Function b, Analysing Cove UNIT-V tem Verilog ATM at, Receivers and rse specific open- n as assignments nination	OOPS Where to Define a Class (L2)- OOPS Terminology - Creating Net Using Objects - Static Variables Vs. Global Variables (L3) - utside of The Class (L3) - Scoping Rules (L2)- Using One Class umic Objects (L2) - Copying Objects (L2). Public Vs. Privating a Test bench (L3) THREADS AND INTER-PROCESS COMMUNICATION AND FUNCTIONAL COVERAGE adds (L3), Inter-Process Communication (L3), Events, Semaph h with Threads and IPC (L3). Coverage Types (L2), Functional coverage Example (L3), Coverage Options (L3), Parameterage Data (L2), Measuring Coverage Statistics (L2) COMPLETE DESIGN MODEL USING SYSTEM VERILOG- CASE STUDY Example (L3), Data Abstraction (L2), Interface Encapsulation d Transmitters (L3), Test Bench for ATM (L3) OPEN ENDED PROBLEMS / QUESTIONS -ended problems will be solved during the classroom teaching. s and evaluated as internal assessment only and not for the en CHAIRP Board of	w Object -Class Ro is Inside te (L2) - hores, Mi al Covera eterized (L3), Des TOTAL: Such pro d semest Such pro ERSON	9 s (L3) putine Anoth Stra 9 ailbox ge St Cover 9 sign To 45 PE	- Obje s (L2) er (L3 ying (es (L3 rategi Grou op Lev s can h	ect) - 3)- Jff 			

Course Upon	e Out comes: completion of this course the students will be able to:	BLOOM'S Taxonomy
C01	Explain the system verilog verification models for digital designs	L2 - Understand
CO2	Apply system verilog to create testbenches for digital designs	L3 - Apply
C03	Build new constructs in System Verilog for verification	L3 - Apply
C04	Describe the communication between system verilog modules	L3 - Apply
C05	Design a complete system model using Verilog	L3 - Apply
REFE	RENCE BOOKS:	Supply States
1.	Chris Spear, "System Verilog for Verification: a Guide to Learning Features", Springer, 1 st Edition, 2006	the Testbench Language
2.	Janick Bergeron, "Writing Testbenches: Functional Verification of HDL N Academic Publishers, 2003	1odels", 2 nd Edition, Kluwer
3.	Stuart Sutherland, Simon Davidman and Peter Flake, "System Verilo Using System Verilog for Hardware Design and Modeling", 2 nd Edition, S	g for Design: a Guide to pringer
VIDE	O REFERENCES:	
1.	https://www.youtube.com/watch?v=zLZRwOkGLNA&list=PLDAnhhk0Kcz	zzWXNfA7S58FjlnCP71IzF
2.	https://www.youtube.com/watch?v=0oMTDaEy5o&list=PLDAnhhk0Kczz o&index=5	WXNfA7S58FjlnCP71IzF
WEB	REFERENCES:	
1.	https://www.chipverify.com/tutorials/systemverilog	
2.	https://www.systemverilog.in/p/systemverilog-tutorial.html	
ONLI	NE COURSES:	Section - Carden (1)
1,	https://onlinecourses.nptel.ac.in/noc21_ee97/preview	
2.	https://onlinecourses.nptel.ac.in/noc24_cs61/preview	

COC	Big and -KiPOs dertin					
COs	PO1	PO2	PO3	PO4	PO5	POG
CO1	1		2	2	2	1
CO2	1		2	2	2	1
CO3	1		2	2	2	1
CO4	1		2	2	, 2	1
CO5	1		2	2	2	1
Average	1		2	2	2	1

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M.E/M.Tech Regulations - 2023

	ME23VL418	ADAPTIVE SIGNAL PROCESSING	CP 3	L	T	P	C R			
Pro	gramme &	M.E. VLSI DESIGN	3	Ver	sion:	1.0				
	Branch	Instructions if any				1. Hall & 18				
Cours	e Obiectives:									
1	To study the ba	sic principles of discrete random signal processing		14	ц÷г,		1			
2	To introduce the	a principles of spectral estimation			1.					
2	To incroduce che		i i e				-			
3	To learn about t	ne weiner and adaptive filters		-	1	-	10			
4	To understand the different signal detection and estimation methods									
5	To acquire skills	to design synchronization methods for proper functioning of	the s	syste	m		ŝ			
UNI	т-і	DISCRETE RANDOM SIGNAL PROCESSING		3	9		į.			
Relati Speci	ion (L3), Power al Types of Ranc	Spectral Density (L3), Spectral Factorization (L3), Filtering F fom Processes (L2)	lando	m Pr	ocess	ses (L	.3)			
Introd Welch Spect	duction (L2), No n and Blackmar cral Estimation (I	onparametric Methods – Periodogram (L3), Modified Perio n-Tukey Methods (L3), Parametric Methods – ARMA, AR L3), Solution Using Levinson-Durbin Algorithm (L3)	dogra and	am (MA	L3), Mode	Bartl Ba:	ett			
UNIT- III WEINER AND ADAPTIVE FILTERS				12	9					
Weine Steep	er Filter: FIR Wi best Descent Met	ener Filter (L4), 11R Wiener Filter (L4), Adaptive Filter: FIR hod (L3)- LMS Algorithm (L3), RLS Adaptive Algorithm (L4),	Ada Appli	ptive catio	Filte ns (L	rs (L4 2)	1)			
UNI	T – IV	ARITHMETIC BUILDING BLOCKS			9					
Bayes Decisi Applic	Detection Tech ion Criteria (L2)	niques (L2), Map, MI – Detection of M-Ary Signals (L2), Ney), Kalman Filter- Discrete Kalman Filter (L3), The Extend	rman ed Ka	pear: almar	son, l 1 Filt	Minim er (L	ia: 3)			
UNI	T-V	SYNCHRONIZATION & A memberley			9					
Signa Estim	l Parameter Est ation of Carrier	imation (L3), Carrier Phase Estimation (L3), Symbol Timin Phase and Symbol Timing (L3)	g Esti	imato	or (L3	3), Jo	in			
		<i>y</i> (,	тот	AL: 4	15 PE	RIO	DS			
2	1. 1. 1.	OPEN ENDED PROBLEMS / QUESTIONS					1			
Course given exami	e specific open-e as assignments nation	nded problems will be solved during the classroom teaching. and evaluated as internal assessment only and not for the er	Such nd ser	n prol meste	olems er	s can	be			
ourse pon e	e Out comes: completion of 1	his course the students will be able to:	BLC	ом'	S Tax	kono	m			
	Apply the basi	c principles of discrete random signal processing	L3 – Apply							
C01	Construct the principles of spectral estimation		L3	- Apj	oly		_			
CO1 CO2	construct the	Analyze the Weiner and Adaptive filters		L4 – Analyse						
CO1 CO2 CO3	Analyze the W	einer and Adaptive filters	L4	-		L2 – Understand				
CO1 CO2 CO3 CO4	Analyze the W Explain the dif	einer and Adaptive filters ferent signal detection and estimation methods.	L4 L2	- Un	derst	and	a			
CO1 CO2 CO3 CO4 CÓ5	Analyze the W Explain the dif	einer and Adaptive filters ferent signal detection and estimation methods. chronization methods for proper functioning of the system)	L2 12 13		derst Jy	and	3			
CO1 CO2 CO3 CO4 CÓ5	Analyze the W Explain the dif Apply the sync	einer and Adaptive filters ferent signal detection and estimation methods. chronization methods for proper functioning of the system CHAIRF		- Un - Apr	dersta Jy	and				

REFE	RENCE BOOKS:
1.	Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, 2 nd Edition, 2009
2.	John G. Proakis, "Digital Communication", McGraw Hill Publications, 4th Edition, 2001
3.	Simon Haykin, "Adaptive Filter Theory", 4th Edition, Pearson Education, 2003
VIDE	O REFERENCES:
1.	https://www.youtube.com/watch?v=nkGPnTzPqrk&list=PLCVaVjGeO3uFc4uEy3oFddcEc_8FO_0Sx
2.	https://www.youtube.com/watch?v=ya0-S1apej8
WEB	REFERENCES:
1.	https://www.sciencedirect.com/topics/engineering/adaptive-signal-processing
2.	https://abrarhashmi.wordpress.com/wp-content/uploads/2016/02/bernard-widrow-peter-n- stearns-adaptive-signal-processing-prentice-hall-1985.pdf
ONLI	NE COURSES:
1.	https://onlinecourses.nptel.ac.in/noc23_ee138/preview
2.	https://www.pptelvideos.com/electronics_and_communications/adaptive_signal_processing/

Mapping of COs with POs									
			PO	s					
COS	PO1	PO2	PO3	PO4	P05	POG			
C01	2â		1	1	1	1			
CO2	1	1.	2	1	1	1			
CO3	-2	in the shire	2	1_1_	1	1			
CO4	2	. Se	1	1	1	1			
CO5	2	1 4	2	2	1	1			
Average	· 1.6 9	1 1	1.6.00	1.2	1	1			

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	ME23VL419	MACHINE LEARNING	CP L T P C				
P	rogramme & Branch	M.E. VLSI DESIGN	Version: 1.0				
		Instructions if any					
Cou	rse Objectives:		n i nanînên kara n				
1	To understand t	he concepts and mathematical foundations of machine learn	ing				
2 To explore the different supervised learning techniques including ensemble method							
3 To learn different aspects of unsupervised learning and reinforcement learning							
4	To learn the role	of probabilistic methods for machine learning					
5	To understand t	ne basic concepts of neural networks and deep learning					
UN	IT-I	INTRODUCTION AND MATHEMATICAL FOUNDATIONS	9				
Alge (L3)	bra & Analytical C - Vector Calculus	Seometry (L23) – Probability and Statistics (L3) - Bayesiar & Optimization (L3) – Decision Theory (L2) – Information th SUPERVISED LEARNING	n Conditional Probabilit eory (L2) 9				
fittin Grad (L2) Ense	g / Over fitting –(dient Linear Model – K-Nearest Neig emble Methods – (Cross Validation – Lasso Regression (L2) - Classification - Lo s – Support Vector Machines (L2) – Kernel Methods (L2) – hbours (L2) – Tree based Methods (L2) – Decision Trees (L L2) Random Forest (L2) – Evaluation of Classification Algorit	pgistic Regression (L2) Instance based Method 2) – ID3 – CART (L2) hms (L2)				
UN	IT- III	UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING	9				
Int Dim algo Diffe	roduction – Cluste ensionality Reduct rithm (L3), Reinf erence Learning (L	ering Algorithms (L3) – K Means – Hierarchical Clustering (tion (L3) – Principal Component Analysis – Recommendat orcement Learning (L2) – Elements – Model based Lea 3)	(L3) – Cluster Validity tion Systems (L3) - El arning (L2) – Tempora				
UN	IIT - IV	PROBABILISTIC METHODS FOR LEARNING	9				
Int Belie (L3) Mod	roduction (L2)– N of Networks (L3) – Probability De els (L3)	aïve Bayes Algorithm (L3) – Maximum Likelihood –Maximum - Probabilistic Modelling of Problems (L3) – Inference in B nsity Estimation (L2)– Sequence Models (L2) – Markov M	n Apriori (L2) – Bayesia ayesian Belief Network lodels – Hidden Marko				
UN	IIT-V	NEURAL NETWORKS AND DEEP LEARNING,	9				
Ne Forw Lear - Us	ural Networks (L2 vard Network (L3) ning (L2) – Deep ve cases (L2)) – Biological Motivation (L2) - Perceptron (L3) – Multi-layer – Back Propagation-Activation and Loss Functions (L4) - Learning (L2) – Convolution Neural Networks (L4) – Recurre	Perceptron (L3) – Fee Limitations of Machin nt Neural Networks (L3				
			TOTAL: 45 PERIODS				
		OPEN ENDED PROBLEMS / QUESTIONS					
Cour give exar	rse specific open-e n as assignments nination	nded problems will be solved during the classroom teaching and evaluated as internal assessment only and not for the er	Such problems can be				
		CIVATO					
		CHAIR	PERSON				

Cours Upon	e Out comes: completion of this course the students will be able to:	BLOOM'S Taxonomy
C01	Outline the mathematical concepts of each type of machine learning	L3 - Apply
C02	Describe the algorithms of supervised learning	L2 - Understand
CO3	Implement reinforcement learning algorithms for an application and analyze the results	L3 – Apply
CO4	Implement typical Clustering algorithms for different types of applications	L3 - Apply
C05	Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification	L4 - Analyse
REFE	RENCE BOOKS:	
1.	Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Pre	ess, 2 nd Edition, 2014
2.	Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 1	st Edition, 2012
3.	Ethem Alpaydin, "Introduction to Machine Learning - Adaptive Computation Series", MIT Press, 3 rd Edition, 2014	n and Machine Learning
VIDE	O REFERENCES:	
1.	https://www.youtube.com/watch?v=ukzFI9rgwfU	Service and the service of the servi
2.	https://www.youtube.com/watch?v=PeMlggyqz0Y	
WEB	REFERENCES:	
1.	https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-ml/	
2.	https://www.ibm.com/topics/machine-learning	
ONLI	NE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc23_cs18/preview	and the second standards
2.	https://onlinecourses.nptel.ac.in/noc23_ee87/preview	and the state of the set

POs									
COc	No 1 - 1/ POS 1 /								
003	PO1	PO2	PO3	P04	PO5	P06			
CO1	3		2	3	1	1			
CO2	3		2	3	1	1			
CO3	3	- Second	2	3	1	1			
CO4	3		2	3	1	1			
C05	3		2	3	1	1			
Average	3		2	3	1	1			

1-Low, 2 -Medium, 3-High.

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M.E/M.Tech Regulations - 2023

	ME23VL420	ADVANCED DIGITAL IMAGE PROCESSING	3	L 3	0	Р 0	3			
Pr	ogramme &	M.E. VLSI DESIGN		L T P 3 0 0 Version: 1.0 0 sforms 0 sforms 0 sforms 0 standard 9 (L2), Elementer 0 orm, KL transform, orm, the transfor	1.0					
	Didition	Instructions if any								
Cour	se Objectives:			1 m	4.5.					
1	To provide the	student with basic understanding of image fundamentals and	trans	form	s					
2	To provide expo	osure to the students about image enhancement and restorat	ion		4.1	19	1			
3	To impart a tho	rough understanding about segmentation and Recognition				23	į.			
4	To know the Vid	To know the Video Processing and motion estimation								
5	To study the co	ncepts will enable students to design and develop an image p	roces	sing	appli	catio	n			
UN	IIT-I	FUNDAMENTALS OF IMAGE PROCESSING AND			9					
Disc (L2) tran	crete Fourier tran), singular value nsforms (L2), Digi	isform (L2), Walsh transform, Hadamard transform, Haar tr e decomposition (L2), Radon transform (L2), compariso ital Camera working principle (L2)	ansfo	rm, ł diffe	KL tra erent	ima	rm			
spat dom deg	tial filters, Sharpe nain (L3), image radation, Image	ening spatial filters (L3). Frequency domain methods: Basics e smoothing, image sharpening (L3), Introduction to Ima restoration model (L3), Linear and Nonlinear image restor	of filte ge re ation	ering estora tech	in fre ition, nique	quer Ima s (L	icy ige 3)			
DIIII	a deconvolution ((L3), Color image enhancement (L2)				18 C.				
UN	IIT- III	(L3), Color image enhancement (L2) SEGMENTATION AND RECOGNITION			9		Ta off			
UN Edg segi proc Des (L4)	IT- III mentation (L2) mentation (L4) cessing- erosion a criptor (L2), Regi) – Recognition ba	 (L3), Color image enhancement (L2) SEGMENTATION AND RECOGNITION A Edge linking via Hough transform (L3) – Thresholding – Region growing (L4) – Region splitting and merging and dilation (L4), Boundary representation (L2), Boundary defined Laboratoria (L4), Texture – Patter A matching (L2) 	(L3) g (L3 escrip ms ar	– R)– M otion nd Pa	9 egion Iorph (L2), ttern	bas ologi Four class	ca iei			
UN Edg segi proc Des (L4)	IT – III mentation (L2) mentation (L4) cessing- erosion a criptor (L2), Regi) – Recognition ba	 (L3), Color image enhancement (L2) SEGMENTATION AND RECOGNITION A Edge linking via Hough transform (L3) – Thresholding – Region growing (L4) – Region splitting and merging and dilation (L4), Boundary representation (L2), Boundary di ional Descriptors – Topological feature (L4), Texture – Patter ased on matching (L2) BASIC STEPS OF VIDEO PROCESSING 	(L3) g (L3 escrip rns ar	– R)– M otion nd Pa	9 egion 1orph (L2), ttern 9	bas ologi Four class	ec ca ier			
UN Edg segi prod Des (L4) UN Ana Mod	IT – III mentation (L2) mentation (L4) cessing- erosion a criptor (L2), Regi) – Recognition ba IT – IV log Video, Digital dels (L4), Geomet	 (L3), Color image enhancement (L2) SEGMENTATION AND RECOGNITION a, Edge linking via Hough transform (L3) – Thresholding – Region growing (L4) – Region splitting and merging and dilation (L4), Boundary representation (L2), Boundary defined and Descriptors – Topological feature (L4), Texture – Patter ased on matching (L2) BASIC STEPS OF VIDEO PROCESSING Video (L3), Time-Varying Image Formation models: Three-D cric Image Formation, Photometric Image Formation (L4), Sar 	(L3) g (L3 escrip rns ar imens	– R)– M nd Pa siona g of V	9 egion Iorph (L2), ttern 9 I Moti 'ideo	bas ologi Four class on signa	ier ca ier ses			
UN Edg segi proc Des (L4) UN Ana Moc (L2) UN	IT – III e detection (L2) mentation (L4) cessing- erosion a criptor (L2), Regi) – Recognition ba IT – IV log Video, Digital dels (L4), Geomet), Filtering operat	 L3), Color image enhancement (L2) SEGMENTATION AND RECOGNITION A Edge linking via Hough transform (L3) – Thresholding – Region growing (L4) – Region splitting and merging and dilation (L4), Boundary representation (L2), Boundary driven disonal Descriptors – Topological feature (L4), Texture – Patter ased on matching (L2) BASIC STEPS OF VIDEO PROCESSING Video (L3), Time-Varying Image Formation models: Three-D tric Image Formation, Photometric Image Formation (L4), Sarions (L2) 2-D MOTION ESTIMATION 	(L3) g (L3 escrip ms ar imens mpling	– R)– M nd Pa siona g of V	9 egion 1orph (L2), ttern 9 I Moti 'ideo 9	bas ologi Four class on signa	ier ses			
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Cours Upon	e Out comes: completion of this course the students will be able to:	BLOOM'S Taxonomy
C01	Explain the digital image, representation of digital image and digital images in transform Domain	L2 - Understand
C02	Apply the detection of point, line and edges in images in various image compression techniques	L3 – Apply
C03	Analyze the video technology from analog color TV systems to digital video systems, how video signal is sampled and filtering operations in video processing	L4 – Analyse
C04	Apply the general coding methodologies for 2D motion estimation in video processing	L3 - Apply
C05	Describe image and video processing systems	L2 - Understand
REFE	RENCE BOOKS:	
1.	Gonzalez and Woods, "Digital Image Processing" Pearson, 3rd Edition, 2016	
2.	Alan.C.Bovik, "Handbook of Image and Video processing", Academic press, 2	2 nd Edition, 2010
3.	K.R.Castelman, "Digital Image processing", Prentice Hall, 1st Edition 2007	
VIDE	O REFERENCES:	a si ha pri 200 m
1.	https://www.youtube.com/watch?v=xUCsfKA8bi0&list=PLm_MSClsnwm9I2i	viE0YKt6PZTyQCYc8j
2.	https://www.youtube.com/watch?v=DSGHkvQBMbs&list=PLuv3GM6gsE08D	uaC6pFUvFaDZ7EnWGX
WEB	REFERENCES:	
1.	https://catalog.olemiss.edu/engineering/engs-673	
2.	https://www.geeksforgeeks.org/digital-image-processing-basics/	the second second
ONLI	NE COURSES:	- surgesteeld and a
1.	https://onlinecourses.nptel.ac.in/noc23_cs218/preview	
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C01	3		2	2	2	2
CO2	3	age sea	2	2	2	2
CO3	3		2	2	2	2
C04	3		2	3	2	2
C05	3		2	2	• 2	2
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M.E/M.Tech Regulations - 2023

	ME23VL421	MEDICAL IMAGE ANALYSIS	CP 3	L 3	0	Р 0	C 3	
Pro	ogramme &	M.E. VLSI DESIGN		Vers	ion:	1.0		
	branch	(Special Elective)					18	
Cours	se Objectives:	the second se	1.00	14				
1	To apply image	enhancement and restoration techniques in medical images	1.1			P		
2 To apply the image registration techniques for given medical image modalities								
3	To segment and	gment and analysis the given medical image modalities						
4	To apply compu	ter- aided diagnosis methods for medical image processing a	nd an	alysis	Lines -	- 15		
5	To apply deep le	earning techniques for given medical imaging modalities				171 4	1	
UN	IT-I	INTRODUCTION TO IMAGE PROCESSING			9			
form equa (L3)	nation and acqu alization) (L3), Im	isition (L2), Image enhancement (filtering, contrast a hage restoration (denoising, deblurring) (L3), Feature extract	djustr ion ar	nent, nd rep	his prese	togr ntat	am ior	
UNI	IT-II	IMAGE REGISTRATION	<u> </u>		9			
trans	sformation mode stration in medica	els (elastic, spline-based, deformable) (L3), Practical a	anng, applica) (L3 ations), no of	ima	gic	
UNI	IT- III	IMAGE SEGMENTATION			9			
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C04	Analysis the given medical images by using computer-aided diagnosis	L4 - Analysis						
C05	Utilize the deep learning techniques to analysis the given medical images	L4 - Analysis						
REFE	RENCE BOOKS:	Salar Salara						
1.	Atam P. Dhawan, "Medical Image Analysis", John Wiley & Sons, 1st Edition, 2010							
2.	S. Kevin Zhou, Hayit Greenspan and Dinggang Shen, "Deep Learning for Med Elsevier, 1 st Edition, 2017	dical Image Analysis",						
3.	Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and M Springer, 4 th Edition, 2017	lachine Vision",						
4.	Jerry L. Prince, Jonathan M. Links, "Medical Imaging Signals and Systems", F Edition, 2014	Pearson Education, 1 st						
5.	I.N. Bankman, "Handbook of Medical Image Processing and Analysis", Acade 2008	emic Press, 3 rd Editior						
VIDE	O REFERENCES:							
1.	https://onlinecourses.nptel.ac.in/noc22_bt34/preview							
2.	https://onlinecourses.nptel.ac.in/noc24_ee57/preview							
WEB	REFERENCES:							
1.	https://www.iitk.ac.in/cce/courses/23-24/BioMed/	Constant States Sector						
ONLI	NE COURSES:	Carles and an order of a						

1. https://onlinecourses.nptel.ac.in/noc23_cs218/preview

	23	E. Annesse	РО	s 🛃		
COs	PO1	PO2	PO3	P04	P05	POG
C01	3		2	2	2	2
CO2	3	- 3R	2	2	2	2
CO3	3		2	2	2	2
CO4	. 3.9	o mot st	2 151	iligher	2	2
C05	3		2	2	2	2
Average	3		2	2	2	2

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	ME23VL422	APPLIED OPTIMIZATION FOR WIRELESS AND BIGDATA	CP 3	L	T	P	C 3
Pro	gramme &	M.E. VLSI DESIGN	ESS AND CP L T I 3 3 0 0 Version: 1 Ssion Ssion Ssion Sion Wireless Sensor Networks and efficient data transmission upplications (L2) - Optimal Precent Radio propagation models (L2) 9 nal Systems (L2) - Intelligent (L2) - Analysis Vs Reporting Distributions (L2) - Re-Samp Distributions (L2) - Re-Samp iculture case studies (L2) 9 ation (L2) - Linear Regression Neighbors (L3)- Clustering ficulture case studies (L2) 9 oases (L2)- Hadoop Distribute tion Inference Attacks on TOTAL: 45 PER 00 techniques (L3)- Evaluat chniques for Big Data (L3) - TOTAL: 45 PER Doom teaching. Such problems of not for the end semester BLOOM'S Taxo L2 - Understa L3 - Apply L2 - Understa L3 - Apply	1.0	3		
	Branch	(Special Elective)	1				
ourc	o Objectives	(Special Elective)					
Juis	To us doustood th	a different techniques in wireless data transmission		1			
1	To understand th		-	-		at a	
2	To understand th		4				
3	To introduce stat	istic and analytic tools in bigdata	-		14.1	-	-
4	To learn databas	e frameworks in Diguala	-	-	1		
5	To gain knowledg		T	10.20	•		
UNI	T-I	WIRELESS DATA TRANSMISSION			9		-
optin Optin in Hy	nization technique nized Leach Prote brid MIMO syster	es for wireless sensor networks (L2)- secure and efficient o ocol (L2)- MIMO Antenna design for Wireless Applications (ns (L3)- Wireless Underground networks (L2)- Radio propag	lata t L2)- (jation	rans Optin mod	missional Pr dels (1	on (L recod	.2)- ling
UNI	T-II	INTRODUCTION TO BIGDATA	1		9		
Intro analy Mode Statis	duction to Big D vsis (L2) - Nature ern Data Analytic stical Inference -	ata Platform (L2) - Challenges of Conventional Systems of Data (L2) - Analytic Processes and Tools (L2) - Analy Tools (L2) - Statistical Concepts: Sampling Distributions Prediction Error (L2)	(L2) sis Vs (L2)	- In Rep - R	tellige ortin e-Sar	ent d g (L3 nplin	ata 3) - g -
UNI	T- III	BIGDATA AND ALGORITHMS	12		9		
Decis Adap	sion Trees (L3)- tive QOS (L2)- A T – IV	Support Vector Machines (L3)- K-Nearest Neighbors ware scheduling algorithm (L3)- Big data in agriculture case BIGDATA FRAMEWORKS	(L3)- stud	Clu ies (l	sterin _2) 9	g (L	.2)-
Map Syste Netw	Reduce – Hadoo ems (L2)– Case orks (L2)	p, Hive, MapR– Sharding (L2)– NoSQL Databases (L2)- H Study (L2)- Preventing Private Information Inference	ladoc ce A	p Di ttack	stribu s on	ited So	File cial
UNI	T-V	OPTIMIZATION TECHNIQUES IN BIGDATA	1		9		2
Class Techi optim	ification of optin nique Effectivene nization process (nization techniques (L2)- bigdata optimization technique ss (L3) - Optimizing Intelligent Reduction Techniques for L2) - ant colony optimization (L2)	es (L Big l	3)- Data	Evalu (L3)	- qu	of ery
			тот	AL:	45 PI	ERIC	DS
		OPEN ENDED PROBLEMS / QUESTIONS					
Cours given exami	e specific open-e as assignments a ination	nded problems will be solved during the classroom teaching and evaluated as internal assessment only and not for the en	. Sucl nd se	n pro mest	blem: er	s can	be
loon	completion of +	his course the students will be able to	BLC	ом	'S Ta	xond	om
COL	Explain the diffe	erent techniques in wireless data transmission	1	2 - 11	nders	tand	
001	Docariba the h-	sie concent of higdete analytics	1	2 - 1	Indor	stand	1
C02	Analy and a stress	is toole for modicities in high-to analytics		2 - 0	nuer	stant	
C03	Apply algorithm	ic tools for prediction in bigdata analytics	L	5 - A	pply		-
C04	Relate the datab	base framework in bigdata analytics		2 - 0	nders	tand	
C05	Apply various of	otimization techniques in bigdata	L	3 - A	pply		710
REFE	RENCE BOOKS:		2	1			1
1.	Georgios Skour	letopoulos, George Mastorakis, "Mobile Big data", Springer,	1 EC	lition	201	8	
1.1	1	CHAT	DEP	1		1	
		Board	ofSh	SIJA			
KI	от	35 Facult Monte Jew Tacult Monte Jew Tories	tute o	f Tec	hnolog	s - 2 ngg Iy	02

2.	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2 nd Edition, 2019
3.	Bill franks, "Taming the Big Data Tidal Wave", John Wiley & sons, 1st Edition, 2012
4.	Hannah Bast, Claudius Korzen, "Algorithms for Big Data" Springer, 1 st Edition, 2022
5.	Ali Emrouznejad, "Big Data Optimization: Recent Developments and Challenges", Springer 1 st Edition, 2018
VIDE	O REFERENCES:
1.	https://onlinecourses.nptel.ac.in/noc20_ee59/preview
2.	https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs12/
WEB	REFERENCES:
1.	https://www.simplilearn.com/tutorials/big-data-tutorial/big-data-applications
ONLI	NE COURSES:
1.	https://onlinecourses.nptel.ac.in/noc22_ee63/preview

	Map	ping of	COs with	POs	S	
			PO	S	Extended in	1.1
COs	PO1	PO2	PO3	P04	PO5	POG
C01	2	511	2-0	3	3	_ 1
C02	2		2	2	3	1
C03	51		2/	2	3	1
C04	1		2	3	2	1
C05	2	1.0	2	2	1	1
Average	1.6		2	2.4	2.4	1

1-Low, 2 -Medium, 3-High.

Beyend This interlige

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	3VL423	MEDICAL IMAGE PROCESSING	3	L 3	0	0	3
Program	nme &	M.E. VLSI DESIGN		Vers	sion:	1.0	
DI di	ich	(Special Elective)					
Course Ob	jectives:		1.1			- 6	
1 To u	To understand the medical image formation principles such as X-Ray and CT						
2 To le	2 To learn how to store and process medical images for analysis						
3 To b	To become familiar with the fundamentals of image visualization					-	
4 To u proc	To understand the process of segmentation and classification of the field of medical image processing						
5 To u	nderstand th	ne concepts of nuclear imaging technologies	1		1.10		
UNIT-I		INTRODUCTION	9				
importance physics - methods	ce – applicat X-Ray gene – artifacts –	ions – trends – challenges (L2) - Systems, and modalities (eration – attenuation – scattering (L2) - Basic principles of CT hardware (L2)	Princi of CT	ples - re	(L2) cons	- X-R tructi	ay or
UNIT-II		STORAGE AND PROCESSING		6 m a	9		1
- filtering UNIT- I	- histogram	visualization) - SI		9		
Mathemal (L2) - ima	tics of MR (L age artifacts	.3)- spin physics (L2)- NMR spectroscopy (L3) - imaging pr (L2)	incipl	es ai	nd ha	ardwa	are
		CECHENTATION AND CLASSIFICATION					÷.
UNIT - J		SEGMENTATION AND CLASSIFICATION	wing	and	9 wat	orcho	de
Medical I (L2)- Mar segmenta methods Intensity	mage Segm kov Random tion (L2)- se (L2)- atlas-g (L2) -based	SEGMENTATION AND CLASSIFICATION entation (L2)- Histogram-based methods (L2)- Region gro Field models (L2)- active contours - model-based segment emi-automated methods (L2)- clustering-based methods (L2 guided approaches - multi-model segmentation (L2)- Medic methods - cost functions - optimization techniques (L2)	owing ation 2)- cla cal Im	and (L2)· assific age	wate - mul catior Regin	ershe Iti-sc n-bas strati	ed ed ed or
Medical I (L2)- Mar segmenta methods Intensity UNIT-V	mage Segm kov Random tion (L2)- se (L2)- atlas-g (L2) -based	SEGMENTATION AND CLASSIFICATION entation (L2)- Histogram-based methods (L2)- Region gro Field models (L2)- active contours - model-based segment emi-automated methods (L2)- clustering-based methods (L2 guided approaches - multi-model segmentation (L2)- Medic methods - cost functions - optimization techniques (L2) NUCLEAR IMAGING	owing ation 2)- cla cal Im	and (L2) assific age	wate - mul catior Regin	ershe Iti-sca n-bas strati	ec or
Medical I (L2)- Mar segmenta methods Intensity UNIT-V PET and effect (L3 (L2)- ultr technolog - Applicat Image Gu	Nage Segm kov Random tion (L2)- se (L2)- atlas-g (L2) -based SPECT Ultra SPECT Ultra) - 3D imag asound ima y in medical tions (L2)- O ided Therapy	SEGMENTATION AND CLASSIFICATION entation (L2)- Histogram-based methods (L2)- Region gro Field models (L2)- active contours - model-based segment emi-automated methods (L2)- clustering-based methods (L2 guided approaches - multi-model segmentation (L2)- Medic methods - cost functions - optimization techniques (L2) NUCLEAR IMAGING sound Imaging methods (L2)- mathematical principles (L2 ging - positron emission tomography (L2) - single photon oging (L2)- applications - Medical Image Search and Re image search (L2) - content-based image retrieval (L3) - ne ther Applications of Medical Imaging Validation (L3)- Image y (L2)- Computer Aided Diagnosis/Diagnostic Support Syste	owing ation 2)- cla cal Im 3)- ro emis etriev ew tre Guid ms (L	and (L2)- assific age esolu sion al (L ends ed S .2)	y wate - mul catior Regis 9 tion tomc -3), - ont urger	ershe Iti-sca strati - no ograp Curre tolog Y (L2	diale ecor ise hyen eso
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UNIT – J Medical I (L2)- Mar segmenta methods Intensity UNIT–V PET and effect (L3 (L2)- ultr technolog – Applicat Image Gu	Nage Segm kov Random tion (L2)- se (L2)- atlas-o (L2) -based SPECT Ultra) - 3D imag asound ima y in medical tions (L2)- O ided Therapy	SEGMENTATION AND CLASSIFICATION entation (L2)- Histogram-based methods (L2)- Region gro Field models (L2)- active contours - model-based segment emi-automated methods (L2)- clustering-based methods (L2 guided approaches - multi-model segmentation (L2)- Medic methods - cost functions - optimization techniques (L2) NUCLEAR IMAGING sound Imaging methods (L2)- mathematical principles (L2 ging - positron emission tomography (L2) - single photon oging (L2)- applications - Medical Image Search and Re image search (L2) - content-based image retrieval (L3) - ne ther Applications of Medical Imaging Validation (L3)- Image y (L2)- Computer Aided Diagnosis/Diagnostic Support Syste	owing ation 2)- cla cal Im 3)- ro emis etriev ew tre Guid ms (L TOT/	and (L2)- assific age esolu sion al (L ends ed S .2)	y wate - mul catior Regin 9 tion tomc -3), - ont urger	ershe Iti-sca n-bas strati - no ograp Curre tolog Ty (L: RIO	diale ecor ise hyen eso 2)·
UNIT – J Medical I (L2)- Mar segmenta methods Intensity UNIT–V PET and effect (L3 (L2)- ultr technolog – Applicat Image Gu	tv mage Segm kov Random tion (L2)- se (L2)- atlas-c (L2) -based SPECT Ultra) - 3D imag asound ima y in medical tions (L2)- O ided Therapy ecific open-en ssignments a on	SEGMENTATION AND CLASSIFICATION entation (L2)- Histogram-based methods (L2)- Region gro Field models (L2)- active contours - model-based segment emi-automated methods (L2)- clustering-based methods (L2 guided approaches - multi-model segmentation (L2)- Medic methods - cost functions - optimization techniques (L2) NUCLEAR IMAGING sound Imaging methods (L2)- mathematical principles (L2 ging - positron emission tomography (L2) - single photon oging (L2)- applications - Medical Image Search and Re image search (L2) - content-based image retrieval (L3) - ne ther Applications of Medical Imaging Validation (L3)- Image y (L2)- Computer Aided Diagnosis/Diagnostic Support Syste DPEN ENDED PROBLEMS / QUESTIONS and evaluated as internal assessment only and not for the en	owing ation 2)- cla cal Im 3)- ro emis etriev ew tre Guid ms (L TOT/ Such d sen	and (L2)- assific assific esolu sion al (L ends ed S .2) AL: 4 prob	y wate multication Registrian tion tomo 3), - ont urger 5 PE	ershe lti-sc n-bas strati - no ograp Curre tolog Ty (L: RIO	ds ecor ise hy ent esc 2)-
VNIT – J Medical I (L2)- Mar segmenta methods Intensity UNIT–V PET and effect (L3 (L2)- ultr technolog – Applicat Image Gu Course spe given as as examinatic Course Ou	tv mage Segm kov Random tion (L2)- se (L2)- atlas-g (L2) -based SPECT Ultra SPECT Ultra or 3D imag rasound im	SEGMENTATION AND CLASSIFICATION entation (L2)- Histogram-based methods (L2)- Region gro Field models (L2)- active contours - model-based segment emi-automated methods (L2)- clustering-based methods (L2 guided approaches - multi-model segmentation (L2)- Medic methods - cost functions - optimization techniques (L2) NUCLEAR IMAGING sound Imaging methods (L2)- mathematical principles (L2 ging - positron emission tomography (L2) - single photon riging (L2)- applications - Medical Image Search and Ro image search (L2) - content-based image retrieval (L3) - no ther Applications of Medical Imaging Validation (L3)- Image y (L2)- Computer Aided Diagnosis/Diagnostic Support Syste DPEN ENDED PROBLEMS / QUESTIONS and evaluated as internal assessment only and not for the en this course the students will be able to:	owing ation 2)- cla cal Im 3)- ro emis etriev ew tre Guid ms (L TOT/ Such d sem	and (L2)- assific age esolu sion al (L ends ed S 2) AL: 4 prob neste	y wate - mul catior Regis 9 tion tomo -3), - ont urger -5 PE olems r	ershe lti-sc n-bas strati - no ograp Curre tolog ry (L RIO can	dsale ecor ise hyent es 2)- be
UNIT – J Medical I (L2)- Mar segmenta methods Intensity UNIT–V PET and effect (L3 (L2)- ultr technolog - Applicat Image Gu Course spective given as as examinatic Course Out Jpon com CO1	tv mage Segm kov Random tion (L2)- se (L2)- atlas-c (L2) - based SPECT Ultra) - 3D imag rasound ima y in medical tions (L2)- O ided Therapy ecific open-en ssignments a on t comes: pletion of t present the r	SEGMENTATION AND CLASSIFICATION entation (L2)- Histogram-based methods (L2)- Region gro Field models (L2)- active contours - model-based segment emi-automated methods (L2)- clustering-based methods (L2 guided approaches - multi-model segmentation (L2)- Medic methods - cost functions - optimization techniques (L2) NUCLEAR IMAGING sound Imaging methods (L2)- mathematical principles (L2 ging - positron emission tomography (L2) - single photon riging (L2)- applications - Medical Image Search and Re image search (L2) - content-based image retrieval (L3) - ne ther Applications of Medical Imaging Validation (L3)- Image y (L2)- Computer Aided Diagnosis/Diagnostic Support Syste OPEN ENDED PROBLEMS / QUESTIONS and evaluated as internal assessment only and not for the en this course the students will be able to: medical image formation principles	wing ation 2)- cla cal Im 3)- ro emis etriev ew tre Guid ms (L TOT/ Such d sem BLO	and (L2)- assific age esolu sion al (L ends ed S 2) AL: 4 prob neste OM's	y wate mul catior Regi: 9 tion tomc 3), - onl urger 5 PE olems r	ershe lti-sch n-bas strati - no ograp Curre tolog Ty (L: RIO can	dsale ecor ise hy es 2)- DS
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Campus, Kakapal Salem-637 504

	medical image processing				
C03	Illustrate the fundamentals of medical image visualization techniques	L3 - Apply			
C04	Elaborate various methods of segmentation and classification in medical image processing	L2 - Understand			
C05	Illustrate the technologies involved in nuclear imaging	L3 - Apply			
REFE	RENCE BOOKS:				
1.	J. S. R. Jang, C. T. Sun, E. Mizutani, "Neuro Fuzzy and Soft Computing - A C to Learning and Machine Intelligence", PHI learning, 2 nd Edition, 2012	Computational Approach			
2.	Yoshua Bengio, Aaron Courville, Ian Good fellow, "Deep Learning", MIT Pres	ss, 1 st Edition, 2016			
3.	Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning", 2 nd Edition, 2009				
4.	Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 1st Edition, 2006				
5.	Shai Shalev, Shwartz, Shai Ben David, "Understanding Machine Learning", (Press, 1 st Edition, 2017	Cambridge University			
VIDE	O REFERENCES:	and the second states of the			
1.	https://onlinecourses.nptel.ac.in/noc20_ee59/preview				
2.	https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs12/	(特許)的)。 (特許)的			
WEB	REFERENCES:				
1.	https://www.simplilearn.com/tutorials/big-data-tutorial/big-data-application	าร			
ONLI	NE COURSES:				
1.	https://onlinecourses.nptel.ac.in/noc22_ee63/preview				

CO -	6	1	РО	s		h.e.
COS	PO1	PO2	PO3	PO4	PO5	POG
C01	2		2	3	3	1
CO2	-2	i net i	- 2	. 1.2. Jug	3	1
CO3	1		2	2	3	1
CO4	1		2	3	2	1
CO5	2		2	2	1	1
Average	1.6	Sector SA.	2	2.4	2.4	1

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