PSN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Melathediyoor-627152.

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)

(Accredited by NBA and NAAC, and an ISO 9001:2015 Certified Institution)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATION-2018

M.E (APPLIED ELECTRONICS)

CURRICULUM FOR I,II,III& IV SEMESTER (FULL TIME)

SEMESTER I

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
		THEORY				
1	520001	Applied Mathematics for Electronics Engineers	3	1	0	4
2	520002	Advanced Signal Processing	3	1	0	4
3	520003	Advanced Digital System Design	3	0	0	3
4	520004	Solid State Devices	3	0	0	3
5	520005	Microprocessors and Embedded Systems	3	0	0	3
6		Professional Elective I	3	0	0	3
		PRACTICAL				
7	520101	Electronics Design Lab – I	0	0	4	2
		TOTAL	**18**	**2**	**4**	**22**

SEMESTER II

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
		THEORY				
1	520006	Automotive Electronics	3	0	0	3
2	520007	Digital Control Engineering	3	0	0	3
3	520008	Soft Computing and Optimization Techniques	3	0	0	3
4	520009	Analysis and Design of Analog Integrated Circuits	3	0	0	3
5	520010	ASIC and FPGA Design	3	0	0	3
6		Professional Elective II	3	0	0	3
		PRACTICAL				
7	520102	Electronics Design Lab – II	0	0	4	2
8	520501	Technical Seminar	0	0	2	1
		TOTAL	**18**	**0**	**6**	**21**

LIST OF ELECTIVES
ELECTIVE-I

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
1.	520201	Low Power VLSI Design	3	0	0	3
2.	520203	CMOS Analog VLSI Design	3	0	0	3
3.	520204	Foundations of VLSI CAD	3	0	0	3
4.	520205	System Design using FPGA	3	0	0	3
5.	520206	Analog and Mixed Mode VLSI Design	3	0	0	3
6.	520207	System on Chip Design	3	0	0	3

ELECTIVE-II

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
1.	520208	DSP Processor Architecture and Programming	3	0	0	3
2.	520209	DSP Integrated Circuits	3	0	0	3
3.	520210	Wavelet Transform and Application	3	0	0	3
4.	520202	Speech and Audio Signal Processing	3	0	0	3
5.	520211	Sensor and Signals Conditioning	3	0	0	3
6.	520212	Neural Networks and their Applications	3	0	0	3

SEMESTER III

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
THEORY						
1		Professional Elective III	3	0	0	3
2		Professional Elective IV	3	0	0	3
3		Professional Elective V	3	0	0	3
PRACTICAL						
4	520301	Project Work (Phase – I)	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
PRACTICAL						
1	520302	Project Work (Phase – II)	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

Total No. of credits to be earned for the award of Degree 22+21+15+12=70

ELECTIVE-III

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
1.	520213	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
2.	520214	High Performance Communication Networks	3	0	0	3
3.	520215	MEMS and NEMS	3	0	0	3
4.	520216	Cryptography And Network Security	3	0	0	3
5.	520217	Multimedia compression techniques	3	0	0	3
6.	520218	Application of MEMS	3	0	0	3

ELECTIVE-IV

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
1.	520219	Nano Electronics	3	0	0	3
2.	520220	Photonics	3	0	0	3
3.	520221	Data Converters	3	0	0	3
4.	520222	Robotics	3	0	0	3
5.	520223	Fiber Optic Sensors	3	0	0	3
6.	520224	Smart System Design	3	0	0	3

ELECTIVE-V

S.NO	SUB CODE	SUBJECT NAME	L	T	P	C
1.	520225	Advanced Digital Image Processing	3	0	0	3
2.	520226	Internet of Things	3	0	0	3
3.	520227	Medical Image Processing	3	0	0	3
4.	520228	Detection and estimation theory	3	0	0	3
5.	520229	Pattern Recognition and Artificial Intelligence	3	0	0	3
6.	520230	Research Methodologies	3	0	0	3

SEMESTER I

520001 APPLIED MATHEMATICS FOR ELECTRICAL / ELECTRONICS ENGINEERS **L T P C**

3 1 0 4

AIM:

To provide the basic mathematical knowledge to enhance the exposure of technical knowhow essential for electrical / electronics engineers

LEARNING OUTCOMES:

Having successfully completed this course, the students should be able to:

- The students will become familiar with the basics of matrix factorizations and their

sources .The application of different kinds of processes

UNIT I CALCULUS OF VARIATIONS **12**

Maximum and minimum of functions of several independent variables – Lagrangian method of multipliers – Variational problems of fixed boundaries only: Simplest variational problems – Euler equation – Brachistochrone problem – Variational problems involving several unknown functions – Functional involving first and second order derivations – Functional involving two or more independent variables – Isoperimetric problems.

UNIT II MATRIX THEORY **12**

Some important matrix factorizations – The Cholesky decomposition – QR factorization– Least squares method – Singular value decomposition - Toeplitz matrices and some applications.

UNIT III STOCHASTIC PROCESSES **12**

Introduction and classification of stochastic processes , Chapman Kolmogorov equation, Poisson process- Discrete Markov chain, computation of n-step transition probabilities, state classification and continuous time Markov chain – Birth and death processes, pure birth process and pure death process applications. Assignment using applications of Stochastic process software ,AR modelling

UNIT IV QUEUING MODELS **12**

Poisson Process - Markovian Queues - Single and Multi-Server Models - Little's Formula - Machine Interference Model - Self Service Queue - Non- Markovian Queues - Pollaczek Khintchine Formula

UNIT V GRAPH THEORY **12**

Introduction – Basic terminology – Representation of graphs – Connected graphs – Matrix representation of graphs (excluding graphs) – Applications – Critical path method – Shortest path problems – trees – definition – Binary tree

L=60 TOTAL: 60 PERIODS

REFERENCES:

1.Sheldon M. Ross, "Introduction to Probability Models", Academic Press, 2003.

TEXT BOOK :

1.Elsgolts L, “Differential Equation and Calculus of variation”, MIR Publishers, 2005.(For unit 1)
2.Narasingh Deo,”Graph Theory &its Applications” Prentice Hall publications, New Edition(For unit 5)

3.Trivedi K.S, “Probability and Statistics with Reliability, Queuing and Computer ScienceApplications, Prentice Hall, 2003. (For units 3,4)
4.Bronson.R. Matrix Operations, “Schaum’s outline series”, Mc Graw Hill, New York,New Edition. (For unit 2)

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520002	ADVANCED SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

AIM:

To familiarize the student with compute designing digital filters and able to understand the multirate signal processing.

LEARNING OUTCOMES:

Having successfully completed this course, the students should be able to:

- Learn fundamental concepts on signal processing in power spectrum estimation.
- To learn the various method for spectral estimation
- Able to understand the filter concept and linear estimation
- To Study the adaptive filters and its applications.
- Explore the concepts of multi rate signal processing and multi rate filters.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete Random Processes, Ensemble Averages, Stationary processes, Bias and Estimation, Auto covariance, Autocorrelation, Parseval's theorem, Wiener-Khintchine relation, White noise, Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types of Random Processes , ARMA, AR, MA , Yule-Walker equations.

UNIT II SPECTRAL ESTIMATION 9

Estimation of spectra from finite duration signals, Nonparametric methods , Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods , ARMA, AR and MA model based spectral estimation.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Linear prediction, Forward and Backward prediction, Solution of Prony's normal equations, Least mean-squared error criterion, Wiener filter for filtering and prediction, FIR and IIR Wiener filters.

UNIT IV ADAPTIVE FILTERS 9

FIR adaptive filters, adaptive filter based on steepest descent method- Widrow-Hoff LMS algorithm, Normalized LMS algorithm, Adaptive channel equalization, Adaptive echo cancellation, Adaptive noise cancellation, RLS adaptive algorithm.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Mathematical description of change of sampling rate , Interpolation and Decimation, Decimation by an integer factor, Interpolation by an integer factor, Sampling rate conversion by a rational factor, Polyphase filter structures, Multistage implementation of multirate system, Application to subband coding , Wavelet transform , Assignment using MATLAB Tools.

L=45 T= 45 TOTAL: 60 PERIODS

REFERENCES:

1. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons, Inc, Singapore, 2009.
2. Saeed V. Vaseghi, “Advanced Digital Signal Processing and Noise Reduction”, 4th Edition,Wiley, 2009.
3. John G. Proakis and Dimitris K Manolakis “Digital Signal Processing”, Pearson Education, 4th Edition, 2009.
4. Richard G. Lyons “Understanding Digital Signal Processing”, PHI, 3rd Edition, 2010.
5. Alan V. Oppenheim and Ronald W. Schafer “Discrete-Time Signal Processing”,3rd Edition PHI.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO’s	**Statement’s**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Learn fundamental concepts on signal processing in power spectrum estimation	3	3	3	3	3							2	2	2
CO-2	To learn the various method for spectral estimation	3	3	3	3	3							2	2	2
CO-3	Able to understand the filter concept and linear estimation	3	3	3	3	3							2	2	2
CO-4	To Study the adaptive filters and its applications	3	3	2	2	2							2	2	

CO-5	Explore the concepts of multi rate signal processing and multi rate filters	3	3	2	3	3							2	2	2

520003 ADVANCED DIGITAL SYSTEM DESIGN

L	**T**	**P**	**C**
3	**0**	**0**	**3**

AIM:

To introduce the notion of asynchronous sequential circuit and design the system**.**

LEARNING OUTCOMES:

Having successfully completed this course, the students should be able to:

- Analyze the basic concepts of logic system design.
- Analyze the synchronous sequential circuits design.
- Categorize the asynchronous sequential circuits with their flow tables.
- Implement the hazards free circuits.
- Recognize the concepts of System Design Using VHDL and Programmable Devices.

UNIT I SEQUENTIAL CIRCUIT DESIGN 9

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits – ASM Chart – ASM Realization.

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 9

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment – Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits.

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS 9

Fault Table Method – Path Sensitization Method – Boolean Difference Method – D Algorithm – Tolerance Techniques – The Compact Algorithm – Practical PLA's – Fault in PLA – Test Generation – Masking Cycle – DFT Schemes – Built-in Self Test.

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES 9

Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a PAL – Realization State machine using PLD –Complex Programmable Logic Devices (CPLDs) - FPGA – Xilinx FPGA – Xilinx 3000 - Xilinx 4000

UNIT V SYSTEM DESIGN USING VHDL 9

VHDL Description of Combinational Circuits – Arrays – VHDL Operators – Compilation and Simulation of VHDL Code – Modeling using VHDL – Flip Flops – Registers – Counters – Sequential Machine Combinational Logic Circuits - VHDL Code for – Serial Adder, Binary

Multiplier – Binary Divider – complete Sequential Systems – Design of a Simple Microprocessor - Assignment using VHDL.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Donald G. Givone "Digital principles and Design" Tata McGraw Hill, 2010.
2. Nripendra N Biswas "Logic Design Theory" Prentice Hall of India, 2012.
3. Charles H. Roth Jr. "Fundamentals of Logic design" Thomson Learning, 2004, 7th Edition
4. Nelson V.P., Nagale H.T., Carroll B.D., and Irwin J.D., "Digital Logic Circuit Analysis and Design", PHI Inc. 2011.
5. Stephen Brown and Zvonk Vranesic "Fundamentals of Digital Logic with VHDL Design' Tata McGraw Hill, 2011
6. Navabi.Z. "VHDL Analysis and Modeling of Digital Systems", Mc Graw Hill, 1997, 2nd Edition.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO-1	Analyze the basic concepts of logic system design	3	2	1	1	2					3	1	2	2	1
CO-2	Analyze the synchronous sequential circuits design	2	2	3	3	2	3			1	1	2	2	3	2
CO-3	Categorize the asynchronous sequential circuits with their flow tables	3	2	2	1	3				2	3	2	2	2	2
CO-4	Implement the hazards free circuits	3	2	2	3	2		2			3	2	1	2	2

CO-5	Recognize the concepts of System Design Using VHDL and Programmable Devices	3	2	1	3	2	1			3	2	1	2	3	2

520004 **SOLID STATE DEVICES** **L T P C**
3 0 0 3

AIM:

To familiarize the student with concept of device and concepts of high frequency and high power devices

LEARNING OUTCOMES:

Having successfully completed this course, the students should be able to:

- To study and model MOSFET and advanced MOSFET.
- Can be Modelled the Process Variation and quality assurance.
- To Design and analysis of various types of diodes.
- Identification of new developments in solid state devices
- To design the simple electronics devices as the simulation level

UNIT I MOSFET DEVICE PHYSICS 9

Equivalent circuit representation of MOS transistor, High frequency behavior of MOS transistor and A.C small signal modeling, model parameter extraction, modeling parasitic BJT, Resistors, Capacitors, Inductors.

UNIT- II DEVICE MODELLING **9**

Prime importance of circuit and device simulations in VLSI; Nodal, mesh, modified nodal and hybrid analysis equations. Solution of network equations: Sparse matrix techniques, solution of nonlinear networks through Newton-Raphson technique, convergence and stability.

UNIT- III HIGH FREQUENCY AND HIGH POWER DEVICES **9**

Tunnel Diodes, IMPATT Diode, operation of TRAPATT and BARITT Diodes, Gunn Diode - transferred - electron mechanism, formation and drift of space charge domains-n-p-n Diode, Semiconductor Controlled Rectifier, Insulated Gate Bipolar Transistor.

UNIT IV MATHEMATICAL TECHNIQUES DEVICE SIMULATIONS **9**

Poisson equation, continuity equation, drift-diffusion equation, Schrodinger equation, hydrodynamic equations, trap rate, finite difference solutions to these equations in 1D and 2D space, grid generation.

UNIT V SIMULATION OF DEVICES **9**

Computation of characteristics of simple devices like p-n junction, MOS capacitor and MOSFET; Small-signal analysis.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Arora, N., "MOSFET Modeling for VLSI Simulation", Cadence Design Systems, 2007
2. Christian C. Enz, Eric A. Vittoz, "Charge-based MOS Transistor Modeling The EKV model for low-power and RF IC design", John Wiley & Sons, Ltd, 2006.
3. Fjeldly, T., Yetterdal, T. and Shur, M., "Introduction to Device Modeling and Circuit Simulation", Wiley-Interscience., 1997
4. Grasser, T., "Advanced Device Modeling and Simulation", World Scientific Publishing Company., 2003
5. Selberherr, S., "Analysis and Simulation of Semiconductor Devices", Springer-Verlag.,1984
6. D.K. Bhattacharya & Rajinish Sharma, Solid State Electronic Devices, Oxford University Press, 2007.

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CO-PO MAPPING

COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To study and model MOSFET and advanced MOSFET	3	3	2	2	2				2	3	3	2	1	1
CO-2	Can be Modelled the Process Variation and quality assurance	3	3	2	2	3						3	3	2	2
CO-3	To Design and analysis of various types of diodes	3	3	2	2	2	2				2		2	2	2

CO-4	Identification of new developments in solid state devices	3	2	2	2	3							2	1	2
CO-5	To design the simple electronics devices as the simulation level	3	3	2	2	2					2		3	2	

520005 MICROPROCESSORS AND EMBEDDED SYSTEMS

L	**T**	**P**	**C**
3	**0**	**0**	**3**

AIM:

To familiarize about the features, specification and features of modern microprocessors and Embedded systems.

LEARNING OUTCOMES:

Having successfully completed this course, the students should be able to:

- To explain the features and important specifications of modern microprocessors
- To explain the salient features of CISC microprocessors based architectures.
- To explain the salient features RISC processors based on ARM architecture and different application profiles of ARM core
- To explain the features and important specifications of modern microcontrollers
- To Learn design challenges and design methodologies

UNIT I FEATURES OF MODERN MICROPROCESSORS 9

Evolution of microprocessors - Data and Address buses – clock speed – memory interface - multi-core architectures – cache memory hierarchy – operating modes – super scalar execution – dynamic execution – over clocking – integrated graphics processing - performance benchmarks

UNIT II CISC AND RISC ARCHITECTURE **9**

Introduction to IA 32 bit architecture -Superscalar architecture -Hyper threading technology – 64 bit extension technology – Intel 64 bit architecture -RISC architecture merits and demerits -3-stage pipeline ARM organization – ARM instruction execution -ARM architecture profiles (A, R and M profiles)

UNIT III FEATURES OF MODERN MICROPROCESSORS **9**

Introduction to microcontrollers – microcontroller vs microprocessors – microcontroller architecture - Processor Core – Memory interfaces– Communication interfaces (SPI,I2C, USB and CAN) – ADC - PWM – Watchdog timers – Interrupts – Debugging interfaces

UNIT IV EMBEDDED SYSTEM OVERVIEW 9

Embedded System Overview, Design Challenges – Optimizing Design Metrics, Design Methodology, RT-Level Combinational and Sequential Components, Optimizing Custom Single-Purpose Processors.

UNIT V EMBEDDED SOFTWARE DEVELOPMENT TOOLS AND RTOS 9

Compilation Process – Libraries – Porting kernels – C extensions for embedded systems – emulation and debugging techniques – RTOS – System design using RTOS.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Barry. B. Breg," The Intel Microprocessors" , PHI,2008.
2. Gene .H.Miller ." Micro Computer Engineering ," Pearson Education , 2003.
3. Joseph Yiu, "The Definitive Guide to the ARM ® Cortex-M3", Newnes, 2010.
4. Bruce Powel Douglas, "Real time UML, second edition: Developing efficient objects for embedded systems", 3rd Edition 1999, Pearson Education.
5. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education, 2002.
6. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To explain the features and important specifications of modern microprocessors	3	3	2	2	2							2	2	2
CO-2	To explain the salient features of CISC	3	2	3	3	2	2			2		2	2	2	2

	microprocessors based architectures														
CO-3	To explain the salient features RISC processors based on ARM architecture and different application profiles of ARM core	3	2	3	2	3	2			3		2	2	3	3
CO-4	To explain the features and important specifications of modern microcontrollers	3	3	3	3	3	3				2		2	3	2
CO-5	To Learn design challenges and design methodologies	3	3	2	2	2	3			2		2	2	2	

520101	ELECTRONICS DESIGN LAB – I	L	T	P	C
		3	0	0	4

AIM:

To study of different interfaces and asynchronous and clocked synchronous sequential circuits

LEARNING OUTCOMES:

Having successfully completed this course, the students should be able to:

- Apply PIC, MSP430, „51 Microcontroller and 8086 for system design
- Design sensor using simulation tools
- To design the ALU Using FPGA
- To simulate the Circuit design using SPICE
- Design and analyze of real time signal processing system

LIST OF EXPERIMENTS

1. System design using PIC Microcontroller.
2. Implementation of Adaptive Filters, periodogram and multistage multirate system in DSP Processor
3. Simulation of QMF using Simulation Packages
4. Modeling of Sequential Digital system using VHDL.
5. Modeling of Sequential Digital system using Verilog.
6. Design and Implementation of ALU using FPGA.
7. Simulation of NMOS and CMOS circuits using SPICE.
8. System design using 16- bit Microprocessor.

TOTAL: 60 PERIODS

List of Requirements:

Hardware Requirements:

S.NO.	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED
1.	FPGA Kit	5
2.	PIC Microcontroller	2

Software Requirements:

S.NO.	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED
1.	Xilinx	10 User License
2.	MATLAB	10 User License

COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	Apply PIC, MSP430, „51 Microcontroller and 8086 for system design	3	3	2	2	1				3	2	2	2		3
CO-2	Design sensor using simulation tools	3	3	2	2	1				3	2	2	3		2
CO-3	To design the ALU Using FPGA	3	3	3	3	3	1			3	2	2	2	2	3
CO-4	To simulate the Circuit design using SPICE	3	3	3	2	2	2			3	2	2	2		2
CO-5	Design and analyze of real time signal processing system	3	3	3	2	1				2	2	2	2	2	2

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SEMESTER –II

520006	AUTOMOTIVE ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To study the fundamentals of automotive electronics and the starting, charging and ignition systems

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the concepts of Automotive Electronics and it's evolution and trends
- To learn the concept of starting, charging.
- Able to understand about the function of magnetic coil and ignition system.
- Able to learn the batteries, lighting system
- Able to understand the concept of , sensors and actuators

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Automobile Systems –Engine – Engine control- Ignition system –Ignition timing- Drive train – Suspension – Brakes – Steering system. Control systems- Proportional controller-Proportional Integral controller - Proportional Integral differential controller - Closed-Loop Limit-Cycle Control, Electronic Dashboard instruments -On-board diagnostic systems

UNIT II STARTING AND CHARGING SYSTEMS 9

Requirements of Starter Motor, Starter Motor types, Construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids, Charging system components, Generators and Alternators, Types, Construction and Characteristics. Voltage and Current Regulation, Cut –out relays and regulators, Charging circuits for D.C. Generator, A.C. Single Phase and Three – Phase Alternators.

UNIT III IGNITION SYSTEM 9

Battery Coil and Magneto–Ignition System, Circuit details and Components of Battery Coil and Magneto–Ignition System, Centrifugal and Vacuum Advance Mechanisms, Spark Plugs, Constructional details and Types. Electronically–Assisted and Full Electronic Ignition System, Non–Contact–type Ignition Triggering devices, Capacitive Discharge Ignition Distributor–less Ignition System, Digital Ignition System.

UNIT IV BATTERIES AND LIGHTING SYSTEMS 9

Principle and construction of Lead Acid Battery, Characteristics of Battery, Battery Rating, Capacity and Efficiency, Various Tests on Battery, Battery–Charging Techniques-Maintenance of batteries.Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods

UNIT V SENSORS AND ACTUATORS 9

Sensors – Oxygen (O2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Shielded Field Sensor, Engine Coolant Temperature (ECT) Sensor, Intake Air Temperature (IAT) Sensor, Knock Sensor, Airflow rat e sensor, Throttle angle sensor. Actuators– Fuel Metering Actuator, Fuel Injector, Ignition Actuator.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. A W Judge, Modern Electrical Equipment of Automobiles, Chapman & Hall, 2004
2. A.P.Young, L.GriffithsAutomotive Electrical Equipment, ELBS & New Press, 2004
3. P.L.Kholi, Automotive Electrical Equipment, Tata McGraw-Hill, 2004
4. Robert Bosch Automotive Hand Book, SAE, 2018.
5. Trevor Mellard, “Automotive Electronic Systems” oxford publication, 3rd edition, 2012.
6. V. A. W. Hillier, “Hillier's Fundamentals of Automotive Electronics” V,A.W. Hiller, 3rd edition, 2009.

COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO’s	Statement’s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To study different the fundamentals of automotive systems	3	3	3	2	2							2	2	2
CO-2	To learn the concept of starting, charging	3	3	2	2	3					2		2	2	2
CO-3	To study about the function of magnetic coil and ignition system	3	3	2	2	2					2		2	2	

CO-4	To study the batteries, lighting system	3	3	3	2	2					1		2	2	
CO-5	To learn the concept of , sensors and actuators	3	3	3	3		2				2		2		2

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PSNCET(Autonomous)

520007 DIGITAL CONTROL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

To learn the fundamental principles of feedback control and dynamic systems, Optimal Control Systems and Digital Control Systems and to learn how to perform the stability analysis of Feedback Control Systems

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the fundamentals of control system
- Examine design of discrete time control systems.
- Analyze the basic Concepts of discrete time control system and Z Transform
- Apply Z plane analysis of discrete time control systems
- Apply the function of the digital control algorithms

UNIT I FUNDAMENTALS OF CONTROL SYSTEM 9

Review of Frequency and Time Response- Analysis and Specifications of Control Systems – Needfor Controllers- Continues Time Compensations, Continues Time PI, PD, PID Controllers – DigitalPID Controllers

UNIT II SIGNAL PROCESSING IN DIGITAL CONTROL 9

Sampling - Time and Frequency Domain Description – Aliasing-Hold Operation – Mathematical Model of Sample and Hold - Zero and First Order Hold - Factors Limiting the Choice of SamplingRate – Reconstruction

UNIT III MODELLING AND ANALYSIS OF SAMPLED DATA CONTROL SYSTEM 9

Difference Equation Description - Z-Transform Method of Description - Pulse Transfer Function -Time and Frequency Response of Discrete Time Control Systems - Stability of Digital ControlSystems - Jury's Stability Test - State Variable Concepts- First Companion- Second Companion-Jordan Canonical Models – Discrete State Variable Models – Elementary Principles

UNIT IV DESIGN OF DIGITAL CONTROL ALGORITHMS 9

Review of Principle of Compensator Design -Z-Plane Specifications - Digital Compensator

Design using Frequency Response Plots - Discrete Integrator - Discrete Differentiator - Development of Digital PID Controller – Transfer Function – Design in the Z-Plane

UNIT V PRACTICAL ASPECTS OF DIGITAL CONTROL ALGORITHMS 9

Algorithm Development of PID Control Algorithms- Software Implementation- Implementation using Microprocessors and Microcontrollers- Finite Word Length Effects- Choice of Data Acquisition Systems- Microcontroller based Temperature Control Systems- Microcontroller based Motor Speed Control Systems .

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Bishop and Dorf, "Digital control systems Design", Prentice Hall; 12th Edition, 2015.
2. Gopal M., "Digital Control and Static Variable Methods", Tata McGraw Hill, New Delhi, 2008.
3. John D'Azzo J., ―ConstantiveHoupios, Linear Control System Analysis and Design‖, TataMcGraw Hill, 2009.
4. Mohammed S. Santina, Allen R. Stubberud, Gene H. Hostetter, Digital control system design, Oxford University Press, 5th edition, 2019=3.
5. M. Sami Fadali, Antonio Visioli, "Digital Control Engineering: Analysis and Design" Elsevier, 3rd edition, 2013.

COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO-1	To understand the fundamentals of control system	3	2	2									1	2	1
CO-2	Examine design of discrete time control systems	3	3	2	2								1	2	2
CO-3	Analyze the basic Concepts of discrete time control system and Z Transform	3	2	3	2								1	2	2

CO-4	Apply Z plane analysis of discrete time control systems	2	3	2	1								1	2	2
CO-5	Apply the function of the digital control algorithms	3	3	2	1								1	2	2

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520008 SOFT COMPUTING AND OPTIMIZATION TECHNIQUES

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Objectives:

- To learn various Soft computing frameworks.
- To familiarizes with the design of various neural networks.
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in conventional optimization techniques.
- To understand the various evolutionary optimization techniques.

UNIT-I NEURAL NETWORKS **9**

Machine Learning using Neural Network, Learning algorithms, Supervised Learning Neural Networks – Feed Forward Networks, Radial Basis Function, Unsupervised Learning Neural Networks – Self Organizing map , Adaptive Resonance Architectures, Hopfield network

UNIT-II FUZZY LOGIC **9**

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

UNIT- III NEURO-FUZZY MODELING **9**

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

UNIT-IV CONVENTIONAL OPTIMIZATION TECHNIQUES 9

Introduction to optimization techniques, Statement of an optimization problem, classification, Unconstrained optimization-gradient search method-Gradient of a function, steepest gradientconjugate gradient, Newton's Method, Marquardt Method, Constrained optimization –sequential linear programming, Interior penalty function method, external penalty function method.

UNIT-V EVOLUTIONARY OPTIMIZATION TECHNIQUES 9

Genetic algorithm - working principle, Basic operators and Terminologies, Building block hypothesis, Travelling Salesman Problem, Particle swam optimization, Ant colony optimization.

Total :45 Periods

Reference Books :

1. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison wesley, 2009.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications,Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Edn., 2003.
4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2003.
5. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall, 1998.
6. Simon Haykins, Neural Networks: A Comprehensive Foundation, Prentice Hall International Inc, 1999.
7. Singiresu S. Rao, Engineering optimization Theory and practice, John Wiley & sons, inc,Fourth Edition, 2009
8. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997.
9. Venkata Rao, Vimal J. Savsani, Mechanical Design Optimization Using Advanced Optimization Techniques, springer 2012

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To learn various Soft computing frameworks	3	2	2		2	2			2	3		3	2	1
CO-2	To familiarizes with the design of various neural networks	3	3	2	2	2				1	2		2	2	2
CO-3	To gain insight onto Neuro Fuzzy modeling and control	3	2	3	2	3				2	3		2	3	2
CO-4	To gain knowledge in conventional optimization techniques	2	3	2	3	2					3		3	2	2
CO-5	To understand the various evolutionary optimization techniques	3	3	2	1	2				2	2		2	2	2

520009 ANALYSIS AND DESIGN OF ANALOG INTEGRATED CIRCUITS L T P C
3 0 0 3

COURSE OBJECTIVE:

To study about models involved in integrated circuits and design the amplifiers using various methods

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Determine the device dimensions of MOSFETs.
- Discuss the most important building blocks of all CMOS analog ICs.
- Analyze the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design.
- Design single and multistage voltage, current and differential amplifiers design the multiplier and transistors using PLL and MOS Technology
- To study about the analog design with MOS Technology and current sources.

UNIT I MODELS FOR INTEGRATED CIRCUIT ACTIVE DEVICES 9

Depletion region of a PN junction - Large signal behavior of bipolar transistors - Small signal model of bipolar transistor - Large signal behavior of MOSFET - Small signal model of the MOS transistors - Short channel effects in MOS transistors - Weak inversion in MOS transistors -Substrate current flow in MOS transistor.

UNIT II CIRCUIT CONFIGURATION FOR LINEAR IC 9

Current sources - Analysis of difference amplifiers with active load using BJT and FET - Supply and temperature independent biasing techniques - Voltage references - Output stages - Emitter follower -Source follower and Push pull output stages.

UNIT III FEEDBACK AND OPERATIONAL AMPLIFIERS 9

Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, One-stage Op Amps, Two-stage Op Amps, Input range limitations, Gain boosting, slew rate, power supply rejection, noise in Op Amps.

UNIT IV STABILITY AND BANDGAP REFERENCES 9

General considerations, Multipolesystems,Phase Margin, Frequency Compensation, Compensation of two stage Op Amps, Slewing in two stage Op Amps, Other compensation techniques.Supply independent biasing, temperature independent references, PTAT current generation, Constant-Gm Biasing

UNIT V ANALOG DESIGN WITH MOS TECHNOLOGY 9

MOS Current Mirrors - Simple- Cascode - Wilson and Widlar current source - CMOS Class AB output stages - Two stage MOS Operational Amplifiers - with Cascode - MOS Telescopic Cascode Operational Amplifier - MOS Folded Cascode and MOS ActiveCascode Operational Amplifiers

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. BehzadRazavi, “Principles of data conversion system design”, SChand publications,2004.
2. Donald O. Pederson, Kartikeya Mayaram, “Analog Integrated Circuits for Communication: Principles, Simulation and Design” , springer, 3rd edition, 2012.
3. Gray, Meyer, Lewis, Hurst, “Analysis and design of Analog IC’s”, 4th Edition, Willey International, 2011.
4. Grebene, “Bipolar and MOS Analog Integrated circuit design”, John Wiley & Sons Inc, 2nd edition, 2009.

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	Determine the device dimensions of MOSFETs	3	3	3	3	2	2			2	2	3	3	2	2
CO-2	Discuss the most important building blocks of all CMOS analog ICs	3	3	3	2	2	2				2	2	2	2	
CO-3	Analyze the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design	3	3	2	2	3				2		2	2	2	1
CO-4	Design single and multistage voltage, current and differential amplifiers design the multiplier and transistors using PLL and MOS Technology	3	3	3	3	2	2			2		2	2	2	
CO-5	To study about the analog design with MOS Technology and current sources	3	3	2	2	2				1		1	2	1	1

520001	ASIC AND FPGA DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To gain knowledge about partitioning, floor planning, placement and routing including circuitextraction of ASIC.

COURSE OUTCOMES:

- To familiarize the different types of programming technologies and logic devices.
- To understand the architecture of different types of FPGA.
- To analyse the synthesis, Simulation and testing of systems.
- To understand about different high performance algorithms and its applications in ASICs.
- To design the FPGA Architecture and the design simulation.

UNIT I OVERVIEW OF ASIC AND PLD **9**

Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies:Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices : ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs

UNIT II ASIC PHYSICAL DESIGN **9**

System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing : global routing - detailed routing - special routing - circuit extraction - DRC

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UNIT III LOGIC SYNTHESIS 9

Design systems –A Comparator/MUX-Inside a logic Synthesizer-Synthesis of the Viterbi Decoder-Verilog and Logic Synthesis-VHDL and Logic Synthesis –Finite State Machine Synthesis-Memory Synthesis-Multiplier-The Engine Controller-Performance Driven Synthesis

UNIT IV SIMULATION AND TESTING 9

Types of Simulation-Logic Systems-Cell models-Delay Models-Static Timing Analysis-Formal Verification-Switch Level Simulation-Transistor level Simulation-Boundary Scan Test-Faults-Fault Simulation –Automatic Test Pattern Generation-Scan test-Built in self test

UNIT V FPGA 9

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance Case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Parag.K.Lala, Digital System Design using Programmable Logic Devices , BSP, 2003
2. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc.,2014.
3. S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications, 1994..

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To familiarize the different types of programming technologies and logic devices	3	3	3	2	2						2	3		3
CO-2	To understand the architecture of different types of FPGA	2		2		2						2	2		2

CO-3	To analyse the synthesis, Simulation and testing of systems	3	2	2	3	1						1	3		2
CO-4	To understand about different high performance algor ithms and its applications in ASICs	3	2	2	2	2						2	3	1	2
CO-5	To design the FPGA Architecture and the design simulation	2		3		2						2	1		2

520102 **ELECTRONICS DESIGN LAB - II** **L T P C**
0 0 4 2

AIM:

To study of different interfaces and asynchronous and clocked synchronous sequential circuits

LEARNING OUTCOMES:

Having Successfully Completed This Course, The Students Should Be Able To:

- To Apply PLL, CPLD, „51 Microcontroller and 8086 For System Design
- Design Sensor Using Simulation Tools
- To analyse the embedded controller using microcontroller
- To simulate the adaptive algorithms using MATLAB
- Design and Analyse of Real Time Signal Processing System

LIST OF EXPERIMENTS

1. System design using PLL

2. System design using CPLD
3. Alarm clock using embedded micro controller
4. Model train controller using embedded micro controller
5. Elevator controller using embedded micro controller
6. Simulation of Non adaptive Digital Control System using MATLAB control system Toolbox
7. Simulation of Adaptive Digital Control System using MATLAB control system toolbox

TOTAL: 60 PERIODS

List of Requirements:

Hardware Requirements:

S.NO.	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED
1.	PLL,CPLD Kit	2
2.	PIC Microcontroller	2

Software Requirements:

S.NO.	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED
1.	Xilinx	10 User License
2.	MATLAB	10 User License

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO-1	To Apply PLL, CPLD, „51 Microcontroller and 8086 For System Design	3	3	2	2	1				3	2	2	2		3
CO-2	Design Sensor Using Simulation Tools	3	3	2	2	1				3	2	2	3		2
CO-3	To analyse the embedded controller using microcontroller	3	3	3	3	3	1			3	2	2	2	2	3
CO-4	To simulate the adaptive algorithms using MATLAB	3	3	3	2	2	2			3	2	2	2		2
CO-5	Design and Analyse of Real Time Signal Processing System	3	3	3	2	1				2	2	2	2	2	2

ELECTIVE-I

520201 **LOW POWER VLSI DESIGN** **L T P C**

3 0 0 3

COURSE OBJECITVE:

The Students will be able to understand the low power VLSI Design.

COURSEOUTCOMES:

- Determine the basics techniques in low power design.
- Design the low power CMOS circuits.
- Understand the advanced techniques in low power design which is a hot topic in today's market where the power plays major role.
- illustrate the power analysis and estimation process by using the spice simulator
- Explain the software design for low power.

UNIT I POWER DISSIPATION IN CMOS 9

Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices- Basic principle of low power design. Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation

UNIT II POWER OPTIMIZATION 9

Logic level power optimization – Circuit level low power design – circuit techniques for reducing power consumption in adders and multipliers.

UNIT III DESIGN OF LOW POWER CMOS CIRCUITS 9

Computer Arithmetic techniques for low power systems – Reducing power consumption in memories – Low power clock, Interconnect and layout design – Advanced techniques – Special techniques. Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library

UNIT IV POWER ESTIMATION 9

Power estimation techniques – Logic level power estimation – Simulation power analysis – Probabilistic power analysis.gate level logic simulation, capacitivepower estimation, static state power, gate level capacitance estimation.

UNIT V SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER 9

Synthesis for low power – Behavioral level transform – software design for low power.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Anantha P. Chandrakasan& Robert W. Brodersen, "Low Power Digital CMOS Design" Kluwer Academic Publications, 2009.
2. Angsuman Sarkar, Swapnadip De, Manash Chanda, Chandan Kumar Sarkar, " Low Power VLSI Design: Fundamentals", webly publications, 2016.
3. Ajit Pal, "Low-Power VLSI Circuits and Systems" PRC press publications, 3rd edition, 2014.
4. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002

5. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design”, Wiley, 2000

6. Rabaey, Pedram, “Low Power Design Methodologies”, Kluwer Academic, 2004.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO’s	**Statement’s**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Determine the basics techniques in low power design	3	3	3	2	1	1						2	3	3
CO-2	Design the low power CMOS circuits	3	3	3	2	2						2	2	2	2
CO-3	Understand the advanced techniques in low power design which is a hot topic in today’s market where the power plays major role	3	3	3	3	3				3		2	2	3	2
CO-4	illustrate the power analysis and estimation process by using the spice simulator	3	3	2	2	3							2	3	
CO-5	Explain the software design for low power	3	3	3	3	3							2		3

520203 **CMOS ANALOG VLSI DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

To understand CMOS analog circuit design and simulate VLSI circuit.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Apply mathematical methods and circuit analysis models in analysis of CMOS circuits
- Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects
- To Knowledge about Op-Amp and CMOS circuits.
- To understand the concept of oscillators.
- To Analyse the noise characteristics

UNIT I ANALOG CMOS SUB-CIRCUITS 9

Introduction to analog design, Passive and active current mirrors, band-gap references, Switched Capacitor circuits - basic principles, sampling switches, switched capacitor integrator, switched capacitor amplifier, simulation of CMOS sub circuits using SPICE.

UNIT II CMOS SINGLE STAGE AMPLIFIERS 9

Common-Source stage (with resistive load, diode connected load, currentsource load, triode load, source degeneration), source follower, common-gate stage, cascode stage, folded cascode stage. Frequency responses of CS stage, CD stage, CG stage, cascode stage, simulation of CMOS amplifiers using SPICE.

UNIT III DIFFERENTIAL AMPLIFIER & OPERATIONAL AMPLIFIERS 9

Single-ended and differential operation, basic differential pair – qualitative and quantitative analyses, common-mode response, differential pair with MOS loads, Performance parameters of op-amp, one stage op-amp, two-stage CMOS op-amp, Gain boosting, slew rate, power supply rejection, Simulation of differential amplifiers using SPICE.

UNIT IV OSCILLATORS 9

General considerations, Ring oscillators, LC oscillators – cross-coupled oscillators, Colpitts oscillator, One-port oscillator, and voltage controlled oscillators. Simulation of oscillators using SPICE.

UNIT V NOISE CHARACTERISTICS 9

Statistical characteristics of noise, Types of noise - thermal noise, flicker noise, Representation of noise in circuits, noise in single-stage amplifiers (CS, CD and CG stages), noise bandwidth.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Allen, Holberg, “CMOS analog circuit design”, Oxford University Press, 2nd Edition, 2012.

2. Gray, Meyer, Lewis, Hurst, “Analysis and design of Analog Integrated Circuits”, Willey International, 5th Edition, 2008.

3. Geiger, “VLSI Design Techniques For Analog and digital circuits” Willey international, 2nd edition, 2009.

4. John P. Uyemura, “CMOS Logic Circuit Design” Kluwer academic publishers, 3rd edition, 2010.

5. Razavi, “Design of analog CMOS integrated circuits”, McGraw Hill, Edition 2008.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO’s	**Statement’s**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Apply mathematical methods and circuit analysis models in analysis of CMOS circuits	3	3	3	2	2						2	3		3
CO-2	Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects	3	2	2	2	2						2	2		2
CO-3	To Knowledge about Op-Amp and CMOS circuits	3	2	2	3	2						1	3		2
CO-4	To understand the concept of oscillators	3	2	2	2	2						2	3	1	2

CO-5	To Analyse the noise characteristics	3	2	3	2	2						2	1		2

520204	FOUNDATIONS OF VLSI CAD	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To introducestudy various physical design methods of VLSI and design rules and routing techniques.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the concepts behind the VLSI design rules and routing techniques.
- To use the simulation techniques at various levels in VLSI design flow,
- To understand the concepts of various algorithms used for floor planning and routing techniques.
- To understand the techniques of modeling.
- To understand the concept of the modeling and synthesis.

UNIT I VLSI DESIGN METHODOLOGIES 9

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methods for combinatorial optimization.

UNIT II DESIGN RULES 9

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms – partitioning

UNIT III FLOOR PLANNING 9

Floor planning concepts - shape functions and floorplan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

UNIT IV SIMULATION 9

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulationCombinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis.

UNIT V MODELLING AND SYNTHESIS 9

High level Synthesis - Hardware models - Internal representation - Allocation - assignment and scheduling - Simple scheduling algorithm - Assignment problem - High level transformations.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2005.

2. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
3. Sadiq M. Sait, Habib Youssef, “VLSI Physical Design automation: Theory and Practice”, World scientific 2005.
4. Steven M.Rubin, “Computer Aids for VLSI Design”, Addison Wesley Publishing 2003.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO’s	**Statement’s**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To understand the concepts behind the VLSI design rules and routing techniques	3	3	3	3	3				2	1	2	1		3
CO-2	To use the simulation techniques at various levels in VLSI design flow	3	3	3	3	2	2			2		2	1	2	
CO-3	To understand the concepts of various algorithms used for floor planning and routing techniques	3	2	3	2	3				2		2	3	2	
CO-4	To understand the techniques of modelling	3	3	2	2						1	2	2	2	
CO-5	To understand the concept of the modelling and synthesis	3	2	2	2	3				2	2	3	2	2	

520205	SYSTEM DESIGN USING FPGA	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To introducestudy the basics of FPGA and PLDs.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Demonstrate the VLSI Cad tool to design CMOS VLSI analog circuits
- Design, implement and analyse various Analog mixed mode circuits
- Perform DRC, LVS for the designed circuits.
- Carry out the mini project on the design of a CMOS subsystem
- Design and analyse the FPGAs, Complex programmable logics.

UNIT I INTRODUCTION **9**

VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

UNIT II DESIGNING WITH PROGRAMMABLE LOGIC DEVICES **9**

Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

UNIT III DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS **9**

Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

UNIT IV DIGITAL DESIGN WITH SM CHARTS **9**

State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

UNIT V DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC **9**

Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. FPGA-Based System Design Wayne Wolf, Verlag: Prentice Hall,2006.
2. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall, 2007.
3. Kevin Skahil, VHDL for programmable logic, Addison Wesley,2008.

4. ZainalabedinNavabi, VHDL, analysis and modeling of digital systems, McGraw-Hill, 2005.
5. Mark Zwolinski, Digital System Design Using VHDL, 2nd Edition, Prentice Hall, 2009 ISBN: ISBN 0-13-039985-X

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Demonstrate the VLSI Cad tool to design CMOS VLSI analog circuits	3	3	3	3	3				2	2	1	2		2
CO-2	Design, implement and analyse various Analog mixed mode circuits	3	3	2	2	2				2		2	1	2	
CO-3	Perform DRC, LVS for the designed circuits	3	2	3	2	3				2	1	3	2	2	
CO-4	Carry out the mini project on the design of a CMOS subsystem	3	2	2	2	3				2	1	2	1		2
CO-5	Design and analyse the FPGAs, Complex programmable logics	3	2	3	2	3				2	2	2	2		2

520206	ANALOG & MIXED MODE VLSI DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To introduceand study the concept of analog and mixed mode VLSI circuits.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand about the concepts of MOS large signal model and small signal model
- To understand the concepts of D/A conversion methods and their architectures.
- To design filters for ADC.
- To understand about the switched capacitor circuits
- To analysis the CMOS Circuit design

UNIT I DATA CONVERTER FUNDAMENTAL 7

Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

UNIT II DATA CONVERTERS ARCHITECTURES 12

DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

UNIT III NON-LINEAR ANALOG CIRCUITS 8

Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Stimulation), Level Shifting (Excluding Input Level Shifting For Multiplier).

UNIT IV DATA CONVERTER SNR 7

Improving SNR Using Averaging (Excluding Jitter & Averaging onwards), Decimating Filters for ADCs (Excluding Decimating without Averaging onwards), Interpolating Filters for DAC, Band pass and High pass Sync filters.

UNIT V MICRONS CMOS CIRCUIT DESIGN 10

Process Flow, Capacitors and Resistors, MOSFET Switch (upto Bidirectional Switches), Delay and adder Elements, Analog Circuits MOSFET Biasing (upto MOSFET Transition Frequency).

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. CMOS Analog Circuit Design, P e Allen and D R Holberg, Second Edition, Oxford University Press, 2008.
2. CMOS- Mixed Signal Circuit Design ,R. Jacaob Baker, (Volll of CMOS: Circuit Design, Layout and Stimulation), IEEE Press and Wiley Interscience, 2009.
3. Design, Layout, Stimulation ,R. Jacaob Baker, Harry W Li, David E Boyce, CMOS Circuit, PHI Edn, 2005.

4. Design of Analog CMOS Integrated Circuits, B Razavi, First Edition, McGraw Hill, 2009.
5. JeyaGowri Analog and Mixed Mode Design- Sapna publishing House 2011.

COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To understand about the concepts of MOS large signal model and small signal model	3	3	3	2	2						2	3		3
CO-2	To understand the concepts of D/A conversion methods and their architectures	3	2	2	2	2						2	2		2
CO-3	To design filters for ADC	3	2	2	3	2						1	3		2
CO-4	To understand about the switched capacitor circuits	3	2	2	2	2						2	3	1	2
CO-5	To analysis the CMOS Circuit design	3	2	3	2	2						2	1		2

520207	SYSTEM ON CHIP DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the concepts of System on Chip Design methodology for Logic and Analog Cores.
- To understand the concepts of System on Chip Design Validation.
- To understand the concepts of SOC Testing.

COURSE OUTCOMES:

- Able to understand about SoC Design Methodology.
- Ability to understand the design of different embedded memories.
- Able to understand the simulation models and design methodology.
- Able to understand the concept of SoC Design Validation
- To analysis about the Testing Concepts of system on chip.

UNIT I INTRODUCTION **9**

System tradeoffs and evolution of ASIC Technology- System on chip concepts and methodology – SoC design issues -SoC challenges and components

UNIT II DESIGN METHODOLOGICAL FOR LOGIC CORES **9**

SoC Design Flow – On-chip buses –Design process for hard cores –Soft and firm cores –Designing with hard cores, soft cores- Core and SoC design examples

UNIT III DESIGN METHODOLOGY FOR MEMORY AND ANALOG CORES **9**

Embedded memories –Simulation modes Specification of analog circuits – A to D converter –Phase located loops –High I/O.

UNIT IV DESIGN VALIDATION **9**

Core level validation –Test benches –SoC design validation – Co simulation –hardware/ Software coverification. Case Study: Validation and test of systems on chip

UNIT V SOC TESTING **9**

SoC Test Issues – Testing of digital logic cores –Cores with boundary scan –Test methodology for design reuse– Testing of microprocessor cores – Built in self method –testing of embedded

memories. Case Study: Integrating BIST techniques for on-line SoC testing. Designing BIST techniques for SOC testing- soft core models for different logic circuits

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. M.Keating, D.Flynn, R.Aitken, A, GibbonsShi, Low Power Methodology Manual for Systemon-ChipDesign Series: Integrated Circuits and Systems, Springer, 2007.
2. Prakash Raslinkar, Peter Paterson &Leena Singh, System-on-a-chip verification: Methodology and Techniques, Kluwer Academic Publishers, 2000
3. RochitRajsunah, System-on-a-chip: Design and Test, Artech House, 2007.

COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	Able to understand about SoC Design Methodology	3	3	3	2	2				2		2	3	3	
CO-2	Ability to understand the design of different embedded memories	3	2	1	2		2						2	2	
CO-3	Able to understand the simulation models and design methodology	3	3	2	3	1				2			1	2	
CO-4	Able to understand the concept of SoC Design Validation	2		1		2				2		2	2	2	1
CO-5	To analysis about the Testing Concepts of system on chip	2	3	2	3							2	2		2

ELECTIVE-II

520208 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVE:

To introducestudy various types of DSP processors, codes and optimization.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Illustrate the architecture of 2100 family of processors and floating point & fixed point representation.
- Construct FFT algorithms, FIR filters and IIR filters using ADSP.
- Analyse the architecture of TMS320C54X, C55X and C6X processors.
- Make use of software tools - EVM and code composer studio to develop DSP algorithms.
- Analyse about frame processing and scheduling techniques.

UNIT I ADSP 21XX ARCHITECTURE AND PROGRAMMING 9

Overview of finite word length effects – Quantization- Truncation and Rounding errors -Introduction to ADSP- 2100 family of processors - Assembly language overview - Development systems - Single precision fixed point division - Multiprecision fixed point addition - subtraction - multiplication and division - Fixed point to floating point conversion and vice versa - Floating point addition - subtraction - multiplication and division.

UNIT II FFT AND FILTER IMPLEMENTATION USING ADSP 21XX 9

Implementation of FFT: Radix- 2 fast Fourier transforms - Block floating point scaling - Optimized radix- 2 DIT FFT-Leakage- Implementation of digital filters: single and double precision FIR FiltersIIR Filters - Multirate filters.

UNIT III TMS320C6X ARCHITECTURE 9 9

Architecture of DSP chip TMS320C54x and TMS320C55x, TMS320C6X DSP chip CPU Operation - Pipelined CPU- VelociTI - C64x DSP- Software tools: EVM - DSK Target C6x board

Assembly file - Memory management- Compiler utility- Code initialization - Code composer studio - Interrupt data processing.

UNIT IV CODE OPTIMIZATION 9

Word-wide optimization - Mixing C and assembly- software pipelining - C64x improvements - Real time filtering – Circular buffering- Adaptive filtering.

UNIT V FRAME PROCESSING, REAL TIME ANALYSIS AND SCHEDULING 9

Frame processing: DMA DSP Host Communication- DFT and FFT Implementation- Real time FFT - Real time analysis-Real time scheduling - real time data exchange - DSP / BIOS - Data synchronization and communication

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, 4th Edition, 2011.
2. Digital Signal Processing Applications using the ADSP – 2100 Family", Volume 1 Analog devices, DSP Division Prentice Hall, 1992.
3. Nasser Kehtarnavaz and Mansour Keramat, "DSP System design using the TMS320C600", Prentice hall, 2010.
4. Sophocles J.Orfanidis,"Introduction to Signal Processing", Prentice Hall, 2010.
5. Sen M.Kuo ,BobH.Lee, "Real – Time Digital Signal Processing- Implementations, Applications and Experiments with the TMS320C55x" , Third Edition,John Wiley and Sons, 2013.
6. Venkataramani.B and Bhaskar.M "Digital Signal Processors-Architecture, Programming and Applications" TMH, second edition, 2008.

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO-1	Illustrate the architecture of 2100 family of	3	3	2	2	2							2	2	2

	processors and floating point & fixed point representation														
CO-2	Construct FFT algorithms, FIR filters and IIR filters using ADSP	3	3	2	2	2				2		2	2	3	2
CO-3	Analyse the architecture of TMS320C54X, C55X and C6X processors	3	3	2	2	2							2	2	2
CO-4	Make use of software tools - EVM and code composer studio to develop DSP algorithms	3	3	2	1	2	3			2			2	2	2
CO-5	Analyse about frame processing and scheduling techniques	3	3	2	1	2	2			2		3	3	2	2

520209	DSP INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

To learn how DSP applications are implemented using VLSI Technology, and understand various VLSI fabrication techniques and trends in CMOS technology

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Understanding of discrete-time transforms.
- The ability to design FIR and IIR filters.
- Knowledge of spectral estimation and linear prediction.
- The ability to apply above knowledge and skills to engineering problems
- To analysis about the function of arithmetic units and integrated circuit design.

UNIT I DSP INTEGRATED CIRCUITS AND VLSI CIRCUIT TECHNOLOGIES 9

Standard digital signal processors-Application specific IC‘s for DSP - DSP systems - DSP system design - Integrated circuit design - MOS transistors - MOS logic - VLSI process technologies -Trends in CMOS technologies

UNIT II DIGITAL SIGNAL PROCESSING 9

Digital signal processing - Sampling of analog signals - Selection of sample frequency – Signal -processing systems - Frequency response - Transfer functions - Signal flow graphs – Filter structures - Adaptive DSP algorithms - DFT - The Discrete Fourier Transform - FFT - The Fast Fourier Transform Algorithm - Image coding - Discrete cosine transforms

UNIT III DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS 9

FIR filters - FIR filter structures - FIR chips - IIR filters - Specifications of IIR filters – Mapping of analog transfer functions - Mapping of analog filter structures - Finite word length effects - Parasitic oscillations - Scaling of signal levels - Round-off noise - Measuring round-off noise -Coefficient sensitivity - Sensitivity and noise.

UNIT IV DSP ARCHITECTURES AND SYNTHESIS OF DSP ARCHITECTURES 9

DSP system architectures - Standard DSP architecture - Ideal DSP architectures – Multiprocessorsand multi computers - Systolic and Wave front arrays - Shared memory architectures – Mappingof DSP algorithms onto hardware - Implementation based on complex PEs - Shared memoryarchitecture with Bit-serial PEs.

UNIT V ARITHMETIC UNITS AND INTEGRATED CIRCUIT DESIGN 9

Conventional number system - Redundant Number system - Residue Number System – Bit parallel and Bit-Serial arithmetic - Basic shift accumulator - Reducing the memory size - Complex multipliers - Improved shift – accumulator - Layout of VLSI circuits - FFT processor -DCT processor and Interpolator as case studies.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. A.V. Oppenheim, R.W.Schafer and J.R.Buck, Discrete-time Signal Processing, Prentice Hall, 2009
2. Barrett Hazeltine, Christopher Bull, "Appropriate technology" Academic Press, 2009.
3. Emmanuel C. I feachor and Barrie W.Jervis, Digital Signal Processing–A Practical Approach, Pearson Education, 2001.
4. Lars Wan hammer, DSP Integrated Circuits, Academic Press, 3RD edition, 2009.
5. Keshab K. Parhi, VLSI Digital Signal Processing Systems Design and Implementation, John Wiley & Sons, 2008.

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	Understanding of discrete-time transforms	3	3	2	2	2							2	2	2
CO-2	The ability to design FIR and IIR filters	3	3	2	2	2				2		2	2	3	2
CO-3	Knowledge of spectral	3	3	2	2	2							2	2	2

	estimation and linear prediction														
CO-4	The ability to apply above knowledge and skills to engineering problems	3	3	2	1	2	3			2			2	2	2
CO-5	To analysis about the function of arithmetic units and integrated circuit design	3	3	2	1	2	2			2		3	3	2	2

520210 WAVELET TRANSFORMS AND APPLICATIONS L T P C

3 0 0 3

COURSE OBJECTIVE:

To introduce fundamentals of Fourier and gain knowledge about MRA and its representation using wavelet transforms. To study the fundamentals of vector and signal spaces

- To explore the concepts of multi resolution analysis of signals

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the basics of signal representation and Fourier theory
- Recognize Multi Resolution Analysis and Wavelet concepts
- To understand about the discrete wavelet transform and various filters algorithms.
- Understand the design of wavelets using Lifting scheme
- Realize the applications of Wavelet transform

UNIT I INTRODUCTION

9

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality -relationship between vectors and signals - Signal spaces - concept of Convergence - Hilbert spaces forenergy signals - Generalized Fourier Expansion.

UNIT II MULTI RESOLUTION ANALYSIS 9

Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General Orthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

UNIT III CONTINUOUS WAVELET TRANSFORMS 9

Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Pyramid and Cascade Algorithms ,DaubechiesCoiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM AND FILTER BANK ALGORITHMS 9

Decimation and interpolation – Signal representation in the approximation subspace– Wavelet decomposition algorithm – Reconstruction algorithm – Change of bases – Two channel perfect reconstruction filter bank –Polyphase representation for filter banks.

UNIT V APPLICATIONS 9

Wavelet packets – Wavelet packet algorithms – Thresholding – Two dimensional wavelets and wavelet packets– Wavelet and wavelet packet algorithms for two dimensional signals – image compression – image coding,wavelet tree coder, EZW code, EZW example.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Rao R M and A S Bopardikar, —"Wavelet Transforms Introduction to theory and Applications", Pearson Education, Asia, 4th Edition, 2009.
2. L.Prasad&S.S.Iyengar, "Wavelet Analysis with Applications to Image Processing", CRC Press, 2008.
3. J. C. Goswami and A. K. Chan, "Fundamentals of wavelets: Theory, Algorithms and Applications" WileyIntersciencePublication,John Wiley & Sons Inc., 2007.
4. Stephen G. Mallat, "A wavelet tour of signal processing" 2 nd Edition Academic Press, 2006.
5. Soman K P and Ramachandran K I, —Insight into Wavelets From Theory to practice, Prentice Hall, 2009.

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COURSE OUTCOMES		PROGRAMS OUTCOMES	PROGRAM SPECIFIC OUTCOMES

CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To understand the basics of signal representation and Fourier theory	3	3	2	2								2	2	2
CO-2	Recognize Multi Resolution Analysis and Wavelet concepts	3	2	2	2	2	1						2	2	2
CO-3	To understand about the discrete wavelet transform and various filters algorithms	3	2	2	2	2	2						2	2	
CO-4	Understand the design of wavelets using Lifting scheme	3	2	2	2	2							2	2	2
CO-5	Realize the applications of Wavelet transform	2	2	2	2	2	1						2	2	2

520202 SPEECH AND AUDIO SIGNAL PROCESSING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To introduce the basic concepts and methodologies for analysis, modelling, synthesis and coding of speech and music and to provide a foundation for developing applications and for further study in the field of digital audio standards and its techniques

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Describe concepts of speech signal processing
- Analyse the speech production and perception model
- Explain the speech parameters for speech processing
- Explain analysis by synthesis speech coding
- Explain the speech detection, speech recognition and synthesis

UNIT I MECHANICS OF SPEECH 9

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speechproduction – Representation of Speech signals – Classification of Speech sounds – Phones –Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Music production – Auditoryperception – Anatomical pathways from the ear to the perception of sound – Peripheral auditorysystem – Psycho acoustics.

UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING 9

Time domain parameters of Speech signal – Methods for extracting the parameters Energy-AverageMagnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time AutoCorrelation Function – Pitch period estimation using Auto Correlation Function.

UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9

Short Time Fourier analysis – Filter bank analysis – Formant extraction – Pitch Extraction – Analysisby Synthesis-Analysis synthesis systems- Phase vocoder—Channel vocoder. Homomorphic speechanalysis: Cepstral analysis of Speech – Formant and Pitch Estimation Speech enhancement techniques in time domain

UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH 9

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

UNIT V APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING 9

Algorithms: Spectral Estimation, dynamic time warping – Hidden Markov model – Music analysis –Pitch Detection– Feature analysis for recognition – Music synthesis – Automatic Speech Recognition– ASR systems – Speaker identification and verification –Speech Synthesis: Text to speech - voice over IP-Enhancement of speech using spectral subtraction,wiener filter- Voice activity detection for speech coding-simulation of audio coding techniques – Pitchdetection using LPC.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Andreas Spanias, Ted Painter, Venkatraman Atti, " Audio Signal Processing and Coding" wiley publications, 3rd edition, 2010.
2. Ben Gold, Nelson Morgan, Dan Ellis - Speech, and Audio Signal Processing: Processing and Perception of Speech and Music - Wiley, India – 2011(2nd Edition)
3. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons Inc., 2004.

4. Paul Hill, "Audio and Speech Processing with MATLAB" CRC Press, 3rd edition, 2010.

5. Vijay Madisetti – The Digital Signal Processing Handbook: Video, Speech, and Audio Signal Processing and Associated Standards - CRC Press, U.K./India – 2009(2nd Edition)

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Describe concepts of speech signal processing	3	2	2	2	1							2	3	
CO-2	Analyse the speech production and perception model	3	2	2	2								2	3	
CO-3	Explain the speech parameters for speech processing	3	3	2	2	2							2	2	
CO-4	Explain analysis by synthesis speech coding	3	3	2	2	2							2	2	
CO-5	Explain the speech detection, speech recognition and synthesis	3	2	3	2	2							2	3	

520211	SENSORS AND SIGNAL CONDITIONING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To introducestudy various types of sensors,basic measurement systems and its components and applications.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand about static and dynamic characteristic of systems.
- To analysis the various measurement devices.
- To understand about application of the sensor devices.
- Evaluate digital sensors and semiconductor device sensors
- Discuss Self-generating sensors

UNIT I INTRODUCTION TO MEASUREMENT SYSTEMS 9

Introduction to measurement systems: general concepts and terminology, measurement systems, sensor classification, general input-output configuration, methods of correction performance characteristics: static characteristics of measurement systems, accuracy, precision, sensitivity, other characteristics: linearity, resolution, systematic errors , random errors, dynamic characteristics of measurement systems: zero-order, first-order, and second-order measurement systems and response

UNIT II RESISTIVE AND REACTIVE SENSORS 9

Resistive sensors: potentiometers, strain gages, resistive temperature detectors, magneto resistors, light-dependent resistors, Signal conditioning for resistive sensors: Wheatstone bridge, sensor bridge calibration and compensation, Instrumentation amplifiers, sources of interference and interference reduction, Reactance variation and electromagnetic sensors, capacitive sensors, differential, inductive sensors, linear variable differential transformers (LVDT), magneto elastic sensors, hall effect sensors, Signal conditioning for reactance-based sensors & application to the LVDT.

UNIT III DIGITAL SENSORS AND SEMICONDUCTOR DEVICE SENSORS 9

Digital sensors: position encoders, variable frequency sensors – quartz digital thermometer, vibrating wire strain gages, vibrating cylinder sensors, saw sensors, digital flow meters, Sensors based on semiconductor junctions: thermometers based on semiconductor junctions, magneto diodes and magneto transistors, photodiodes and phototransistors, sensors based on MOSFET transistors, CCD imaging sensors , ultrasonic sensors, fiber-optic sensors.

UNIT IV SELF-GENERATING SENSORS 9

Self-generating sensors: thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors , electrochemical sensors, Signal conditioning for self-generating sensors: chopper and low-drift amplifiers, offset and drifts amplifiers , electrometer amplifiers, charge amplifiers, noise in amplifiers

UNIT V SENSORS- THEIR APPLICATIONS 9

Smart sensors- primary sensors-excitation-amplification-filters-converters-compensation-data communication, On-board Automobile sensors-Flow rate sensors- Pressure sensors-temperature sensors-oxygen sensors, Home appliance sensors, Aerospace sensors- Sensors for environmental pollution.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Andrzej M. Pawlak Sensors and Actuators in Mechatronics Design and Applications, 2006.
2. D. Johnson, “Process Control Instrumentation Technology”, John Wiley and Sons. 2010
3. E.O. Doeblin, “Measurement System : Applications and Design”, McGraw Hill publications,2009
4. Ian Sinclair, Sensors and Transducers, Elsevier, 3rd Edition, 2011.

5. Kevin James, PC Interfacing and Data acquisition, Elsevier, 2011.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO-1	To understand about static and dynamic characteristic of systems	3	2	2	2		2			2	2	2	2	2	
CO-2	To analysis the various measurement devices	3	2	2	2					2	2		2	2	
CO-3	To understand about application of the sensor devices	3	2	2	2						2		2		2
CO-4	Evaluate digital sensors and semiconductor device sensors	3	2	2	2	3				2	2			2	2
CO-5	Discuss Self-generating sensors	3	2	1	2	2					3	2	2	2	2

520212	NEURAL NETWORK & THEIR APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To study about fundamentals of Neural network & applications.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the various techniques like neural networks, genetic algorithms and fuzzy systems.

- Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc.
- Basic neural network models&Basic learning algorithms: the delta learning rule, the back propagation algorithm, self-organization learning, the r4-rule, etc.

- Applications: pattern recognition, function approximation, information visualization, etc.
- To apply soft computing techniques to solve problems

UNIT I INTRODUCTION 9

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm- Classification of ANNs-Neural Network Representation – Problems – Perceptrons.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models

UNIT III FUZZY SYSTEMS 9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS 9

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS 9

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.
2. James A. Freeman and David M. Skapura, —Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
3. Jacek M. Zurada, Introduction to Artificial Neural Systems, PWS Publishing Company, 2007
4. S.Rajasekaran, G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017

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Electronics and Communication Engineering

COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To understand the various techniques like neural networks, genetic algorithms and fuzzy systems	3	2	2				2			2		2	2	2
CO-2	Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc	3	2	2		2					2	2	2	2	
CO-3	Basic neural network models&Basic learning algorithms: the delta learning rule, the back propagation algorithm, self-organization learning, the r4-rule, etc	3	2	2	2			2			2		2	2	2
CO-4	Applications: pattern recognition, function approximation, information visualization, etc	3	2	2	2			2				2	2		2

CO-5	To apply soft computing techniques to solve problems	3	3	2	2			1			2	2	2		2

ELECTIVE-III

520213	**ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEMDESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

The aim of this course is to familiarize the student with the EMI/EMC concepts , principles, techniques and measurement standards.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To Understand the basics of EMI
- To analysis the EMI Sources
- To Recognize EMI problems
- To Understand Solution methods in PCB
- Be aware of Measurement technique for emission and immunity

UNIT I EMI/EMC CONCEPTS 9

EMI-EMC definitions and Units of parameters; Electromagnetic environment, Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards, EMC design components

UNIT II EMI COUPLING PRINCIPLES 9

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling ; Differential mode coupling ; Near field cable to cable coupling,cross talk ; Field to cable coupling ; Power mains and Power supply coupling, EMI as combination of radiation and conduction.

UNIT III EMI CONTROL TECHNIQUES 9

Shielding- Shielding Material-Shielding integrity at discontinuities, Filtering- Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter, Power line filter design, Filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding, Bonding, Isolation transformer.

UNIT IV EMC DESIGN OF PCBS 9

EMI Suppression Cables-Absorptive, ribbon cables-Devices-Transient protection hybrid circuits, Component selection and mounting; PCB trace impedance; Routing; Cross talk control-Electromagnetic Pulse-Noise from relays and switches, Power distribution decoupling; Zoning; Grounding; Terminations.

UNIT V EMI/EMC STANDARDS AND MEASUREMENTS 9

Civilian standards - FCC, CISPR, IEC, EN, Military standards - MIL STD 461D/462,Frequency assignment - spectrum conversation, British VDE standards, EMI Shielded Chamber, Open area test sides: OATS measurements, measurement precautions, TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Donald R. J. White, William G. Duff, "A Handbook Series on Electromagnetic Interference and Compatibility: EMI prediction and analysis" Don White Consultants, 4th edition, 2013.
2. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons NewYork. 2011 (Unit - I, II, III)

3. Kodali. V.P, "Engineering EMC Principles, Measurements and Technologies", Wiley-IEEE Press, 2001.

4. V.P.Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, New york, 2001.

5. Paul.C.R , “Introduction to Electromagnetic Compatibility” , John Wiley and Sons,Inc, 2006 (Unit - IV, V)

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO’s	**Statement’s**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To Understand the basics of EMI	3	2		2		1						2	2	2
CO-2	To analysis the EMI Sources	3	2	2		2	1						2	2	2
CO-3	To Recognize EMI problems	3	2	2		1							2	2	2
CO-4	To Understand Solution methods in PCB	3	2	2		2							3	2	
CO-5	Be aware of Measurement technique for emission and immunity	2	3	3		2					2		2		2

520214 **HIGH PERFORMANCE COMMUNICATION NETWORKS** **L T P C**

3 0 0 3

COURSE OBJECTIVE:

To introduce the basic networking concepts and its application along with get awareness about network security.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Realize principles of high speed communication networking.
- Analyze the performance of various networks, and to sharpen one‘s conceptual and intuitive understanding of the field.
- Evaluate the architectures of ISDN, Frame Relay, and ATM.
- Compare the various methods of providing connection -oriented services.
- Create Skills in a balance between the description of existing networks and tools.

UNIT I INTRODUCTION 9

Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing. SONET – DWDM – DSL – ISDN – BISDN, ATM.

UNIT II MULTIMEDIA NETWORKING APPLICATIONS 9

Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP- differentiated services.

UNIT III ADVANCED NETWORKS CONCEPTS 9

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPL Soperation, Routing, Tunneling and use of FEC, Traffic Engineering and MPLS based VPN, overlay networks-P2P connections.

UNIT IV TRAFFIC MODELLING 9

Little’s theorem, Need for modeling, Poisson modeling and its failure, Non- Poisson models, Network performance evaluation, Assignment using relevant software systems.

UNIT V NETWORK SECURITY AND MANAGEMENT 9

Principles of cryptography – Authentication – integrity – key distribution and certification – Access control and: fire walls – attacks and counter measures – security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Aunurag Kumar, D. MAnjunath, Joy kuri, “Communication Networking”, Morgan Kaufmann Publishers, 1st edition 2004.

2. J.F. Kurose & K.W. Ross, “Computer Networking- A top down approach featuring the Internet”, Pearson, 5th edition, 2008.

3. LEOM-GarCIA, WIDJAJA, “Communication networks”, TMH seventh reprint 2002.

4. Walrand .J. Varatya, High performance communication network, Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.

5. William Stallings, ISDN and Broadband ISDN with Frame Relay and ATM‖, 6th edition, Pearsoneducation Asia, 2010.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Realize principles of high speed communication networking	3	2	3	2	2							3		3
CO-2	Analyze the performance of various networks, and to sharpen one's conceptual and intuitive understanding of the field	3	2	3	3	3							2		3
CO-3	Evaluate the architectures of ISDN, Frame Relay, and ATM	3	2	2	2	2							1		3
CO-4	Compare the various methods of providing connection -oriented services	2	3	2	3	3							3		2
CO-5	Create Skills in a balance between the description of existing networks and tools	2	2	3	3	3							3		1

520215	MEMS AND NEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To educate the students about the MEMS and NEMS systems..

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To familiarize the concepts of microelectromechanical devices.
- To know the fabrication process of Microsystems.
- To know the design concepts of micro sensors and micro actuators.
- To familiarize concepts of quantum mechanics and Nano systems.
- To know the design concept of actuators and memory elements of Nano system

UNIT I OVERVIEW AND INTRODUCTION 9

New trends in Engineering and Science: Micro and Nano scale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Micro electromechanical Systems, Applications of Micro and Nano electromechanical systems, Micro electromechanical systems, devices and structures , MEMS materials, Micro fabrication

UNIT II MEMS FABRICATION TECHNOLOGIES 9

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT III MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, electro static sensors, thermal resistive sensor, thermal bimorph sensor, properties of piezoelectric Materials, Piezo electric Pressure sensors-. Case study: Piezo-resistive pressure sensor,

UNIT IV MICRO ACTUATORS 9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), cantilever piezo electric actuator model, Micromechanical Motors and pumps. Case study: Comb drive actuators, Magnetic actuation

UNIT V NANOSYSTEMS AND QUANTUM MECHANICS 9

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. M.H.Bao "Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes", Elsevier, Newyork, 2000.
2. P. RaiChoudry" MEMS and MOEMS Technology and Applications", PHI, 2012.
3. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002
4. Stephen D. Senturia," Micro system Design", Kluwer Academic Publishers, 2001.
5. Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" ,Tata Mcraw Hill, 2002.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO-1	To familiarize the concepts of microelectromechanical devices	3	3	3	3	1							2		3
CO-2	To know the fabrication process of Microsystems	3	3	3	2	1							2	1	1
CO-3	To know the design concepts of micro sensors and micro actuators	3	3	3	3	2	2						2		2
CO-4	To familiarize concepts of quantum mechanics and Nano systems	3	3	2	3	2	2						2	1	1

CO-5	To know the design concept of actuators and memory elements of Nano system	3	3	3	2	2	2						2	2	2

520216 CRYPTOGRAPHY AND NETWORK SECURITY L T P C

3 0 0 3

COURSE OBJECTIVE

To obtain comprehensive knowledge in cryptography and network security

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- Analyze the basic concepts of network protocols.
- Examine the process of cryptographic algorithms.
- Elaborate various public key encryption.
- Demonstrate the basic working principles of digital signature.
- Express various data security techniques

UNIT I INTRODUCTION TO SYMMETRIC-KEY ENCIPHERMENT 9

Security Goals, Cryptographic Attacks, Services and mechanism, Techniques. Traditional Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers. Mathematics of Cryptography: Integer arithmetic, Modular arithmetic, Matrices, Linear Congruence. SLE: Stream and Block Ciphers.

UNIT II MATHEMATICS OF SYMMETRIC-KEY CRYPTOGRAPHY 9

Algebraic Structures, Introduction to Modern Symmetric-Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers. Data Encryption Standard (DES): Introduction, DES Structure (overview only), Security of DES. SLE: Multiple DES-Conventional Encryption Algorithms.

UNIT III ADVANCED ENCRYPTION STANDARD (AES): 9

Introduction, Transformations, Key expansion, The AES Ciphers, Examples, Analysis of AES. Encipherment Using Modern Symmetric-Key Ciphers: Use of Modern Block Ciphers (overview only). SLE: Use of Stream Ciphers (overview only)

UNIT IV ASYMMETRIC-KEY CRYPTOGRAPHY 9

RSA Cryptosystems, Elliptic curve crypto systems. SLE: ElGamal Cryptosystem.

UNIT V MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION 9

Message Integrity, Random Oracle Model, Message Authentication. Digital Signature: Comparison, Process, Services, Attacks of Digital Signature, Digital Signature Schemes. SLE: Variations and Applications. Entity Authentication: Introduction, Passwords, Challenge

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Bruce Scheneier, "Applied Cryptography", 20th edition, John Wiley & Sons, 2017.
2. BehrouzA.Forouzan, "Cryptography and Network Security", Special Edition, Tata McGraw Hill, 2007.
3. Charlie Kaufmann, Radia Perlman, Mike Speciner, "Network Security", Second Edition, Prentice Hall, 2008.
4. PRAKASH C. GUPTA, "CRYPTOGRAPHY AND NETWORK SECURITY" PHP Publications, 4th edition, 2014.
5. William Stallings. "Cryptography and Network" Security Principles and Practices, Fourth Edition. By Publisher: Prentice Hall. Pub Date: November 16, 2005.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Analyze the basic concepts of network protocols	3	3	2	1								3	3	
CO-2	Examine the process of cryptographic algorithms	3	3	3	2	2							2	3	2
CO-3	Elaborate various public key encryption	3	3	2	2		3			2			2	3	3

CO-4	Demonstrate the basic working principles of digital signature	3	2	3	2	3				2			2	2	2
CO-5	Express various data security techniques	3	3	2	3	2	2		2	2		2	2	2	

520217 MULTIMEDIA COMPRESSION TECHNIQUES L T P C

3 0 0 3

COURSE OBJECTIVE:

To introduce the concepts for realizing compression in text, audio, image and video.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To Complete Understanding Of Error–Control Coding.
- To Understand Encoding and Decoding Of Digital Data Streams.
- To Introduce Methods for The Generation Of These Codes And Their Decoding Techniques.
- To understand the Detailed Knowledge Of Compression And Decompression Techniques.
- To Introduce the Concepts Of Multimedia Communication.

UNIT I INTRODUCTION 9

Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Text, Images, Graphis, Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression – Lossy& Lossless compression techniques – Overview of source coding, Information theory &source models

UNIT II TEXT COMPRESSION 9

Compression techniques – Huffman coding – Adaptive Huffman Coding – Arithmetic coding – Shannon-Fanon coding – Dictionary techniques –LZ77,LZ78, LZW family algorithms.

UNIT III AUDIO COMPRESSION 9

Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – ADPCM-LPC-CELP -Application to speech coding – G.722 – Application to audio coding– MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques

UNIT IV IMAGE COMPRESSION 9

Predictive techniques – DM, PCM, and DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000standards - JBIG, JBIG2 standards- Runlength coding

UNIT V VIDEO COMPRESSION 9

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – DVI real time compression – Packet Video,Video Compression Algorithm Based on Frame Difference Approaches.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Fred Halshall "Multimedia Communication – Applications, Networks, Protocols And Standards", Pearson Education, 2007.
2. Khalid Sayood: Introduction to Data Compression, Morgan Kauffman Harcourt India, 3rd Edition, 2012.(Unit-I,II,III)
3. Mark S.Drew, Ze-NianLi : "Fundamentals of Multimedia", PHI, 3rd Edition, 2009.
4. Watkinson,J : "Compression in Video and Audio", Focal press,London.2006.
5. YunQ.Shi, Huifang Sun : "Image and Video Compression for Multimedia Engineering –Fundamentals, Algorithms & Standards, CRC press, 2003.(Unit-,IV,V)

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To Complete Understanding Of Error–Control Coding	3					3		3		2		2	2	

CO-2	To Understand Encoding and Decoding Of Digital Data Streams	3	2	2		2	2		2					3	
CO-3	To Introduce Methods for The Generation Of These Codes And Their Decoding Techniques	3	2	2									2	2	
CO-4	To understand the Detailed Knowledge Of Compression And Decompression Techniques	3	2	2							2		2	2	
CO-5	To Introduce the Concepts Of Multimedia Communication	2	2				1			2		2		2	

520218 **APPLICATION OF MEMS** **L T P C**

3 0 0 3

COURSE OBJECTIVE:

To introduce the concepts of micro electro mechanical devices and to know the fabrication process of Microsystems.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To Understanding the concepts of MEMS
- Design of different type of micro sensors
- Understanding the concepts of MEMS transducers
- To study about the MEMS and thermal transducers
- Design a different type of sensors and MEMS sensors

UNIT I INTRODUCTION TO MEMS **9**

MEMS, Use of MEMS, Fabrication process. The Substrate and adding material to it: Introduction, The silicon substrate, Additive technique Oxidation, Additive technique-Physical vapor deposition, other additive techniques.

UNIT II MEMS FABRICATION TECHNOLOGIES 9

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect- Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials

UNIT III MEMS TRANSDUCERS-I 9

Modelling: Units, The input-output concept, Physical variables and notation, Preface to the modeling chapters. MEMS Transducers: An overview-Transducer, Distinguishing between sensors and actuators, Response characteristics of transducers, MEMS Sensors- Principles of operation, MEMS Actuators Principles of operation, Signal conditioning, RF applications and Optical applications. Piezoresistive Transducers: Introduction, Modeling Piezoresistive transducers, Piezoresistive pressure sensor.

UNIT IV MEMS TRANSDUCERS – II 9

Capacitive Transducers: Introduction, Capacitor fundamentals, Modeling a capacitor sensor, Capacitive accelerometer,Thermal Transducers: Introduction, Basic heat transfer, Hot-arm actuator.

UNIT V MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Adams, Thomas M., Layton, Richard A., "Introductory MEMS Fabrication and Applications", Springer.2010
2. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006.
3. Mohamed Gad-el-Hak, "MEMS-Applications", CRC Press, 29-Nov-2005.
4. Michael Kraft, Neil M White, "Mems for Automotive and Aerospace Applications" , WP Publication 4th edition, 2013.
5. Tai-Ran Hsu, "MEMS and Microsystems- Design and Manufacture", McGraw-Hill, 2002.
6. Vikas Choudhary, Krzysztof Iniewski, "MEMS: Fundamental Technology and Applications" CRC Press, 4th edition, 2013.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To Understanding the concepts of MEMS	3	3	3	3	1							2		3
CO-2	Design of different type of micro sensors	3	3	3	2	1							2	1	1
CO-3	Understanding the concepts of MEMS transducers	3	3	3	3	2	2						2		2
CO-4	To study about the MEMS and thermal transducers	3	3	2	3	2	2						2	1	1
CO-5	Design a different type of sensors and MEMS sensors	3	3	3	2	2	2						2	2	2

ELECTIVE-IV

520219	NANO ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To understand the basic concepts, how transistor as NANO device, various forms of NANO Devices, NANO Sensors, properties of NANO electronics with its applications.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the NANO electronics fabrication methods.
- To analysis the NANO electronics measurement techniques.
- To design the logic devices of silicon FET, MOSFET and its applications.
- Simulate and design the NANO device
- To learn about the logic devices and its applications.

UNIT I INTRODUCTION TO NANOELECTRONICS 9

Definition of a nano system -Microelectronics towards biomolecule electronics-Particles and waves- Wave-particle duality-Wave mechanics- Schrödinger wave equation- Wave mechanics of particles: - Atoms andatomic orbitals- Materials for nanoelectronics- Semiconductors-Crystal lattices: Bonding in crystals- Electron energy bands- Semiconductor heterostructures.

UNIT II ELECTRONIC AND PHOTONIC MOLECULAR MATERIALS 9

Preparation – Electroluminescent Organic materials - Laser Diodes - Quantum well lasers:-Quantum cascade lasers- Cascade surface-emitting photonic crystal laser- Quantum dot lasers - Quantum wire lasers:- White LEDs - LEDs based on nanowires - LEDs based on nanotubes - LEDs based on nanorods - High Efficiency Materials for OLEDs- High Efficiency Materials for OLEDs - Quantum well infrared photo detectors.

UNIT III THERMAL SENSORS 9

Thermal energy sensors -temperature sensors, heat sensors - Electromagnetic sensors - electrical resistance sensors, electrical current sensors, electrical voltage sensors, electrical power sensors, magnetism sensors - Mechanical sensors - pressure sensors, gas and liquid flow sensors, position sensors - Chemical sensors - Optical and radiation sensors.

UNIT IV GAS SENSOR AND BIO SENSORS 9

measurement of gas sensing property, Discussion of sensors for various gases, Gas sensors based on semiconductor devices, Principles - DNA based biosensors – Protein based biosensors – materials for biosensor applications

UNIT V LOGIC DEVICES AND APPLICATIONS 9

Logic Devices-Silicon MOSFETs-Ferroelectric Field Effect Transistors-Quantum Transport Devices Based on Resonant Tunneling-Single-Electron Devices for Logic Applications-Superconductor Digital Electronics-Quantum Computing Using Superconductors-Carbon Nanotubes for Data Processing-Molecular Electronics

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. K.E. Drexler, “Nano systems”, Wiley, 2009
2. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, “Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications”, Cambridge University Press 2011
3. W. Ranier, “Nano Electronics and Information Technology”, John Wiley & Sons 2012
4. Wilson M., Kannangara K., Smith G., Simmons M., and Raguse B., “Nanotechnology:

basic science and emerging technologies”, Overseas Press, 2005.

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COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To understand the NANO electronics fabrication methods	3	2	1	1	2		2					2	2	2
CO-2	To analysis the NANO electronics measurement techniques	3	2	2	2			2				2	2		2
CO-3	To design the logic devices of silicon FET, MOSFET and its applications	3	3	2	2	2		2			2	2	2	2	
CO-4	Simulate and design the NANO device	3	2		2			2					2	2	
CO-5	To learn about the logic devices and its applications	3	2	2	2						2			2	2

520220 **PHOTONICS** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

To introduce the concepts of photonics and various wave generating components.

COURSE OUTCOMES::

Having successfully completed this course, the students should be able to:

- To understand the light and its propagation.
- To evaluate the different types of Interfaces.
- To understand about the function of various kind of networks for the data transmission
- To Learn about holography

- To determine the non-linear optic devices.

UNIT I NTRODUCTION TO PHOTONICS 9

Nature of Light – Wave and light terminology, Maxwell equation, light spectra and sources, absorption andemission, black body radiation.Dielectric Media, Constitutive Relations, Anisotropic Media. Geometric Optics – law of reflection includingplane mirrors, prisms and thin lenses includingLensmaker's equation, Lens problems and optical instruments using the thin lens equation.

UNIT II WAVE OPTICS 9

Wave descriptive terminology, wave superposition (interference) including double – slit interference, diffraction and diffraction gratings, interference applications, eg. Michelson, Mach Zender and Fabry Perot interferometers, Thin film interference and Fiber Bragg Gratings. Diffraction Effects including: airy disk, near far field effects. Polarization principles including scattering, reflection and birefringence.

UNIT III DATA TRANSMISSION INTERFACES AND DISPLAYS 9

Photonic Networks – Microwave Communication System – Liquid Crystal Displays – Organic Light emitting diodes.

UNIT IV HOLOGRAPHY 9

Holography – Theory and basic principles, Requirement to record and reconstruct holograms –Amplitude and phase holograms - Experimental techniques- Recording Materials-Reflection holography- HolographicInterferometry-Nondestructive testing, optical memory, Applications of holography.

UNIT V NON-LINEAR OPTICS 9

Non-linear optics – Harmonic Generation, sum and difference frequency generation, wave mixing,Optical Parametric Oscillator. Non-linear optic materials – inorganic and organic. Phase matching,efficiency of harmonic generation- powder and single crystal methods.Second-order nonlinear phenomena (electro- optic effect, second harmonic generation and frequency conversion), Third-order nonlinear phenomena (Z-scan and four-wave mixing), Phase conjugation Silicon Photonics-Silicon on Insulator Photonics-Fabrication of Silicon Waveguides"

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Bahaa E. A. Saleh, Malvin Carl Teich, "Fundamentals of Photonics", John Wiley & Sons 2011, 2nd Edition.
2. B. Balkrishna Laud, "Lasers and Non-Linear Optics", New Age International 2011
3. T.P. Pearsall, "Photonics Essentials: An introduction with experiments", McGraw Hill 2003

4. F.G. Smit and T.A. King, “Optics and Photonics: An introduction”, Wiley & Sons, Ltd 2003

5. R.S. Quimby, “Photonics and Lasers-An Introduction”, Wiley 2006

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO’s	**Statement’s**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To understand the light and its propagation	3	2	2	2	2				2	2		2	2	
CO-2	To evaluate the different types of Interfaces	3	2	2	2						2		2	2	
CO-3	To understand about the function of various kind of networks for the data transmission	3	3		2					2	2			2	
CO-4	To Learn about holography	3	2	2		2	2				1			2	
CO-5	To determine the non-linear optic devices	3	2		2		2				2		2	2	

520221 **DATA CONVERTERS** **L T P C**

3 0 0 3

COURSE OBJECTIVE:

- To explain the basic operational and design principles of CMOS Analog to Digital and Digital to Analog converter architectures.
- To introduce the design calculations for developing the various blocks associated with a typical CMOS AD or DA converter.
- To make students decide the dimensions and bias conditions of all the MOS transistors involved in the design.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

- To explain sample and hold circuits
- To design ADC/DAC circuits
- To analyze ADC/DAC Architecture and Performance
- To discuss calibration techniques
- To understand the precision techniques

UNIT I SAMPLE AND HOLD CIRCUITS 9

Sampling switches, Conventional open loop and closed loop sample and hold architecture, Open loop architecture with miller compensation, multiplexed input architectures, recycling architecture switched capacitor architecture.

UNIT II SWITCH CAPACITOR CIRCUITS AND COMPARATORS 9

Switched-capacitor amplifiers, switched capacitor integrator, switched capacitor common mode feedback. Single stage amplifier as comparator, cascaded amplifier stages as comparator, latched comparators.

UNIT III DIGITAL TO ANALOG CONVERSION 9

Performance metrics, reference multiplication and division, switching and logic functions in AC, Resistor ladder DAC architecture, current steering DAC architecture.

UNIT IV ANALOG TO DIGITAL CONVERSION 9

Performance metric, Flash architecture, Pipelined Architecture, Successive approximation architecture, Time interleaved architecture.

UNIT V PRECISION TECHNIQUES 9

Comparator offset cancellation, Op Amp offset cancellation, Calibration techniques, range overlap and digital correction.

TOTAL:45 PERIODS

REFERENCES

1. BehzadRazavi, “Principles of data conversion System Design”, IEEE press, 2011
2. Gabriele Manganaro,” Advanced Data Converters’ Cambridge University Press,2012.
3. Franco Maloberti, “Data Converters”, Springer, 2007.
4. Rudy Van de Plassche, “CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters”, Kluwer Acedamic Publishers, Boston, 2003.

5. Marcel Pelgrom ,'Analog-to-Digital Conversion" Springer, 2017.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To explain sample and hold circuits	3	2	2	2	2	2				2	2		2	2
CO-2	To design ADC/DAC circuits	3	3	3	2		2				2	2			2
CO-3	To analyze ADC/DAC Architecture and Performance	3	2	2			2				2	2		2	
CO-4	To discuss calibration techniques	3	2	2		2		2			2	2			2
CO-5	To understand the precision techniques	3	2	2		2						2			2

520222 **ROBOTICS** **L T P C**

3 0 0 3

COURSE OBJECTIVE:

To introduce robot terminologies and robotic sensors.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the concept about the terminologies.
- To educate direct and inverse kinematic relations.
- To understand on formulation of manipulator Jacobians and introduce path planning techniques
- To design on robot dynamics
- To introduce robot control techniques

UNIT I INTRODUCTION AND TERMINOLOGIES

Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates-Reference frames-workspace-Robot languages-actuators-sensors-Position, velocity and accelerationsensors-Torque sensors-tactile and touch sensors-proximity and range sensors- vision system-socialissues.

UNIT II KINEMATICS 9

Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematicssolution and programming-degeneracy and dexterity.

UNIT III DIFFERENTIAL MOTION AND PATH PLANNING 9

Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian- RobotPath planning

UNIT IV DYNAMIC MODELLING 9

Lagrangian mechanics- Two-DOF manipulator- Lagrange-Euler formulation – Newton-Eulerformulation – Inverse dynamics

UNIT V ROBOT CONTROL SYSTEM 9

Linear control schemes- joint actuators- decentralized PID control- computed torque control – forcecontrol- hybrid position force control- Impedance/ Torque control

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Fu. K.S., Gonzalz. R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., (2006)
2. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2005
3. Fu, Gonzalez and Lee Mcgrahill, "Robotics", international edition.2009.
4. R.K. Mittal and I J Nagrath, "Robotics and Control", Tata MacGraw Hill, Fourth edition. 2012.
5. R.D. Klafter, TA Chmielewski and Michael Negin, " "Robotic Engineering, An Integratedapproach&quot";, Prentice Hall of India, 2005.

6. Saeed B. Niku “Introduction to Robotics”, Pearson Education, 2009.

COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO’s	Statement’s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To understand the concept about the terminologies	3	2	2	2	2		2				1	2	2	
CO-2	To educate direct and inverse kinematic relations	3	2	2	2		1	2				1	2	2	
CO-3	To understand on formulation of manipulator Jacobians and introduce path planning techniques	3	2	2			1	2				1	1	2	
CO-4	To design on robot dynamics	3		2	2			1				1	2		
CO-5	To introduce robot control techniques	3	2	2	2		2	1				1	2	2	2

520223	FIBER OPTIC SENSORS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To familiarize the student with basic fiber sensor technology and different kinds of sensors used in applications

COURSE OUTCOMES

Having successfully completed this course, the students should be able to

- To understand about Optical resonators.
- To Acquire knowledge about magnetic sensors.
- To evaluate the Chemical and Biosensors.
- To understand about smart structures.
- To analysis the fiber optic sensor and it's applications

UNIT I SENSOR TECHNOLOGY

The Emergence of Fiber Optic Sensor Technology-Optical Fibers-Light Sources-Optical DetectorsFiber Couplers - Optical Modulators - Fiber Optic Sensors Based on the Sagnac Interferometer and Passive Ring Resonator- Mach-Zehnder and Michelson Interferometers.

UNIT II GRATING SENSORS **9**

Fibre Bragg Grating– Fabrication fiber grating - Multimode Grating and Polarization Sensors-Sensors Based on Relative Movement of Opposed Gratings-Grating Peri Modulation -Sensors Based on the Photo elasticEffect-Retardation Plates-Fiber Grating Sensors

UNIT III DISTRIBUTED AND MAGNETIC SENSORS **9**

Fiber Optic Distributed and Magnetic Sensor-Distributed Sensing- Basic Principles of Sensor Multiplexing- Interferometric Sensor Multiplexing- Faraday effect sensors-Magneto strictive – Lorentz force sensors- Evanescent Field Absorption Sensors-Evanescent wave sensors

UNIT IV CHEMICAL AND BIOSENSOR

Fiber Optic Chemical and Biosensor: Reagent Mediated sensor-Humidity sensor – Temperature. Pressure and rotation sensors -pH sensor Hydrogen sensor - CO2sensor – Ammonia sensor - Chloride sensor – Glucose sensor - Surface Plasmonic Resonance based sensor

UNIT V APPLICATIONS

Industrial Applications of Fiber Optic Sensors: Temperature – Pressure - fluid level – flow – position vibration - rotation measurements - Current -voltage measurement - Chemical analysis. Fiber optics smartstructures and their Applications

Total: 45 periods

REFERENCES

1. Bhagavānadāsa Gupta Banshi Das Gupta, "Fiber Optic Sensors: Principles and Applications", New India Publishing 2006
2. B.Culshaw and J.Daykin, "Optic fiber Sensors Systems and Applications", Artech House 4th edition, 2015
3. David A. Krohn, "Fiber optic sensors: fundamentals and applications", ISA Publishing 2000, 3rd Edition
4. Eric Udd, William B. Spillman, Jr., "FiberOptic Sensors: An Introduction for Engineers and Scientists", John Wiley & Sons 2011
5. Francis T.S. Yu, Shizhuo Yin, Paul B.Ruffin, "Fibe Optic Sensors", CRC Press Publisher 2010.
6. KTV Grattan & BT Meggit, "Optical fiber sensor technology & Applications", Kluwer Academic 2000

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To understand about Optical resonators	3	2	3	3	2							1	2	2
CO-2	To Acquire knowledge about magnetic sensors	3	2	2		2							1	2	2
CO-3	To evaluate the Chemical and Biosensors	3	3	2	2		2						2		2

CO-4	To understand about smart structures	3	2	2		2						1	2		1
CO-5	To analysis the fiber optic sensor and it's applications	3	3	2	2		2					1	2	2	

520224 SMART SYSTEM DESIGN L T P C

3 0 0 3

COURSE OBJECTIVE:

To understand about the smart system technologies and its role in real time applications and familiarize the design and development of embedded system based system design

COURSE OUTCOMES:

- To understand about the function of the embedded system
- To understand the embedded application and mobile embedded system.
- To understand about the concept of Raspberry pi and some essential components.
- To understand the concept of smart embedded appliances and integrated management system.
- To understand the embedded components of robotics and controllers.

UNIT I INTRODUCTION 9

Overview of smart system design and requirements- Hardware and software selection & co-design- Communications-smart sensors and actuators-Open-source resources for embedded system- android 42 for embedded system - Embedded system for Ecommerce-Embedded system for Smart card design and development –Recent trends.

UNIT II MOBILE EMBEDDED SYSTEM 9

Design requirements-Hardware platform- OS and Software development platform- Mobile Apps development- Applications: heart beat monitoring, blood pressure monitoring, mobile banking and appliances control.

UNIT III HOME AUTOMATION 9

Home Automation System Architecture-Essential Components- Linux and Raspberry Pi – design and real time implementation.

UNIT IV SMART APPLIANCES AND ENERGY MANAGEMENT 9

Overview- functional requirements-Embedded and Integrated Platforms for Energy Management- Energy Measurement Techniques for Smart Metering-Smart Embedded Appliances Networks – Security Considerations.

UNIT V EMBEDDED SYSTEMS AND ROBOTICS 9

Robots and Controllers-components - Aerial Robotics -Mobile Robot Design- Three-Servo Ant Robot- Autonomous Hexacopter System.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Anna Ha´c, “Wireless Sensor Network Designs”, John Wiley & Sons Ltd, 2003.
2. C.K.Toh, “ AdHoc mobile wireless networks”, Prentice Hall, Inc, 2002.
3. Grimm, Christoph, Neumann, Peter, Mahlknech and Stefan, Embedded Systems for Smart Appliances and Energy Management , Springer 2013.
4. KazemSohraby, Daniel Minoli and TaiebZnati, “ Wireless Sensor Networks Technology, Protocols, and Applications“, John Wiley & Sons, 2007.
5. Karim Yaghmour, Embedded Android , O'Reilly, 2013.
6. NilanjanDey, Amartya Mukherjee, Embedded Systems and Robotics with Open Source Tools, CRC press, 2016.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO’s	**Statement’s**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To understand about the function of the embedded system	3	2		2						2		2		2
CO-2	To understand the embedded application and	3	2		2						2		2		2

	mobile embedded system														
CO-3	To understand about the concept of Raspberry pi and some essential components	2	2		2	2	2				2		2	2	
CO-4	To understand the concept of smart embedded appliances and integrated management system	3	2		2						2			2	2
CO-5	To understand the embedded components of robotics and controllers	2	2			2						2		2	2

ELECTIVE-V

520225	ADVANCED DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To explore the concepts of digital image processing and design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To Understand the image fundamentals and mathematical transforms
- To understand the image segmentation and representation techniques.
- Identify the image restoration model and different noise models
- To Introduce the concepts of image registration and image fusion.
- To Analyze the constraints in image processing when dealing with 3D data sets

UNIT I FUNDAMENTALS OF DIGITAL IMAGE PROCESSING 9

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing

UNIT II SEGMENTATION 9

Image Segmentation: Edge Detection - Line Detection - Curve Detection - Edge Linking And Boundary Extraction, Boundary Representation, Region Representation And Segmentation, Morphology-Dilation, Erosion, Opening And Closing. Hit And Miss Algorithms Feature Analysis

UNIT III FEATURE EXTRACTION 9

First and second order edge detection operators, Phase congruency, Localized feature extraction detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features.

UNIT IV REGISTRATION AND IMAGE FUSION 9

Registration- Preprocessing, Feature selection-points, lines, regions and templates Featurecorrespondence-Point pattern matching, Line matching, region matching Template matching. Transformation functions-Similarity transformation and Affine Transformation. Resampling- Nearest Neighbour and Cubic Splines Image Fusion-Overview of image fusion, pixel fusion, Multiresolution based fusiondiscrete wavelet transform, Curvelet transform. Region based fusion.

UNIT V 3D IMAGE VISUALIZATION 9

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.

Total: 45 periods

REFERENCES:

1. John C.Russ, "The Image Processing Handbook", CRC Press,2007, 6th Edition.
2. . Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Academic Press, 2th Edition 2008.
3. Ardeshir Goshtasby, " 2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications",John Wiley and Sons,2005.
4. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson,Education, Inc.,Second Edition, 2004.
5. Anil K. Jain, , Fundamentals of Digital Image Processing', Pearson Education,Inc., 2002.

COURSE OUTCOMES		PROGRAMS OUTCOMES												PROGRAM SPECIFIC OUTCOMES	
CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO-1	To Understand the image fundamentals and mathematical transforms	3	2	2		2					2	2		2	
CO-2	To understand the image segmentation and representation techniques	3	2		2		2				2	2		2	
CO-3	Identify the image restoration model and different noise models	2	2		1	1					1	1		2	
CO-4	To Introduce the concepts of image registration and image fusion	3	2		2	2					2	2	2		2
CO-5	To Analyze the constraints in image processing when dealing with 3D data sets	3	2		2					2	2			2	2

520226 INTERNET OF THINGS L T P C

3 0 0 3

COURSE OBJECTIVES:

The purpose of this course is to impart knowledge on IoT Architecture and various protocols

COURSE OUTCOMES:

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web based services on IoT devices

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

UNIT II IoT AND M2M 9

Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT III INTRODUCTION TO PYTHON 9

Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages – JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT IV IoT PHYSICAL DEVICES AND ENDPOINTS 9

Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT V IoT PHYSICAL SERVERS AND CLOUD OFFERINGS 9

Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
4. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
5. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014
6. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 2nd Edition, VPT, 2014.

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COURSE OUTCOMES		PROGRAMS OUTCOMES	PROGRAM SPECIFIC OUTCOMES

CO's	Statement's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	To introduce the terminology, technology and its applications	2	2		2	2				2	2		2	2	
CO-2	To introduce the concept of M2M (machine to machine) with necessary protocols	3	2		2						2		2	2	2
CO-3	To introduce the Python Scripting Language which is used in many IoT devices	3	2		2					2		2	2		2
CO-4	To introduce the Raspberry PI platform, that is widely used in IoT application	2	2		2					2			2	2	2
CO-5	To introduce the implementation of web based services on IoT devices	2	2	1		2				1			2	2	

520227 MEDICAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To study about fundamentals of medical image processing techniques.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To understand the fundamentals of medical image processing techniques.
- To develop computational methods and algorithms to analyze and quantify biomedical data
- Students will be able to apply image processing concepts for medical images.
- Will be able to analyze Morphology, Segmentation techniques and implement these in images.

- Enables quantitative analysis and visualization of medical images of numerous modalities such as PET, MRI, CT, or microscopy

UNIT I IMAGE FUNDAMENTALS AND PRE-PROCESSING 9

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms. Image enhancement – point operation, Histogram modeling, spatial operations, Transform operations,

UNIT II BASICS OF MEDICAL IMAGE SOURCES 9

Radiology- The electromagnetic spectrum-Computed Tomography-Magnetic Resonance Tomography –ultrasound-nuclear medicine and molecular imaging-other imaging techniques-radiation protection and dosimetry.

UNIT III MEDICAL IMAGE REPRESENTATION 9

Pixels and voxels – algebraic image operations - gray scale and color representation-depth-color and look up tables - image file formats- DICOM- other formats- Analyze 7.5, NifTI and Interfile, Image quality and the signal to noise ratio- MATLAB based simple operations.

UNIT IV MEDICAL IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation- pixel based, edge based, region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification – Statistical, Rule based, Neural Network approaches

UNIT V IMAGE REGISTRATIONS AND VISUALIZATION 9

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. AtamP.Dhawan, „Medical Image Analysis‟, Wiley Interscience Publication, NJ, USA 2007.

2. G.R. SINHA, BHAGWATI CHARAN PATEL, “Medical Image Processing”, PHI publications, 3rd edition, 2010.

3. R.C.Gonzalez and R.E.Woods, „Digital Image Processing‟, 3rd edition, Pearson Education, 2008.

4. Thomas Martin Deserno, “Biomedical Image Processing”, Springer, 4th edition, 2012.

5. Wolfgang Birkfellner, „Applied Medical Image Processing – A Basic course", CRC Press, 2016.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To understand the fundamentals of medical image processing techniques	3	2	2	2	2	1				1		2	1	2
CO-2	To develop computational methods and algorithms to analyze and quantify biomedical data	3	2	2	2	3					1		2	2	
CO-3	To apply image processing concepts for medical images	3	2	2	2	1					2		3		2
CO-4	To analyze Morphology, Segmentation techniques and implement these in images	3	3	2	2	2							3	2	
CO-5	Enables quantitative analysis and visualization of medical images of numerous modalities such	3	3	3	2	2					1		2	2	

	as PET, MRI, CT, or microscopy														

520228	DETECTION & ESTIMATION THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To understand the concepts of detection and estimation.

- To learn the basics of multi-user detection theory
- To understand the theory behind various estimation techniques.
- To understand Wiener filter and Kalman filter in detail.

COURSE OUTCOMES:

- To be able to apply detection and estimation theory to solve communication problems.
- To design Wiener and Kalman filters to solve linear estimation problems.

- To be able to apply detection and estimation theory to solve communication problems.
- To apply probability and stochastic process concepts in detection and estimation.
- To design Wiener and Kalman filters to solve linear estimation problems.

UNIT I REVEIW OF PROBABILITY AND STOCHASTIC PROCESS 9

Conditional Probability, Bayes' Theorem , Random Variables, Conditional Distributions and Densities, moments and distribution of random variables., Stationary Processes Cyclostationary Processes Averages and Ergodicity Autocorrelation Function Power Spectral Density Discrete Time Stochastic Processes, Spatial Stochastic Processes, Random Signals, Relationship of Power Spectral Density and Autocorrelation Function.

UNIT II SINGLE AND MULTIPLE SAMPLE DETECTION 9

Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection, The Optimum Digital Detector in Additive Gaussian Noise , Performance of Binary Receivers in AWGN.

UNIT III FUNDAMENTALS OF ESTIMATION THEORY 9

Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory, Types of Estimation Problems, Properties of Estimators, Bayes estimation, Minimax Estimation, Maximum-Likelihood Estimation, Comparison of Estimators of Parameters.

UNIT IV WIENER AND KALMAN FILTERS 9

Orthogonality Principle, Autoregressive Techniques, Discrete Wiener Filter, Continuous Wiener Filter, Generalization of Discrete and Continuous Filter Representations , Linear Least-Squares Methods, Minimum-Variance Weighted Least-Squares Methods, Minimum-Variance, LeastSquares, Kalman Algorithm - Computational Considerations, Signal Estimation, Continuous Kalman Filter, Extended Kalman Filter.

UNIT V APPLICATIONS 9

in Non-Gaussian Noise , Examples of Noise Models, Receiver Structures, and Error-Rate Performance, Estimation of Non-Gaussian Noise Parameters Fading Multipath Channel Models, Receiver Structures with Known Channel Parameters, Receiver Structures without Knowledge of Phase, Receiver Structures without Knowledge of Amplitude or Phase, Receiver Structures and Performance with No Channel Knowledge.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Harry L. Van Trees, "Detection, Estimation and Modulation Theory", Part I John Wiley and Sons, New York, 2013.
2. Ludeman, Lonnie C. Random processes: filtering, estimation, and detection. John Wiley & Sons, Inc., 2011.
3. Sergio Verdu“ Multi User Detection” Cambridge University Press, 2002.

4. Steven M. Kay, "Fundamentals of Statistical Processing, Volume V: Estimation Theory", Prentice Hall Signal Processing Series, Prentice Hall, PTR, NewJersy, 2010.
5. Thomas Schonhoff, "Detection and Estimation Theory", Prentice Hall, New Jersy, 2007.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To be able to apply detection and estimation theory to solve communication problems.	3	2	2			2				2		2	2	
CO-2	To design Wiener and Kalman filters to solve linear estimation problems	3		2	2						2		2	2	
CO-3	To be able to apply detection and estimation theory to solve communication problems	3	2	2		2					2			2	2
CO-4	To apply probability and stochastic process concepts in detection and estimation	3	2		2					2	2		2	2	2
CO-5	To design Wiener and Kalman filters to solve	3	2	2	2		2					2	2	2	

	linear estimation problems														

520229 PATTERN RECOGNITION & ARTIFICAL INTELLIGENCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To understand different supervised and unsupervised learning techniques
- To obtain sound knowledge on recent advancement on pattern recognition techniques.

COURSE OUTCOMES:

- Analysis the procedure for various pattern recognition principles in real world problem.
- Analysis feature enhancement and optimization methods
- Analysis the windowing of better solution in rough surface searching algorithms both using association and non association rules.
- Identification of new developments in object recognition systems
- To study about the neural networks and neural pattern recognition.

UNIT I PATTERN CLASSIFIER **9**

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation -Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm-Problems with Bayes approach - Pattern classification by distance functions - Minimum distance patternclassifier

UNIT II UNSUPERVISED CLASSIFICATION **9**

Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm –Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clusteringsolutions

UNIT III STRUCTURAL PATTERN RECOGNITION **9**

Elements of formal grammars - String generation as pattern description - Recognition of syntacticdescription -Parsing - Stochastic grammars and applications - Graph based structural representation

UNIT IV FEATURE EXTRACTION AND SELECTION **9**

Entropy minimization - Karhunen - Loeve transformation - Feature selection through functionsapproximation -Binary feature selection.

UNIT V RECENT ADVANCES **9**

Neural network structures for Pattern Recognition - Neural network based Pattern associators –Unsupervised learning in neural Pattern Recognition - Self organizing networks - Fuzzy logic – Fuzzypattern classifiers -Pattern classification using Genetic Algorithms.

L=45 TOTAL: 45 PERIODS

REFERENCES:

1. Duda R.O., Hart.P.E., and Strok, *Pattern Classification,* second Edition Wiley, New York, 2008..
2. Robert J.Schalkoff, *Pattern Recognition: Statistical, Structural and Neural Approaches*, JohnWiley&Sons Inc., New York, 2007..
3. IEEE Transaction on Pattern Recognition Techniques 2006
4. IEEE Engineering Medicine and Biology Magazine 2006

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	Analysis the procedure for various pattern recognition principles in real world problem	3	3	3	2								2	2	3
CO-2	Analysis feature enhancement and optimization methods	3	2	3	2								2	2	2
CO-3	Analysis the windowing of better solution in rough surface searching algorithms both using association and non association rules	3	3	3	3	2	2						2	2	2
CO-4	Identification of new developments in object recognition systems	2	3	3	2	2	2						2	2	

CO-5	To study about the neural networks and neural pattern recognition	3	3	3	2	3					2		3		2

520230	RESEARCH METHODOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

To familiarize the student with the basic need of research for their evolution using various methods and techniques.

COURSE OUTCOMES:

Having successfully completed this course, the students should be able to:

- To Introduce about research and its importance.
- To understand the experimental design
- To understand about design and data collection techniques evolve in research.
- To understand the multivariate statistical techniques
- Get idea about prepare research report and its execution.

UNIT I INTRODUCTION TO RESEARCH

The hallmarks of scientific research – the building blocks of science in research – the research process for applied and basic research – the need for theoretical frame work – hypothesis development – hypothesis testing with quantitative data. The research design. The purpose of the study: Exploratory, Descriptive, Hypothesis testing (Analytical and Predictive) – cross sectional and longitudinal studies.

UNIT II EXPERIMENTAL DESIGN 9

The laboratory and the field experiment – Simulation--internal and external validity – factors affecting internal validity. Measurement of variables – scales and measurement of variables – development scales - rating scale and concept in scales being developed. Stability measures. Meaning & Role of hypothesis

UNIT III DATA COLLECTION METHOD 9

Interviewing, questionnaires etc. Secondary sources of data collection. Guidelines for questionnaire design – electronic questionnaire design and surveys. Special data source: Focus groups, Static and dynamic data-collection methods and when to use each. Sampling techniques and confidence in determining sample size. Hypothesis testing determination of optimal sample size.

UNIT IV A REFRESHER ON SOME MULTIVARIATE STATISTICAL TECHNIQUES 9

Factor analysis – cluster analysis – discriminate analysis –multiple regression & Correlation – canonical correlation – application of SPSS package.

UNIT V THE RESEARCH REPORT 9

The purpose of the written report – concept of audience – Basics of written reports. The integral parts of a report – the title of a report. The table of content, the synopsis, the introductory section, method of sections of a report, result section – discussion section – recommendation and implementation section

TOTAL : 45 PERIODS

REFERENCES:

1. Donald R.Cooper and Ramcis S.Schindler, Business Research Methods, TataMcGraw Hill Publishing CompanyLimited, New Delhi, 2000
2. C.R.Kothari Research Methodology, Wishva Prakashan, New Delhi, 2001
3. Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., New York, 2000.
4. Donald H.Mc.Burney, Research Methods, Thomson Asia Pvt. ltd. Singapore 2002
5. G.W.Ticehurst and A.J.Veal, Business Research Methods, Longman, 1999
6. Ranjit Kumar, Research Methodology, Sage Publication, London, New Delhi, 1999.
7. Raymond-Alain Thie'tart, ET, al., doing management research, sage publication, London, 1999.

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COURSE OUTCOMES		**PROGRAMS OUTCOMES**												**PROGRAM SPECIFIC OUTCOMES**	
CO's	**Statement's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO-1	To Introduce about research and its importance	3	2	2	2	2					2	2	2		2
CO-2	To understand the experimental design	3	2	2	2						2	2		2	
CO-3	To understand about design and data collection techniques evolve in research	3	2	2		1				2		2	2		2

CO-4	To understand the multivariate statistical techniques	3	2		2	2				2		2	2	2	
CO-5	Get idea about prepare research report and its execution	3	2	2		2					2	2			2