Kongunadu College of Engineering and Technology

(Autonomous)

Affiliated to Anna University, Chennai

M.E. Applied Electronics

Regulations: KNCET-PGR2024

Choice Based Credit System

I to IV Semesters Curricula & Syllabi

(Applicable for the students Admitted from 2024-25 Onwards)

Semester I							
S.No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
Theory							
1	PG24MA101	Applied Mathematics for Electronics Engineers	FC	4	0	0	4
2	PG24AE101	Advanced Digital System Design	PCC	3	2	0	3
3	PG24AE102	Advanced Digital Signal Processing	PCC	3	0	0	3
4	PG24AE103	Embedded Systems	PCC	3	0	0	3
5	PG24AE104	Power Conversion Circuits for Electronics	PCC	3	0	0	3
6	PG24RM001	Research Methodology and IPR	RMC	2	0	0	2
7		Professional Elective I	PEC	3	0	0	3
Practicals							
8	PG24AE101L	Electronic System Design Laboratory	PCC	0	0	3	1.5
9	PG24AE102L	Signal and Image Processing Laboratory	PCC	0	0	3	1.5
			Total	**21**	**2**	**6**	**24**

CHAIRMAN 27/05
BOS/ECE

Semester II							
S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
Theory							
1	PG24AE201	Sub Micron Circuit Design	PCC	3	0	0	3
2	PG24AE202	IoT for Smart Systems	PCC	3	0	0	3
3	PG24AE203	VLSI Design Techniques	PCC	3	0	0	3
4	PG24AE204	Soft Computing and Optimization Techniques	PCC	3	0	0	3
5	24MC002	Universal Human Values 2: Understanding Harmony	MC	3	0	0	3
6		Professional Elective II	PEC	3	0	0	3
7		Professional Elective III	PEC	3	0	0	3
Practicals							
8	PG24AE201L	VLSI and IoT Laboratory	PCC	0	0	4	2
9	PG24AEEC 201L	Design Project and Paper Writing	EEC	0	0	2	1
			Total	**21**	**0**	**6**	**24**

Semester III							
S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
Theory							
1		ASIC and FPGA Design	PCC	3	0	0	3
2		Professional Elective IV	PEC	3	0	0	3
3		Professional Elective V	PEC	3	0	0	3
4		Professional Elective VI	PEC	3	0	0	3
Practicals							
5		Project Work Phase I	EEC	0	0	12	6
			Total	**12**	**0**	**12**	**18**

CHAIRMAN 27/05
BOS/ECE

Semester IV							
S. No	**Course Code**	**Course Title**	**Course Category**	**No of Hours/Week**			**Credit**
				L	**T**	**P**	
Practicals							
1		Project Work Phase II	EEC	0	0	24	12
			Total	**0**	**0**	**24**	**12**

CHAIRMAN 27/05
BOS/ECE

Professional Elective Course (PEC)

Semester- I

Elective I

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1	PG24AE101PE	Sensors for Healthcare	PEC	3	0	0	3
2	PG24AE102PE	Computer Architecture and Parallel Processing	PEC	3	0	0	3
3	PG24AE103PE	Automotive Electronics	PEC	3	0	0	3
4	PG24AE104PE	Robotics	PEC	3	0	0	3
5	PG24AE105PE	Micro Electro Mechanical Systems	PEC	3	0	0	3

Semester- II

Elective II

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1	PG24AE201PE	Analog Integrated Circuit Design	PEC	3	0	0	3
2	PG24AE202PE	Speech and Audio Signal Processing	PEC	3	0	0	3
3	PG24AE203PE	High Performance Networks	PEC	3	0	0	3
4	PG24AE204PE	Nano Technologies	PEC	3	0	0	3
5	PG24AE205PE	Hardware Security	PEC	3	0	0	3

CHAIRMAN
BOS/ECE
27/05

Semester- II

Elective III

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1	PG24AE206PE	DSP Processor Architecture and Programming	PEC	3	0	0	3
2	PG24AE207PE	VLSI for Wireless Communication	PEC	3	0	0	3
3	PG24AE208PE	Solid State Device Modeling and Simulation	PEC	3	0	0	3
4	PG24AE209PE	Electromagnetic Interference and Compatibility	PEC	3	0	0	3
5	PG24AE210PE	Sensors and Actuators	PEC	3	0	0	3

Semester- III

Elective IV

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1		Hardware Secure Computing	PEC	3	0	0	3
2		System on Chip Design	PEC	3	0	0	3
3		Advanced Microprocessors and Microcontrollers Architectures	PEC	3	0	0	3
4		Biomedical Signal Processing	PEC	3	0	0	3
5		Signal Integrity for High Speed Design	PEC	3	0	0	3

CHAIRMAN
BOS/ECE
27/05

Semester- III
Elective V

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1		Deep Learning	PEC	3	0	0	3
2		Advanced Digital Image Processing	PEC	3	0	0	3
3		PCB Design	PEC	3	0	0	3
4		Pattern Recognition	PEC	3	0	0	3
5		Hardware Software Co-Design for FPGA	PEC	3	0	0	3

Semester- III
Elective VI

S. No	Course Code	Course Title	Course Category	No of Hours/Week			Credit
				L	T	P	
1		Advanced Computer Architecture	PEC	3	0	0	3
2		Digital System Design with FPGAs	PEC	3	0	0	3
3		Smart Antennas	PEC	3	0	0	3
4		Foundations of Artificial Intelligence and Data Science	PEC	3	0	0	3
5		Multimedia Compression Techniques	PEC	3	0	0	3

CHAIRMAN 27/05
BOS/ECE

PG24MA101 **APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS** **L T P C 4 0 0 4**

OBJECTIVES:

The students should be made to:

- Understand the fundamentals of fuzzy logic techniques and its applications
- Remember the basics of random variables with emphasis on the standard discrete and continuous distributions
- Applying the basic probability concepts with respect to two dimensional random variables
- Analyzing the concepts of random process, stationary and autocorrelation functions
- Evaluate the queueing models and apply these techniques in networks, image processing by provide the required fundamental concepts

UNIT I FUZZY LOGIC **12**

Classical logic - Multivalued logics - Fuzzy propositions - Fuzzy qualifiers.

UNIT II PROBABILITY AND RANDOM VARIABLES **12**

Probability - Axioms of probability - Conditional probability - Bayes theorem - Random variables - Probability function – Moments - Moment generating functions and their properties - Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions - Function of a random variable.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES **12**

Joint distributions - Marginal and conditional distributions - Functions of two dimensional random variables - Regression curve - Correlation.

UNIT IV RANDOM PROCESSES **12**

Classification – Stationary random process - Markov process – Markov chain – Poisson process – Gaussian process - Auto correlation – Cross correlation.

UNIT V QUEUEING MODELS **12**

Poisson process – Markovian queues – Single and multi server models - Little's formula - Machine Interference model - Steady state analysis - Self service queue.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Understand the concepts of fuzzy sets, fuzzy logic, fuzzy prepositions and fuzzy quantifiers and in relate
- Remember the performance in terms of probabilities and distributions achieved by the determined solutions
- Apply some of the commonly encountered two dimensional random variables and extend to multivariate analysis
- Analyze the various random processes and solve problems involving stochastic processes
- Evaluate and demonstrate the queuing models to solve practical problems

CHAIRMAN
BoS (S&H)
13/05

REFERENCES:

1. Ganesh M., "Introduction to Fuzzy Sets and Systems, Theory and Applications", AcademicPress, New York, 1997.
2. George J.Klir and Yuan B," Fuzzy sets and Fuzzy logic" Prentice Hall,New Delhi, 2006.
3. Devore J.L, "Probability and Statistics for Engineering and Sciences", Cengage learning, 9thEdition, Boston, 2017.
4. Johnson R.A. and Gupta, C.B., "Miller and Freunds Probability and Statistics for Engineers",Pearson India Education, Asia, 9th Edition, New Delhi, 2017.
5. Oliver C. Ibe," Fundamentals of applied probability and Random process", Academic press,Boston, 2014.
6. Gross D. and Harris C.M., "Fundamentals of Queuing theory", Willey student,3rd Edition, New Jersey, 2004.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	1	-	-	2	-	2
CO2	3	3	3	2	-	-	-	-	1	-	-	1	-	2
CO3	3	2	2	2	-	-	-	-	1	-	-	1	-	2
CO4	3	3	3	2	-	-	-	-	2	-	-	2	-	2
CO5	3	2	2	2	-	-	-	-	1	-	-	1	-	2

CHAIRMAN
BoS (S&H)

PG24AE101 ADVANCED DIGITAL SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Design synchronous sequential circuits
- Learn about hazards in asynchronous sequential circuits.
- Study the fault testing procedure for digital circuits.
- Understand the architecture of programmable devices.
- Design and implement digital circuits using programming tools

UNIT I SEQUENTIAL CIRCUIT DESIGN **9**

Analysis of clocked synchronous sequential circuits and modeling - State diagram, State table, State table assignment and Reduction-Design of synchronous sequential circuits design of iterative circuits - ASM Chart and realization using ASM.

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN **9**

Analysis of asynchronous sequential circuit - Flow table reduction - Races - State assignment - Transition table and Problems in transition table - Design of asynchronous sequential circuit - Static, Dynamic and essential hazards - Mixed operating mode asynchronous circuits - Designing vending machine controller

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS **9**

Fault table method - Path sensitization method - Boolean difference method - D algorithm - Tolerance techniques - The compact algorithm - Fault in PLA - Test generation - DFT schemes - Built in self - test.

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES **9**

Programming logic device families - Designing a synchronous sequential circuit using PLA / PAL - Designing ROM with PLA - Realization of finite state machine using PLD - FPGA - Xilinx FPGA - Xilinx 4000.

UNIT V SYSTEM DESIGN USING VERILOG **9**

Hardware modelling with Verilog HDL - Logic system, Data types and Operators for modelling In Verilog HDL - Behavioural descriptions in Verilog HDL - Realization of combinational and

CHAIRMAN 27/05
BOS/ECE

sequential circuits using verilog - Adders - Subtractors - Multiplexer and demultiplexer - Encoder and Decoder - Registers - Counters - Sequential machine - Serial adder - Multiplier - Divider - Design of simple microprocessor, Design of traffic light controller.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Analyze and design synchronous sequential circuits.
- Analyze hazards and design asynchronous sequential circuits.
- Understand the testing procedure for combinational circuit and PLA.
- Design a Synchronous Sequential circuit using PLD and ROM.
- Design and use programming tools for implementing digital circuits of industry standards.

REFERENCES:

1. Charles H.Rothjr., "Fundamentals of Logic Design", Thomson Learning,2013
2. M.D.Ciletti , "Modeling, Synthesis and Rapid Prototyping with the Verilog HDL", Prentice Hall, 1999
3. M.G.Arnold, "Verilog Digital – Computer Design", Prentice Hall (PTR), 1999
4. Nripendra N Biswas,1 "Logic Design Theory", Prentice Hall of India, 2001.
5. Paragk.Lala, "Fault Tolerant and Fault Testable Hardware Design", B S Publications, 2002.
6. Paragk.Lala, "Digital System Design Using PLD", B S Publications, 2003

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	2	-	2	-	-	-	1	2
2	2	-	-	3	-	-	1	2
3	-	-	-	-	2	1	1	2
4	-	-	3	-	-	2	1	2
5	-	-	-	2	3	-	1	2
Avg.	2		3	3	3	2	1	2

CHAIRMAN 27/05
BOS/ECE

PG24AE102 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Learn the fundamental concepts of DSP and Discrete Transforms
- Design of IIR and FIR Digital Filters
- Estimate power spectrum using non- parametric and parametric methods
- Analyze multirate Signal processing by decimation and interpolation
- Apply the concept of multirate signal processing for various applications

UNIT I DIGITAL SIGNAL PROCESSING **9**

Sampling of analog signals - Nyquist Rate- Frequency response - Transfer functions - Filter structures - Fast Fourier Transform (FFT) Algorithms - Image coding - DCT.

UNIT II DIGITAL FILTER DESIGN **9**

IIR and FIR Filters: Filter structures, Implementation of Digital Filters - 2nd Order Narrow Band Filter and 1st Order All Pass Filter, Frequency sampling structures of FIR, Lattice structures, Forward and Backward prediction error filters, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

UNIT III ESTIMATION OF POWER SPECTRUM **9**

Non-Parametric Methods: Estimation of spectra from finite duration observation of signals: Bartlett, Welch & Blackman-Tukey methods, Performance Comparison. Parametric Methods: Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT IV MULTI RATE SIGNAL PROCESSING **9**

Decimation by a factor D - Interpolation by a factor I - Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design and Implementation for sampling rate conversion. Up-sampling using All Pass Filter.

CHAIRMAN 27/05
BOS/ECE

UNIT V APPLICATIONS OF MULTI RATE SIGNAL PROCESSING AND DSP INTEGRATED CIRCUITS 9

Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Sub band Coding of Speech Signals, Quadrature Mirror Filters, Over Sampling A/D and D/A Conversion.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Describe the basics of Digital Signal Processing and Discrete Time Transforms
- Design and implement FIR/IIR digital filters using various structures
- Estimate power spectrum using appropriate parametric/non-parametric method
- Analyze discrete time system at different sampling frequencies using the concept of multirate signal processing
- Design discrete time system for the given application using Multi rate signal processing

REFERENCES

1. J.G.Proakis& D. G.Manolakis Digital Signal Processing: Principles, Algorithms & Applications -, 4th Ed., Pearson Education, 2013.
2. Alan V Oppenheim & Ronald W Schaffer Discrete Time signal processing, Pearson Education, 2014.
3. Keshab K. Parhi, 'VLSI Digital Signal Processing Systems Design and Implementation", John Wiley& Sons, 2007.
4. Steven. M .Kay, Modern Spectral Estimation: Theory & Application –PHI, 2009.
5. P.P.Vaidyanathan, Multi Rate Systems and Filter Banks , Pearson Education, 1993.
6. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing–A practical approach", 2nd Edition, Harlow, Prentice Hall, 2011

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	3	2	-	-	1	-
2	1	-	3	3	-	-	1	-
3	1	-	2	3	-	-	-	-
4	1	-	-	2	2	-	-	2
5	2	-	2	-	2	-	1	2
Avg	1	-	3	3	2	-	1	2

CHAIRMAN 27/05
BOS/ECE

PG24AE103 EMBEDDED SYSTEMS **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Gaining a strong understanding ofembedded systems, their components, and design challenges.
- Learn processor architectures, including pipelining and specialized instruction sets.
- Understand and identify the various communication protocols used in embedded systems (serial, parallel, and wireless)
- Explore modeling techniques for embedded system behavior using state machines and concurrent processes
- Inspect the programming structure in embedded system using software development tools.

UNIT I 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 II GENERAL AND SINGLE PURPOSE PROCESSOR **9**

Basic architecture, Pipelining, Superscalar and VLIW architectures, Programmer's view, Development environment, Application-specific instruction-Set processors (ASIPs) Microcontrollers, Timers, Counters and watchdog timer, UART, LCD controllers and Analog-to-digital converters, Memory concepts.

UNIT III BUS STRUCTURES **9**

Basic protocol concepts, Microprocessor interfacing – I/O addressing, Port and bus-based I/O, arbitration, Serial protocols, I2C, CAN and USB, Parallel protocols – PCI and ARM bus, Wireless protocols – IrDA, Bluetooth, IEEE 802.11.

UNIT IV STATE MACHINE AND CONCURRENT PROCESS MODELS **9**

Basic state machine model, Finite-state machine with data path model, Capturing state machine in sequential programming language, Program-state machine model, Concurrent process model, Communication among processes, Synchronization among processes, Dataflow model, Real-time systems, Automation: Synthesis, Verification: Hardware/Software Co-simulation, Reuse: Intellectual property cores, Design process models.

CHAIRMAN 27/05
BOS/ECE

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.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Explain the key concepts of embedded systems and their design process.
- Design and develop embedded hardware platforms
- Design and implement communication mechanisms between different embedded system components.
- Examine the importance of programming concept for state machine and concurrent process models
- Leverage embedded software development tools and debug embedded systems effectively.

REFERENCES:

1. Bruce Powel Douglas, "Real time UML, second edition: Developing efficient objects forembedded systems", 3rd Edition 1999, Pearson Education.
2. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet",Pearson Education, 2002.
3. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.Steve Heath, "Embedded System Design", Elsevier, 2nd Edition, 2004.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	2	2	-	-	1	1
2	2	-	-	2	3	-	1	1
3	2	-	2	2	2	-	1	-
4	-	-	-	2	2	-	-	1
5	3	-	2	2	3	-	1	1
Avg	2	-	2	2	3	-	1	1

CHAIRMAN 27/05
BOS/ECE

PG24AE104	POWER CONVERSION CIRCUITS FOR ELECTRONICS	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understanding different switching devices with respect to their characteristics
- Analyze different converters with their applications.
- Study advanced converters and switching techniques implemented in recent technology
- Design the AC and DC Choppers
- Learning the Automation and Control methods for SCADA and telemetry

UNIT I POWER ELECTRONIC DEVICES ANDSEMICONDUCTOR SWITCHES 9

Introduction, Applications of power electronics, Power electronics devices: Characteristics of power devices – characteristics of SCR, diac, triac, GTO, PUJT, power transistors – power FETs – LASCR – two transistor model of SCR Protection of thyristors against over voltage – over current, dv/dt and di/dt. Power Semiconductor Switches: Rectifier diodes, fast recovery diodes.

UNIT II SCR PERFORMANCE AND APPLICATIONS 9

Turn on circuits for SCR – triggering with single pulse and train of pulses synchronizing with supply – Thyristor turn off methods, natural and forced commutation, self-commutation series and parallel operations of SCRs. Rectifiers: Single phase and three phase controlled Rectifiers with inductive loads, RL load. Construction & Working of Opto- Isolators, Opto-TRIAC, Opto-SCR.

UNIT III INVERTERS AND VOLTAGE CONTROLLERS 9

Voltage and current source inverters, resonant, Series inverter, PWM inverter. AC and DC choppers – DC to DC converters – Buck, boost and buck – boost. 25 Single phase and three phase Cyclo-converters, Power factor control and Matrix Converters. Industrial applications DC and AC Drives DC Motor Speed control Induction Motor Speed Control.

UNIT IV POWER HEATING, SENSOR AND ACTUATORS 9

RC base constant timers, Timer circuits using SCR, IC-555, Programmable timer and their industrial applications, Induction heating and Dielectric heating system and their applications, Sensors, Transducers, and Transmitters for measurement, Control & Monitoring: Thermo-resistive transducer, Photoconductive transducers, Pressure transducers, Flow transducers, Level sensors, Speed sensing, Vibration transducers, Variable-frequency drives, Stepper motors and Servomotor drives.

CHAIRMAN 27/05
BOS/ECE

UNIT V AUTOMATION AND CONTROL 9

Data communications for industrial electronics, Telemetry, SCADA & Automation, AC & DC Drives, Voltage & Power factor control through solid state devices, Soft switching, Industrial robots.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Understand different switching devices with respect to their characteristics
- Analyze different converters with their applications.
- Identify the advanced converters and switching techniques implemented in recent technology
- Design the AC and DC Choppers
- Outline the concepts of Automation and Control methods for SCADA and telemetry

REFERENCES:

1. Thomas E. Kissell, "Industrial Electronics: Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls", 3rd edition, 2003, Prentice Hall.
2. B. Paul, "Industrial Electronic and Control", Prentice Hall of India Private Limited , 2004
3. M.H. Rashid, "Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rd edition, 2004.
4. Ned Mohan, T.M. Undeland and W.P. Robbins, "Power Electronics: Converters, Applications and Design", Wiley India Ltd, 2008.
5. M.S. JamilAsghar, "Power Electronics" Prentice Hall of India Ltd., 2004
6. V.R. Moorthy, "Power Electronics: Devices, Circuits and Industrial Applications", Oxford University Press, 2007.
7. G.K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall inc. (1989).
8. J.M.D. Murphy, F.G. Turnbull, "Power Electronic Control of AC Motors", Pergamon (1990).

CHAIRMAN 27/05
BOS/ECE

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	2	-	2	-	-	-	-	1
2	1	-	2	-	-	-	1	-
3	-	-	-	2	1	-	-	-
4	-	-	-	2	-	-	1	-
5	-	-	2	-	2	2	1	1
Avg	2	-	2	2	2	2	1	1

CHAIRMAN 27/05
BOS/ECE

PG24RM001 RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

OBJECTIVES:

The Student should be made to:

- Learn the research process and its design methodologies.
- Study the data collection process and its sources
- Understand the data analysis methods and report writing
- Learn about intellectual property rights and its functions.
- Understand the concepts of patents and filling process

UNIT I RESEARCH DESIGN **6**

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES **6**

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods, Data - Preparing, Exploring, examining and displaying

UNIT III DATA ANALYSIS AND REPORTING **6**

Overview of Multivariate analysis, Hypotheses testing and Measures of Association, Presenting Insights and findings using written reports and oral presentation

UNIT IV INTELLECTUAL PROPERTY RIGHTS **6**

Intellectual Property – The concept of IPR, Evolution and development of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance

UNIT V PATENTS **6**

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL: 30 PERIODS

CHAIRMAN 8.7.05
BOS/ECE

OUTCOMES:

At the end of the course, the students should be able to:

- Explain about research process and its design methodologies.
- Summarize the insights gained from data collection process and its sources.
- Examine data analysis method and prepare a report for findings.
- Describe the process, types and features of IPR.
- Enlighten the concept of patent, e-filling process and licensing of related patents.

TEXT BOOK:

1. C R Kothari, "Research Methodology Methods and Techniques", New age international (P) Limited,Publishers,New Delhi,2nd revised edition.

REFERENCES:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business ResearchMethods", Tata McGraw Hill Education, 11thedition 2012.
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools &techniques", Wiley, 2007
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013

CHAIRMAN 27/05
BOS/ECE

PG24AE101L ELECTRONIC SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

The Student should be made to:

- Study the fundamentals of embedded programming and interfacing concepts.
- Gain the knowledge about physical measurement using transducer.
- Acquire the knowledge about designing AC/DC voltage regulator.
- Learn to design the PCB and Antenna using Simulation tools.
- Understand the designing of Wireless Data Modem.

LIST OF EXPERIMENTS:

1. System design using 8051,PIC and MSP430 Microcontroller
2. Interfacing of LED and LCD with ARM
3. Interfacing of Buzzer with ARM
4. Interfacing Stepper motor and Temperature Sensor with ARM
5. LED Interfacing using STM32 Microcontroller
6. Design of an Instrumentation amplifier for Temperature measurement
7. Design of AC/DC Voltage Regulator using SCR
8. PCB Layout design
9. Design and Simulation of Antennas
10. Plot the Radiation Pattern of Antennas
11. Measurement of Displacement using LVDT
12. Design of Wireless Data Modem

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply Microprocessor and Microcontroller concepts for embedded system design.
- Design the AC/DC voltage regulator.
- Analyze the physical measurement using transducer.
- Design the PCB and Antenna using Simulation tools.
- Demonstrate the data transfer using Wireless Data Modem.

CHAIRMAN 07/05
BOS/ECE

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	2	-	1	2	2	1	2	3
2	2	-	1	1	-	3	2	-
3	2	-	1	2	1	2	2	1
4	3	-	-	2	2	2	3	2
5	2	-	-	2	3	3	3	2
Avg	2	-	1	2	2	2	2	2

CHAIRMAN 27/05
BOS/ECE

PG24AE102L SIGNAL AND IMAGE PROCESSING LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

The Student should be made to:

- Acquire knowledge about various filtering concepts in signal processing.
- Understand the concepts of spectrum estimation and multirate systems.
- Learn the various techniques and transforms in image processing.
- Apply suitable enhancement and restoration techniques in images.
- Familiarize the operations of image segmentation and compression.

LIST OF EXPERIMENTS:

1. Simulation of FIR and IIR Digital filters
2. Simulation of QMF
3. Adaptive Noise Cancellation using simulink.
4. Estimation of Power Spectrum for Non-Parametric methods
5. Analysis of Audio and Speech signal
6. Implementation of Decimation and interpolation for multirate system
7. Extraction of R,G,B components using color image and image conversion
8. Perform DCT and DFT on an input image
9. Perform Image enhancement using basic intensity transformation techniques
10. Perform Filtering Operations on Images.
11. Perform basic Edge Detection and Morphological Operations on Images.
12. Image Compression Using Wavelet Transform

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Implement the various filtering concepts in signal processing.
- Analyze the performance of power spectrum estimation and multirate systems.
- Interpret the various techniques and transforms in image processing.
- Apply suitable enhancement and restoration techniques to improve the quality of image.
- Perform the segmentation and compression operations in the images.

CHAIRMAN 27/05
BOS/ECE

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	2	-	-	3	2	1	1	1
2	2	-	-	3	1	1	1	1
3	1	-	-	1	-	-	1	2
4	2	-	-	1	-	-	1	2
5	2	-	-	1	-	-	1	3
Avg	2	-	-	2	2	1	1	2

CHAIRMAN
BOS/ECE
27/05

PG24AE101PE SENSORS FOR HEALTHCARE

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Study the different types of electrodes used in bio potential recording
- Acquire knowledge of smart sensors and the associated signal processing
- Gain knowledge for implementing different types of physiological parameter measurement using appropriate sensors
- Understand the working principle of smart chemical sensors
- Learn the overview of the direction of future health care system

UNIT I BIOPOTENTIAL ELECTRODES 9

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes.

UNIT II SMART SENSORS 9

Smart Physical sensors-Fiber based sensors-Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface– The Automation

UNIT III PHYSICAL SENSORS IN BIOMEDICINE 9

Temperature measurement: core temperature,-surface temperature- invasive. Blood flow measurement: skin blood- hot film anemometer- Doppler sonography- electromagnetic sensor - blood pressure measurement: noninvasive- hemodynamic invasive. Spirometry- sensors for pressure pulses and movement- ocular pressure sensor-acoustic sensors in hearing aid, in blood flow measurement, sensors for bio-magnetism, tactile sensors for artificial limbs, sensors in ophthalmoscopy, artificial retina.

UNIT IV CHEMICAL BIOSENSORS 9

Field Effect Transistor Technologies for Biological and Chemical Sensors -Electrochemical sensor, Chemical fibro sensors, Noninvasive blood gas monitoring-Blood glucose sensors-Electronic noses-gamma radiation dosimeter.

CHAIRMAN 27/05
BOS/ECE

UNIT V NEXT GENERATION HEALTHCARE 9

Internet of Things in Healthcare - Robotics in Healthcare - Implantable Neural Sensors for Brain Machine Interface - Cell Based Sensor - Sensors for food contaminant detection - Liposome Based Sensors - limitations and challenges in state-of-the-art smart biochemical sensors - Future scope of wearable sensors

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Understand about the different types of bio-potential electrodes
- Design systems with smart sensors
- Use appropriate sensors as well as to measure and analyze the physiological parameters obtained
- Design chemical bio-sensors for typical issues
- Analyze the role of upcoming technology in future healthcare

REFERENCES:

1. J. G. Webster, J. G. Webster ,"Medical Instrumentation; Application and Design", John Wiley & Sons, Inc., New York, 4th Edition, 2015
2. Chong-Min Kyung, "Smart Sensors for Health and Environment Monitoring", Springer Publications,2015.
3. Editors: Domenico Formica Emiliano Schena, "Smart Sensors for Healthcare and Medical Applications", Published in Sensors, ISBN 978-3-0365-0651-7 (pdf), August 2021.
4. Editors: Kyung, C., Yasuura, H., Liu, Y., Lin, Y.-L., "Smart Sensors and Systems-Innovations for Medical, Environmental, and IoT Applications", Springer Publications, 2017.
5. Editors: Hamida Hallilland Hadi Heidari, "Smart Sensors for Environmental and Medical Applications", Wiley-IEEE Press, 2020, ISBN: 978-1-119-58734-7.

CHAIRMAN 27/05
BOS/ECE

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	3	-	3	2	3	3	1	1
2	3	-	3	1	3	3	1	1
3	3	-	3	2	3	3	-	1
4	3	-	3	2	3	3	1	2
5	3	-	3	1	3	3	1	3
Avg	3	-	3	2	3	3	1	2

CHAIRMAN 27/05
BOS/ECE

PG24AE102PE	COMPUTER ARCHITECTURE AND PARALLEL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The Student should be made to:

- Study the basic concepts and structure of computers.
- Learn the concepts of number representation and arithmetic operations.
- Understand the different types of memory architectures.
- Learn various parallel processing schemes and vector architecture.
- Acquire the knowledge about Instruction execution stages and Memory hierarchy

UNIT I INTRODUCTION TO COMPUTER ORGANIZATION **9**

Architecture and Function of General Computer System-Basic Operational Concepts, Bus Structures, Software Performance – Memory Locations &Addresses – Memory Operations – Instruction and Instruction Sequencing– Addressing Modes – Assembly Language – System Buses, Multi-Bus Organization.

UNIT II DATA REPRESENTATION **9**

Signed number representation, Fixed and floating point representations, Character representation, Computer arithmetic - Integer addition and subtraction, Ripple carry adder, Carry look-Ahead adder-Multiplication -Shift-and-add, Booth multiplier, Carry save multiplier-Division-Non-restoring and restoring techniques, Floating point arithmetic.

UNIT III PROCESSOR ARCHITECTURE AND CONTROL UNIT **9**

A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Hardwired control – micro programmed control - Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions. Processor Architecture: Very Long Instruction Word (VLIW) Architecture, Digital Signal Processor Architecture, RISC Architecture, MIPS Processor and programming.

UNIT IV PARALLEL PROCESSING **9**

Parallel Processing Challenges – Flyn's Classification – Single Instruction Single Data (SISD), Multiple Instruction Multiple Data (MIMD), Single Instruction Multiple Data (SIMD), Single Program Multiple Data (SPMD) and Vector Architectures – Hardware Multithreading – Multi-Core Processors and other Shared Memory Multiprocessors – Introduction to Graphics

CHAIRMAN 27/05
BOS/ECE

Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT V MEMORY& I/O SYSTEMS **9**

Memory Hierarchy – Memory Technologies – Cache Memory – Measuring and Improving Cache Performance – Virtual Memory, Translation Lookaside Buffers–Accessing I/O Devices– Interrupts–Direct Memory Access–Bus structure–Bus operation–Arbitration–Interface Circuits – Universal Serial Bus.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the basic organization of computer and different instructions formats and addressing modes.
- Interpret the representation and manipulation of data on the computer.
- Illustrate about implementation schemes of control unit and pipeline performance.
- Summarize the various types of parallelism architectures.
- Compare the various memory hierarchy and I/O systems.

REFERENCES:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware / Software Interface", Morgan Kaufmann / Elsevier, 5th Edition,2014
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Tata McGraw Hill, 6th Edition, 2012.
3. William Stallings, "Computer Organization and Architecture–Designing for Performance", Pearson Education, 8th Edition, 2010.
4. John P. Hayes, "Computer Architecture and Organization", Tata McGraw Hill, 3rd Edition, 2012.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	1	2	1	-	1	-
2	1	-	1	2	1	-	1	-
3	-	-	1	2	1	-	1	-
4	-	-	1	2	1	-	1	-
5	-	-	1	2	1	-	1	-
Avg	1	-	1	2	1	-	1	-

CHAIRMAN 27/05
BOS/ECE

PG24AE103PE AUTOMOTIVE ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Know the concepts and develop basic skills necessary to diagnose automotive electronic problems.
- Explain the principle of electronic management system and different sensors used in the systems.
- Know Starting, and charging, lighting systems, advanced automotive electrical systems.
- Include electronic accessories and basic computer control.
- Explore practically about the components present in an Automotive electrical and electronics system.

UNIT I FUNDAMENTALS OF INTEGRATED LOGIC **9**

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II MODERN SENSORS **9**

Film sensors, micro-scale sensors, Particle measuring systems, Vibration Sensors, SMART sensors, Machine Vision, Multi-sensor systems Applications of Sensors: Applications and case studies of Sensors in Automobile Engineering, Aeronautics, Machine tools and Manufacturing processes.

UNIT III CHARGING SYSTEM **9**

Generation of Direct Current- Shunt Generator Characteristics- Armature Reaction- Third rush Regulation- Cutout. Voltage and Current Regulators- Compensated Voltage Regulator Alternators Principle and Constructional Aspects and Bridge Rectifiers- New Developments.

UNIT IV AUTOMOTIVE TRANSMISSION CONTROL SYSTEMS **9**

Transmission control - Cruise control – Braking control – Traction control –Suspension control – Steering control – Stability control – Integrated engine control.

UNIT V ELECTRONICS SYSTEMS **9**

Current Trends in Automotive Electronic Engine Management System- Types of EMS Electromagnetic interference Suppression- Electromagnetic Compatibility- Electronic Dashboard

CHAIRMAN 27/05
BOS/ECE

Instruments- Onboard Diagnostic System- Security - Warning System infotainment and Telematics.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the fundamentals, operation, function of various sensors and actuators in engine management systems.
- Enumerate the principles, application, construction and specification of different sensors and actuators usable in typical automobile by suitable testing
- List out the principles and characteristics of charging system components and demonstrate their working with suitable tools
- Explain the Automotive Transmission Control Systems.
- Describe the principles and architecture of electronics systems and its components present in an automobile related to instrumentation, control, security and warning systems.

REFERENCES:

1. Allan Bonnick, "Automotive Computer Controlled Systems", Butterworth-Heinemann, Elsevier, Indian Edition, 2011.
2. Eric Chowanietz, "Automobile Electronics" by SAE Publications, 1995
3. Tom Weather Jr and Cland C. Hunter, "Automotive Computers and Control System" Prentice Hall Inc.,1984 New Jersey.
4. R.K. Jurgen, "Automotive Electronics Handbook", McGraw Hill 2nd Edition,1995
5. William B Ribbens, "understanding automotive electronics", 5th edition - Butter worth Heinemann Woburn, 1998.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	1	-	2	-	-	-	2	-
2	1	-	2	-	2	-	2	2
3	1	-	2	-	2	-	2	-
4	1	-	2	3	3	-	2	-
5	1	-	2	-	-	-	2	-
Avg	1	-	2	3	2	-	2	2

CHAIRMAN 27/05
BOS/ECE

PG24AE104PE ROBOTICS **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the concepts of robotic Systems.
- Study the concept of robotics kinematics and dynamics.
- Understand the concepts of various Techniques in robotics Control.
- Gain the knowledge about robot Intelligence and Task Planning.
- Learn the concept of robotics with respect to Industrial applications.

UNIT I INTRODUCTION TO ROBOTICS **9**

Robotics - History - Classification and Structure of Robotic Systems - Basic Components – Degrees of Freedom - Robot Joints Coordinates - Reference Frames - Workspace- Robot Languages - Robotic Sensors - Proximity and Range Sensors, Ultrasonic Sensor, Touch and Slip Sensor.

UNIT II ROBOT KINEMATICS AND DYNAMICS **9**

Kinematic Modeling: Translation and Rotation Representation, Coordinate Transformation, DH Parameters, Forward and Inverse Kinematics, Jacobian, Dynamic Modeling: Forward and Inverse Dynamics, Equations of Motion using Euler-Lagrange Formulation, Newton Euler Formulation.

UNIT III ROBOTICS CONTROL **9**

Control of Robot Manipulator - State Equations - Constant Solutions - Linear Feedback Systems, Single - Axis PID Control - PD Gravity Control - Computed Torque Control, Variable Structure Control and Impedance Control.

UNIT IV ROBOT INTELLIGENCE AND TASK PLANNING **9**

Artificial Intelligence - Techniques - Search Problem Reduction - Predicate Logic Means and End Analysis - Problem Solving - Robot Learning - Task Planning - Basic Problems in Task Planning - AI in Robotics and Knowledge based Expert System in Robotics.

UNIT V INDUSTRIAL ROBOTICS **9**

Robot Cell Design and Control - Cell Layouts - Multiple Robots and Machine Interference - Work Cell Design - Work Cell Control - Interlocks - Error Detection Deduction and Recovery - Work Cell Controller - Robot Cycle Time Analysis, Safety in Robotics, Applications of Robot and Future Scope.

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

On successful completion of this course, the students will be able to,

- Describe the fundamental concepts of Robotics.
- Apply the concept of Kinematics and Dynamics in Robotics.
- Discuss the various Robot Control Techniques.
- Summarize the basics of intelligence in Robotics and Task Planning.
- Apply the concept of Robotics in Industrial Applications.

REFERENCES:

1. John J. Craig, "Introduction to Robotics (Mechanics and Control)", Addison-Wesley, 2nd Edition, 2004.
2. Richard D. Klafter, Thomas A. Chmielewski, Michael Negin, "Robotics Engineering: An Integrated Approach", PHI Learning, New Delhi, 2009.
3. K.S.Fu, R.C.Gonzalez and C.S.G.Lee, "Robotics Control, Sensing, Vision and Intelligence", Tata McGraw Hill, 2nd Reprint, 2008.
4. Reza N.Jazar, "Theory of Applied Robotics Kinematics, Dynamics and Control", Springer,1st Indian Reprint, 2010.
5. Mikell. P. Groover, Michell Weis, Roger. N. Nagel, Nicolous G. Odrey, 'Industrial Robotics Technology, Programming and Applications', McGraw Hill, Int 2012.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	1	-	1	3	-	-	2	-
2	1	-	1	3	1	-	2	1
3	1	-	1	3	1	-	2	1
4	1	-	1	3	1	-	2	1
5	2	-	1	3	3	-	2	2
Avg	1	-	1	3	2	-	2	1

CHAIRMAN 27/05
BOS/ECE

PG24AE105PE MICRO ELECTRO MECHANICAL SYSTEMS **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the basic operation of sensors and actuators
- Distinguish the operation of major classes of MEMS devices/systems
- Apply the fundamentals of standard micro fabrication techniques and processes
- Incorporate the unique demands, environments and applications of MEMS devices
- Understand RF MEMS, Bio MEMS and MOEMS

UNIT I INTRODUCTION TO MEMS **9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS **9**

Electrostatic sensors – Parallel plate capacitors – Applications – Inter digitated Finger capacitor- Piezo resistive sensors – Piezo resistive sensor materials - piezoelectric effects – piezoelectric materials-Stress analysis of mechanical elements – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micro magnetic components.

UNIT III MICROMACHINING **9**

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies –Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT IV POLYMER AND OPTICAL MEMS **9**

Polymers in MEMS – SU-8, PMMA, PDMS, Langmuir – Blodgett Films, Micro System fabrication – Photolithography – Ion implantation- Diffusion – Oxidation – Chemical vapor deposition – Etching- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

CHAIRMAN 27/05
BOS/ECE

UNIT V OVERVIEW OF MEMS AREAS 9

Bonding techniques for MEMS: Surface bonding, Anodic bonding, Silicon - on - Insulator, wire bonding , Scaling – Assembly of micro systems- RF MEMS - switches, active and passive components, Bio MEMS – Micro fluidics, Digital Micro fluidics, Ink jet printer,- MOEMS – opticalswitch, optical cross-connect, tunable VCSEL, micro bolo meters.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Analyze the working principles of micro sensors and actuators
- Understand the application of scaling laws in the design of micro systems
- Apply the typical materials used for fabrication of micro machines
- Design the principles of standard micro fabrication techniques
- Identify the challenges in the design and fabrication of RF, Bio, and MOEMS Systems.

REFERENCES:

1. Stephen D Senturia, "Micro system Design", Springer Publication, 2000
2. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2012
3. Marc J. Madou, "Fundamentals of Microfabrication: The Science of Miniaturization", 2nd Edition, 2002.
4. Nadim Maluf, "An Introduction to Micro Electro Mechanical System Design", ArtechHouse,2000.
5. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton,2001.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	1	-	2	3	3	3	2	1
2	1	-	3	3	3	3	1	1
3	1	-	3	3	3	2	2	-
4	1	-	2	3	2	3	2	1
5	1	-	2	2	3	3	2	-
Avg	1	-	2	3	3	3	2	1

CHAIRMAN 27/05
BOS/ECE

PG24AE201 SUB MICRON CIRCUIT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Understand the concepts of MOS large signal model and small signal model
- Provide in-depth understanding of the analog integrated circuit and building blocks
- Study the methodologies for analysis and design of fundamental CMOS Analog and Mixed signal Circuits like Data Converters and filters.
- Learn the Analog and Digital layout design for mixed signal circuits
- Design the integrated circuits like oscillators and PLLs.

UNITI INTRODUCTION AND BASIC MOS DEVICES 9

Challenges in analog design-Mixed signal layout issues- MOS FET structures and characteristics-large signal model – small signal model- single stage Amplifier-Source follower Common gate stage – Cascode.

UNIT II SUBMICRON CIRCUIT DESIGN 9

Submicron CMOS process flow, Capacitors and resistors, Current mirrors, The MOSFET Switch, Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise - OP Amp parameter

UNIT III DATA CONVERTERS 9

Characteristics of Sample and Hold- Digital to Analog Converters- architecture-Differential Non linearity-Integral Non linearity- Voltage Scaling-Cyclic DAC-Pipeline DAC-Analog to Digital Converters- architecture – Flash ADC-Pipeline ADC-Differential Non linearity-Integral Non linearity. Overview of SNR of Data Converters- Clock Jitters- Improving Using Averaging – Decimating Filters for ADC- Band pass and High Pass Sinc Filters- Interpolating Filters for DAC.

UNIT IV ANALOG AND DIGITAL LAYOUT DESIGN FOR MIXED SIGNAL 9

Layout introduction: Introduction, MOS transistor layers, stick diagram, symbolic diagram. Digital layout design: Introduction, guide line of transistor layout, PMOS and NMOS transistor layout, CMOS transistor layout. Introduction to analog layout techniques and Passive component layout - capacitor, resistor and inductor, Floor planning of analog and digital components, power supply and ground pin issues, matching, shielding, interconnection issues.

CHAIRMAN 27/05
BOS/ECE

UNIT V OSCILLATORS AND PLL 9

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops. Applications of PLL, frequency multiplication and synthesis. Introduction to RF IC Design, building blocks, applications.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Carry out research and development in the area of analog and mixed signal IC design.
- Well versed with the MOS fundamentals, small signal models and analysis of MOSFET based circuits.
- Analyze and design the CMOS circuit model using data converters.
- Understand and Design of analog and digital layout design for different mixed signal circuits using various applications as per the user specifications.
- Design an mixed signal circuits such as Comparator, ADCs, DACs, PLL.

REFERENCES:

1. P. Allen and D. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2nd Edition, 2012.
2. B. Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003.
3. R. Jacob Baker, H.W. Li, and D.E. Boyce "CMOS Circuit Design, Layout and Simulation", Prentice-Hall of India, 1998.
4. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, "Analysis and Designof Analog Integrated Circuits", Wiley Publishers, 5th Edition, 2009.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	1	1	2	3	3	3	3	-
2	2	-	3	3	3	3	-	1
3	-	1	2	3	2	2	3	-
4	1	-	2	3	2	3	2	1
5	-	2	2	2	3	3	1	-
Avg	1	1	2	3	3	3	2	1

CHAIRMAN
BOS/ECE

PG24AE202 IoT FOR SMART SYSTEMS **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Acquire knowledge about fundamentals of Internet of Things.
- Understand the various architecture types used for IoT.
- Illustrate the connectivity technologies and protocols for IoT.
- Apply knowledge with Arduino and Raspberry Pi for IoT system design.
- Learn the various IoT case studies.

UNIT I INTRODUCTION TO IoT **9**

Characteristics of IoT - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates – IoT Platforms Design Methodology- Domain Specific IoTs - M2M.

UNIT II IoT ARCHITECTURE **9**

M2M High Level ETSI Architecture - IETF Architecture For IoT - OGC Architecture – IoT Reference Model - Domain Model - Information Model - Functional Model - Communication Model - IoT Reference Architecture.

UNIT III IoT CONNECTIVITY TECHNOLOGIES AND PROTOCOLS **9**

Bluetooth – Wireless Fidelity(Wi-Fi) - Zigbee - Radio Frequency Identification (RFID) – Near Field Communication (NFC) - LoRA- IPv6 over Low power WPAN (6LoWPAN)- Message Queue Telemetry Transport Protocol (MQTT) - Constrained Application Protocol(CoAP).

UNIT IV IoT SYSTEM DESIGN WITH RASPBERRY PI **9**

IoT Device - Building blocks - Raspberry Pi Board - Linux on Raspberry Pi - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Interfacing an LED and switch, Interfacing a LDR- Interfacing an Ultrasonic Sensor - Interfacing a DHT Sensor - Interfacing a PIR Sensor - Interfacing a Soil Moisture Sensor- Interfacing a Stepper Motor.

UNIT V IoT CASE STUDIES **9**

Different Types of Sensors used in IoT Applications - Home Automation – Smart Parking – Weather Monitoring- Air Pollution Monitoring- Forest Fire Detection - Patient Health Monitoring- Smart Irrigation – Structural Health Monitoring

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

At the end of the course, the students should be able to:

- Explain the characteristics and components needed for an IoT system design.
- Build the different types of architecture used for IoT.
- Analyze the connectivity technologies and protocols used for IoT.
- Apply the programming with Raspberry Pi for IoT systems.
- Implement the various IoT application case studies

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, " Internet of Things, A Hands-on-Approach", 1st Edition, Universities press Pvt. Ltd., India, 2015.
2. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

REFERENCES:

1. Sudip Mishra, Anandarup Mukherjee and Arijit Roy, " Introduction to IoT", Cambridge University Press,2021.
2. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, and Mahendra Swain, "Internet of things with Raspberry pi and Arduino", CRC Press Taylor & Francis Group,2020.
3. Peter Waher, "Learning Internet of Things", 1st Edition, Packt Publishing Ltd, UK, 2015.
4. Jeeva Jose, "Internet of Things", Khanna Book Publishing House, New Delhi,2018.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	1	-	-	2	2	2	3	3
2	2	-	-	2	1	2	2	3
3	-	-	-	2	3	3	3	3
4	2	-	-	2	3	2	2	3
5	3	-	-	2	2	2	2	3
Avg	2	-	-	2	2	2	2	3

CHAIRMAN 27/05
BOS/ECE

PG24AE204 SOFT COMPUTING AND OPTIMIZATION TECHNIQUES L T P C

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn the concept of fuzzy logic, design of fuzzy logic controller and its applications
- Study the Supervised Learning and Unsupervised Learning techniques in neural networks
- Learn mathematical background for optimized genetic programming.
- Be exposed to neuro-fuzzy hybrid systems and its applications.
- Understand the various evolutionary optimization techniques.

UNITI FUZZY LOGIC **9**

Introduction to Fuzzy logic - Fuzzy sets and membership functions - Operations on Fuzzy sets Fuzzy relations, rules, propositions, implications, and inferences - Defuzzification techniques- Fuzzy logic controller design - Applications of Fuzzy logic. Case Study: Fuzzy Logic Control in Smart Appliances

UNIT II ARTIFICIAL NEURAL NETWORKS **9**

Basic concepts and major classes of neural networks, supervised and unsupervised learning, Single-layer perceptron, Multi - layer perceptron, Back Propagation Neural network, Recurrent neural networks, support vector machine, Application of neural network modeling Case Study: Neural Networks for Stock Market Prediction

UNITIII GENETIC ALGORITHM **9**

Genetic basic concepts - Genetic algorithm - operators - Fitness evaluation - crossover - mutation - Traditional optimization and search techniques - Travelling Salesman Problem, Particle swam optimization, Ant colony optimization, Case Study: Genetic Algorithms for Robot Path Planning

UNIT IV NEURO-FUZZY MODELING **9**

Adaptive Neuro - Fuzzy Inference Systems (ANFIS) Architecture - Coactive Neuro - Fuzzy Modeling, framework, neuron functions for adaptive networks - Neuro fuzzy spectrum - Analysis of Adaptive Neuro - Fuzzy Control. Case Study: Hybrid Approach for Medical Diagnosis

UNIT V CONVENTIONAL OPTIMIZATION TECHNIQUES **9**

Introduction to optimization techniques, Unconstrained optimization - gradient search method - Gradient of a function, steepest gradient method, Newton's Method, Marquardt Method,

CHAIRMAN
BOS/ECE

Constrained optimization – sequential linear programming, Interior and external penalty function method. Case Study: Anomaly Detection in Network Traffic

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Develop application on different soft computing techniques like Fuzzy, Neural Neuro-Fuzzy system.
- Summarize the concept of Supervised and Unsupervised Learning techniques inneural networks
- Develop the various applications using genetic algorithms
- Apply Neuro Fuzzy systems for clustering and classification
- Apply various optimization techniques to solve the real world problems

REFERENCES:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and MachineLearning", Addison wesley, 2009.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications",Prentice Hall, 1995.
4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "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. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	2	-	2	2	2	-	1	1
2	2	-	2	2	2	-	1	1
3	2	-	2	2	2	-	1	1
4	2	-	2	2	2	-	1	1
5	2	-	2	2	2	-	1	1
Avg	2	-	2	2	2	-	1	1

CHAIRMAN 27/05
BOS/ECE

24MC002	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	L T P C 3 0 0 3

OBJECTIVES

The Students should be made to:

- Understand the need of value education and human aspiration
- Know the difference between self and body
- Recognize the harmony in the family and society
- Understand harmony in nature
- Identify the human values and ethics

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Value Education – need and process, Self-Exploration – process, Basic Human Aspirations - Continuous Happiness and Prosperity, Basic requirement for fulfillment of Human Aspirants, Understanding Happiness and Prosperity – Continuity of Happiness from Physical Facility.

UNIT II HARMONY IN THE HUMAN BEING 9

Human being as a co-existence of the self and the Body - The needs of Self and Body, Body as an Instrument - The Self as the Seer- Doer-Enjoyer, Harmony in the self, Harmony of the Self with the Body – Programme for Self – regulation and health.

UNIT III HARMONY IN THE FAMILY AND SOCIETY 9

Family as the basic unit of human interaction , Understanding Relationship, Trust as the foundational value, Respect as the Right Evaluation, Harmony in the society – Understanding Human Goal, Harmony from Family Order to World Family Order – Universal Human Order - Scope.

UNIT IV HARMONY IN THE NATURE AND EXISTENCE 9

Nature - as Collections of Units, Classification of Units into Four Orders, Interconnectedness, and mutual fulfillment among the four orders of nature, self-regulation in Nature, Understanding Existence as Units in Space, Existence as Co-existence.

UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 9

Natural Acceptance of Human Values - Definitiveness of Ethical Human Conduct, Humanistic Education, Humanistic Constitution, Universal Human Order, Competence in Professional Ethics,

CHAIRMAN
BOS/ECE

Holistic Technologies, Production System and Management Models- -Typical case, Strategies for Transition towards value based life and profession.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the students will be able to

- Understand the significance of value education and distinguish between values and skills.
- Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
- Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings.
- Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
- Distinguish between ethical and unethical practices and understand the human values.

TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values andProfessional Ethics, Excel Books, New Delhi, 2nd Revised Edition, 2019.

REFERENCES:

1. Tripathi A N, "Human Values", New Age Intl. Publishers, New Delhi, 2009.
2. Govindarajan M, Natrajan S and Senthilkumar V S, "Engineering Ethics (Including Human Values)", Eastern Economy, PHI, 12th Edition, 2011.
3. Govindarajan M and Natrajan S, "Professional Ethics and Human Values", PHI, 2011.
4. Banerjee B P, "Foundation of Ethics and Management", Excel Publication, 2005.
5. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co, Lucknow, Reprinted 2008.
6. Seebauer and Robert L Berry, "Fundamentals of Ethics for Scientist and Engineers", Oxford University Press, 2000.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	2	-	3	-	-	-	-	-
2	2	-	2	-	-	-	-	-
3	2	-	2	-	-	-	-	-
4	2	-	2	-	-	-	-	-
5	3	-	3	-	-	-	-	-
Avg	2	-	2	-	-	-	-	-

CHAIRMAN
BOS/ECE

PG24AE201L VLSI AND IoT LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

The Student should be made to:

- Study and simulate the combinational and sequential logic circuits
- Understand the implementation of digital logic circuits and modules with FPGA.
- Learn and understand the designing of CMOS logic circuits,.
- Gain knowledge on sensors, actuators and other electronic devices used for interfacing with Raspberry pi /Arduino
- Acquire knowledge with Arduino/Raspberry Pi for IoT system design.

LIST OF EXPERIMENTS:

1. Modeling of Combinational Digital System Circuits using Verilog and VHDL
2. Modeling of Sequential Digital System Circuits using Verilog and VHDL
3. Design and Implementation of ALU using FPGA
4. Implementation of Bluetooth with FPGA
5. Design and Simulation of basic logic gates using CMOS
6. Design and Simulation of Full adder using CMOS
7. Interfacing of LED and Switch with Arduino/Raspberry Pi
8. Sensor interfacing with Arduino/Raspberry Pi
9. Actuator interfacing with Arduino/Raspberry Pi
10. LED and Motor control using Bluetooth
11. Home Automation System using IoT
12. Weather Monitoring System using IoT

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Apply the HDL programming for designing the combinational and sequential logic circuits.
- Demonstrate the FPGA implementation of digital logic circuits and modules.
- Analyze the CMOS logic circuits using EDA/SPICE tools.
- Utilize the different types of sensors, actuators and electronic devices for IoT prototyping.
- Implement the Arduino/Raspberry Pi for various IoT applications.

CHAIRMAN
BOS/ECE

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	3	-	-	3	-	2	2	-
2	2	-	-	3	-	3	2	-
3	1	-	-	3	-	2	2	-
4	2	-	-	2	2	2	2	3
5	2	-	-	2	2	2	2	3
Avg	2	-	-	3	2	2	2	3

CHAIRMAN
BOS/ECE

PG24AE201PE ANALOG INTEGRATED CIRCUIT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Understand the single stage amplifiers using PMOS and NMOS driver circuits with different loads.
- Learn the frequency response concepts of multi-stage amplifiers and noise characteristics.
- Gain the basic concepts of amplifiers and develop different stages of operational amplifiers.
- Know about various compensation techniques of operational amplifier.
- Study different types of current mirrors, active loads, voltage and current reference circuits

UNIT I SINGLE STAGE AMPLIFIERS **9**

Common source stage, Source follower, Common gate stage, Cascode stage, Single ended and differential operation, Basic differential pair, Differential pair with MOS loads.

UNIT II MULTISTAGE AMPLIFIER AND NOISE ANALYSIS **9**

Miller effect, Association of poles with nodes, frequency response of common source stage, Source followers, Common gate stage, Cascode stage, Differential pair, Statistical characteristics of noise, noise in single stage amplifiers, noise in differential amplifiers.

UNIT III OPERATIONAL AMPLIFIERS **9**

Concept of negative feedback, 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 FREQUENCY COMPENSATION **9**

General considerations, Multi-pole systems, Phase Margin, Frequency Compensation, compensation of two stage Op Amps, Slewing in two stage Op Amps, Other compensation techniques.

UNIT V CURRENT MIRROR, ACTIVE LOADS AND REFERENCES **9**

Basic current mirrors - Cascode current mirrors, active loads, voltage and Current references – supply Insensitive biasing, Temperature Insensitive biasing, Matching Considerations – current mirror.

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

On successful completion of this course, the students will be able to,

- Design single stage amplifiers with MOS loads
- Analyze the concepts of frequency response in various multistage amplifiers and noise characteristics.
- Examine the performance of different stages in operational amplifiers
- Analyze multi-pole systems and the frequency compensations techniques.
- Design simple current mirror circuits and biasing circuits.

REFERENCES:

1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", 5th Edition, Wiley, 2009.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2001.
3. Willey M.C. Sansen, "Analog design essentials", Springer, 2006.
4. Grebene, "Bipolar and MOS Analog Integrated circuit design", John Wiley & Sons Inc., 2003.
5. Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", 2nd edition, Oxford University Press, 2002.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	2	1	2	-	1	-
2	-	-	2	-	-	2	1	2
3	2	-	-	-	1	-	1	2
4	-	-	1	-	3	-	1	-
5	-	-	-	1	1	3	1	1
Avg	2	-	2	1	2	3	1	2

CHAIRMAN 27/05
BOS/ECE

PG24AE202PE SPEECH AND AUDIO SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Gain a foundational understanding of the mechanics of speech production and audio perception.
- Understand the principles behind filter banks and transforms used in audio processing.
- Explore various audio coding methods, including lossless and lossy compression.
- Analyze time and frequency domain speech processing methods.
- Examine the concepts of Linear Prediction Coding (LPC) for speech analysis and coding.

UNIT I INTRODCUTION TO SPEECH AND AUDIO SIGNAL 9

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

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

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

UNIT III AUDIO CODING AND TRANSFORM CODERS 9

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

CHAIRMAN 27/05
BOS/ECE

UNIT IV TIME AND FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING 9

Time domain parameters of speech signal - methods for extracting the parameters :energy, average magnitude - zero crossing rate - silence discrimination using zcr and energy short time fourier analysis - formant extraction - pitch extraction using time and frequency domain methods homomorphic speech analysis: cepstral analysis of speech - formant and pitch estimation - homomorphic vocoders.

UNIT V PREDICTIVE ANALYSIS OF SPEECH 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Explain the process of speech production and the nature of speech signals.
- Explore these fundamental frequency domain transforms used for audio signal analysis.
- Design and apply filter banks for audio coding applications.
- Analyze speech and audio signals using time-domain parameters (energy, ZCR) and frequency-domain techniques (short-time Fourier analysis).
- Apply your knowledge of speech and audio processing techniques to real-world problems.

REFERENCES:

1. B.Gold and N.Morgan, "Speech and Audio Signal Processing", Wiley and Sons, 2000.
2. L.R.Rabiner and R.W.Schaffer, "Digital Processing of Speech Signals", Prentice Hall, 1978.
3. Mark Kahrs, Karlheinz Brandenburg, Kluwer Applications of Digital Signal Processing to Audio And Acoustics, Academic Publishers,
4. Udo Zlzer, "Digital Audio Signal Processing", 2nd Edition A John Wiley & sons Ltd

CHAIRMAN 27/05
BOS/ECE

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	-	-	-	-	1	-
2	2	-	-	2	2	-	1	1
3	2	-	-	2	2	-	1	1
4	2	-	-	3	3	-	1	1
5	2	-	2	2	2	-	1	1
Avg	2	-	2	2	2	-	1	1

CHAIRMAN 27/05
BOS/ECE

PG24AE203PE HIGH PERFORMANCE NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Learn how different network types (like DSL and WiFi) handle data and how fast they can be.
- Explore how to create apps that stream audio and video smoothly.
- Discover tools like VPNs and firewalls to keep your data safe online.
- Learn techniques to understand how much traffic a network can handle.
- Explore tools and strategies to keep your network protected.

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.MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, 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.

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.

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

On successful completion of this course, the students will be able to,

- Analyze and evaluate the performance characteristics of different network technologies.
- Design and implement solutions for multimedia networking applications that prioritize real-time traffic.
- Critically assess the suitability of various network security protocols for different scenarios.
- Troubleshoot and optimize network performance using traffic modeling techniques
- Evaluate and assess the network security and management.

REFERENCES:

1. Aunurag Kumar, D. M Anjunath, Joy Kuri, "Communication Networking", Morgan Kaufmann Publishers, 1st edition 2004.
2. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet", 5th edition, Pearson education 2006
3. Hersent Gurle & Petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003
4. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, 2nd edition, 2003
5. Larry l. Peterson & Bruce S. David, "Computer Networks: A System Approach"- 1996
6. LEOM- GarCIA, WIDJAJA, "Communication networks", TMH 7th reprint 2002.
7. Nader F. Mir , "Computer and Communication Networks, 1st edition 2010
8. Walrand .J. Varatya, "High performance communication network", Morgan Kauffman - Harcourt Asia Pvt. Ltd. 2nd Edition, 2000

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	3	-	2	-	-	-	2	2
2	-	-	-	2	-	2	2	2
3	3	-	2	-	2	-	2	2
4	3	1	2	-	2	-	2	2
5	-	1	-	-	-	-	2	2
Avg.	3	1	2	2	2	2	2	2

CHAIRMAN 27/05
BOS/ECE

PG24AE204PE NANO TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Understand basics concepts of nano electronics
- Learn basics of semiconductor materials
- Understand basics of MOSFETs and nano electronics
- Learn the Advanced nanoscale devices:
- Exploration about biosensors

UNIT I INTRODUCTION TO NANOELECTRONICS **9**

Introduction to nanoelectronics, Limitations of conventional microelectronics, Classical Particles, Classical Waves and Quantum Particles - Quantum Mechanics of Electronics - Schrodinger wave equation.

UNIT II MATERIALS FOR NANOELECTRONICS **9**

Introduction- Semiconductors, Crystal lattices: Bonding in crystals - Electron energy bands - Semiconductor hetero structures – Lattice - matched and pseudo morphic hetero structures- Carbon Nano materials: nano tubes and fullerenes..

UNIT III SHRINK - DOWN APPROACHES **9**

Moore's Law - Technology Scaling and Reliability Challenges, Basic MOS Transistor - Types, Modes of operation, n-MOS operation, Drain Current, Threshold Voltage, Energy band diagram of MOSFET, nanoscale MOSFET, SCEs-limits to scaling, system integration limits.

UNIT IV ADVANCED NANOSCALE DEVICES **9**

Double Gate MOSFETs, Tri-Gate MOSFETs, Tunnel FETs - Multi-Gate TFETs and Heterojunction TFETs - Graphene and Carbon Nanotube Transistors, FinFETs.

UNIT V FET BASED BIOSENSORS **9**

Principles- Components of biosensor - Classification of Biosensors based on transducers, FET based Biosensor - ion-sensitive field effect transistor-operation and fabrication - Characteristics and Performance.

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

At the end of the course, the students should be able to:

- Understand the basic concepts of nano electronics and various aspects of nano electronics
- Summarize the basic knowledge of Semiconductor materials and carbon nano tubes.
- Get knowledge of MOSFETs and nano Electronics Applications
- Familiarity with Advanced nanoscale Devices.
- Understanding of Biosensors and Applications

REFERENCES:

1. G.W. Hanson, Fundamentals of Nano electronics, Pearson, 2009.
2. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, "Introduction to Nano electronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press 2011.
3. Pierre R. Coulet, Loïc J. Blum, Biosensor Principles and Applications, CRC press- 2019.
4. Donald A. Neamen, "Semiconductor Physics and Devices Basic Principles", 3rd Edition, McGraw-Hill Higher- Education, 2003.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	2	-	1	1	2	-	3	1
2	2	-	1	1	1	-	3	1
3	2	-	1	1	3	-	3	1
4	2	-	1	1	2	-	3	1
5	2	-	1	1	3	-	3	1
Avg	2	-	1	1	2	-	3	1

CHAIRMAN 27/05
BOS/ECE

PG24AE205PE HARDWARE SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

The Student should be made to:

- Familiarize students with various hardware attacks.
- Analyze Countermeasures and Secure System Designs
- Explore Passive and Active Bus Probing
- Examine Data Forgery on Communication Links
- Demonstrate Physical Attacks and Security Issues

UNIT I INTRODUCTION TO HARDWARE SECURITY 9

Overview of the computing system, Layers of computing system, Hardware security vs hardware trust, Attacks, Vulnerabilities and counter measures, Conflict between security and Test/Debug, Evolution of Hardware security, Birds eye view, Common hardware security primitives, Performance reliability vs security, Security architecture.

UNIT II HARDWARE TROJANS 9

Introduction, SoC design flow, Hardware Trojans, Hardware Trojans in FPGA designs, Hardware Trojans taxonomy, Trust benchmarks, Countermeasures against Hardware Trojans, Software induced hardware trojan attacks.

UNIT III SIDE-CHANNEL ATTACKS 9

Introduction, Background on side-channel attacks, Power analysis attacks, Electromagnetic side-channel attacks, Fault injection attacks, Timing attacks, Covert channels, Side channel resistant design, Software induced side channel attacks.

UNIT IV TEST ORIENTED ATTACKS 9

Introduction, scan based attacks, JTAG based attacks, Pre-silicon security and trust assessment for SoCs, Post-silicon security and trust assessment for SoCs.

UNIT V PHYSICAL ATTACKS AND COUNTER MEASURES 9

Introduction, Reverse engineering, Probing attacks, Invasive fault injection attack, Security issues in IP based SoC design, Security issues in FPGA, PCB security challenges and attack modes.

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

At the end of the course, the students should be able to:

- Understanding of Hardware Attacks
- Ability to Analyze Counter measures
- Proficiency in Bus Probing Techniques
- Understanding of Data Forgery
- Demonstration of Physical Attack Awareness

REFERENCES:

1. Swarup Bhunia, Mark Tehranipoor, "Hardware Security A hands on learning approach", Morgan Kaufmann Publisher, An Imprint of Elsevier.
2. Douglas R Stinson, "Cryptography: Theory and practice", CRC Press
3. Alfread J Menezes, Paul C Van Oorschot, Vanstone, A. Scott "Handbook of applied Cryptography", CRC Press
4. Stefan Mangard, Elisabeth Oswald, Thomas Popp, "Power analysis attacks: Revealing the secrets of smart cards", Springer - Verla.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	1	-	1	1	2	-	2	1
2	1	-	1	1	2	-	-	-
3	1	-	1	2	2	-	2	-
4	1	-	1	1	-	-	2	1
5	1	-	1	1	2	-	2	1
Avg	1	-	1	1	2	-	2	1

CHAIRMAN 27/05
BOS/ECE

PG24AE206PE	DSP PROCESSOR ARCHITECTURE AND PROGRAMMING	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Comprehends the knowledge & concepts of programmable digital signal processors
- Develop the programming knowledge using Instruction set of DSP Processors.
- Get idea about functions of On-chip Peripherals and it's Instruction set
- Get familiar with the advanced DSP processor architectures and programming
- Introduce architectural features of programmable DSP Processors of TI.

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs **9**

Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals, Applications of Programmable DSPs.

UNIT II TMS320C5X PROCESSOR **9**

Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals, Application Programs for processing real time signals.

UNIT III TMS320C6X PROCESSOR **9**

Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, On-chip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples for Signals and Noise generation, Frequency analysis, Filter design.

UNIT IV ADSP PROCESSORS **9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V ADVANCED PROCESSORS **9**

Study of TI's advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP's Blackfin and Sigma DSP Processors, NXP's DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors.

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

On successful completion of this course, the students will be able to,

- Distinguish between the architectural features of DSP processors and programmable DSP
- Able to write simple assembly language programs using instruction set of TMS320C5x
- Able to distinguish between the architectural features of general purpose processors and DSP processors..
- Illustrate Architectural features of advanced programmable DSP devices.
- Analyze the performance of TI processors family and Compare the features of TI and various DSP's

REFERENCES:

1. B. Venkataramani and M. Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications", Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. Avtar Singh and S. Srinivasan, "Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx", Cengage Learning India Private Limited, Delhi 2012.
3. RulphChassaing and Donald Reay, "Digital Signal Processing and Applications with the C6713 and C6416 DSK", John Wiley & Sons, Inc., Publication, 2012 (Reprint).
4. User guides Texas Instruments, Analog Devices and NXP.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	-	-	-	-	-	-
2	-	-	1	3	3	-	2	-
3	-	-	1	3	3	-	2	-
4	1	-	1	2	2	-	1	1
5	-	-	-	-	-	-	-	-
Avg	1	-	1	3	3	-	2	1

CHAIRMAN 27/05
BOS/ECE

PG24AE207PE VLSI FOR WIRELESS COMMUNICATION **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand the concepts of basic wireless communication concepts.
- Study the parameters in receiver and low noise amplifier design.
- Study the various types of mixers designed for wireless communication.
- Study and design PLL and VCO.
- Understand the concepts of transmitters and power amplifiers in wireless communication

UNIT I COMMUNICATION CONCEPTS **9**

Introduction – Overview of Wireless systems – Standards – Access Methods – Modulation schemes – Classical channel – Wireless channel description – Path loss – Multipath fading – Standard Translation.

UNIT II RECEIVER ARCHITECTURE & LOW NOISE AMPLIFIERS **9**

Receiver front end – Filter design – Non-idealities – Design parameters – Noise figure & Input intercept point. LNA Introduction – Wideband LNA design – Narrow band LNA design: Impedance matching & Core amplifier.

UNIT III MIXERS **9**

Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion – Noise - A Complete Active Mixer. Switching Mixer – Distortion, Conversion Gain & Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain, Distortion, Intrinsic & Extrinsic Noise in Single Ended Sampling Mixer

UNIT IV FREQUENCY SYNTHESIZERS **9**

PLL – Phase detector – Dividers – Voltage Controlled Oscillators – LC oscillators – Ring Oscillators – Phase noise – Loop filters & design approaches – A complete synthesizer design example (DECT) – Frequency synthesizer with fractional divider.

UNIT V TRANSMITTER ARCHITECTURES & POWER AMPLIFIERS **9**

Transmitter back end design – Quadrature LO generator – Power amplifier design.

TOTAL: 45 PERIODS

CHAIRMAN
BOS/ECE 27/05

OUTCOMES:

On successful completion of this course, the students will be able to,

- Able to recollect basic wireless communication concepts.
- Understand the parameters in receiver and design a low noise amplifier
- Apply his knowledge on various types of mixers designed for wireless communication.
- Design PLL and VCO
- Understand the concepts of transmitters and utilize the power amplifiers in wireless communication.

REFERENCES:

1. Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2002.
2. B.Razavi , "RF Microelectronics" , Prentice-Hall ,1998.
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" McGraw-Hill, 1999.
4. Emad N Farag and Mohamed I Elmasry, "Mixed Signal VLSI wireless design – Circuits & Systems", Kluwer Academic Publishers, 2000.
5. J. Crols and M. Steyaert, "CMOS Wireless Transceiver Design," Boston, KluwerAcademic Pub., 1997.
6. Thomas H.Lee, "The Design of CMOS Radio – Frequency Integrated Circuits",, Cambridge University Press ,2003.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	2	2	-	-	1	1
2	-	-	-	-	3	2	1	1
3	-	-	2	-	-	1	1	1
4	-	-	-	1	2	-	1	1
5	-	-	-	-	2	2	1	1
Avg	-	-	2	2	2	2	1	1

CHAIRMAN 27/05
BOS/ECE

PG24AE208PE SOLID STATE DEVICE MODELLING AND SIMULATION **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Learn fundamental and acquire knowledge in MOSFET device modeling
- Understand the techniques of device modeling and simulation
- Acquire knowledge to solve different issues using multistep method
- Study the different types of mathematical techniques in device simulations
- Know the different types devices simulation and signal analysis.

UNIT I MOSFET DEVICE PHYSICS **9**

Capacitor, Basic operation, Basic modeling, Advanced MOSFET modeling, RF modeling of MOS transistors, 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 MULTISTEP METHODS **9**

Solution of stiff systems of equations, adaptation of multistep methods to the solution of electrical networks, general purpose circuit simulators.

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 SMALL SIGNAL MODELING **9**

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

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

On successful completion of this course, the students will be able to,

- Students will have a depth of understanding in physics of solid state devices including BJT and MOSFET
- Use software to assist solid state device design, and analyze circuits using parasitic BJT parameters and Newton Raphson method.
- Model the MOS transistor using Schrodinger equation and Multistep methods.
- Apply and determine the drift diffusion equation and stiff system equation.
- Explain the importance of MOS Capacitor and Small signal modeling

REFERENCES:

1. Arora, N., "MOSFET Modeling for VLSI Simulation", Cadence Design Systems, 2007
2. Chua, L.O. and Lin, P.M., "Computer-Aided Analysis of Electronic Circuits: Algorithms and Computational Techniques", Prentice-Hall., 1975
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. Trond Ytterdal, Yuhua Cheng and Tor A. Fjeldly Wayne Wolf, "Device Modeling for Analog and RF CMOS Circuit Design", John Wiley & Sons Ltd.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	1	2	-	-	-	1	-
2	1	-	2	-	-	-	1	-
3	-	-	-	-	-	-	1	-
4	1	-	-	1	-	-	1	2
5	1	-	2	1	2	-	1	2
Avg	1	1	3	1	2	-	1	2

CHAIRMAN 27/05
BOS/ECE

PG24AE209PE	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L T P C 3 0 0 3

OBJECTIVES:

The Student should be made to:

- Gain broad conceptual understanding of the various aspects of electromagnetic (EM) interference and compatibility
- Develop a theoretical understanding of electromagnetic shielding effectiveness
- Understand ways of mitigating EMI by using shielding, grounding and filtering
- Understand the need for standards and to appreciate measurement methods
- Understand how EMI impacts wireless and broadband technologies

UNIT I INTRODUCTION & SOURCES OF EM INTERFERENCE 9

Introduction - Classification of sources - Natural sources - Man-made sources - Survey of theelectromagnetic environment.

UNIT II EM SHIELDING 9

Introduction - Shielding effectiveness - Far-field sources - Near-field sources - Low-frequency, magnetic field shielding - Effects of apertures.

UNIT III INTERFERENCE CONTROL TECHNIQUES 9

Equipment screening - Cable screening - grounding - Power-line filters - Isolation - Balancing - Signal-line filters - Nonlinear protective devices.

UNIT IV EMC STANDARDS, MEASUREMENTS AND TESTING 9

Need for standards - The international framework - Human exposure limits to EM fields – EMC measurement techniques - Measurement tools - Test environments.

UNIT V EMC CONSIDERATIONS IN WIRELESS AND BROADBAND TECHNOLOGIES 9

Efficient use of frequency spectrum - EMC, interoperability and coexistence - Specifications and alliances - Transmission of high-frequency signals over telephone and power networks – EMC and digital subscriber lines - EMC and power line telecommunications.

TOTAL: 45 PERIODS

CHAIRMAN 27/05
BOS/ECE

OUTCOMES:

On successful completion of this course, the students will be able to,

- Demonstrate knowledge of the various sources of electromagnetic interference
- Display an understanding of the effect of how electromagnetic fields couple through apertures, and solve simple problems based on that understanding
- Realize the different types of shielding, grounding methods.
- Explain the need for standards and EMC measurement methods
- Discuss the impact of EMC on wireless and broadband technologies

REFERENCES:

1. Christopoulos C, "Principles and Techniques of Electromagnetic Compatibility", CRC Press, 2nd Edition, Indian Edition, 2013.
2. Paul C R, "Introduction to Electromagnetic Compatibility", Wiley India, 2nd Edition,2008.
3. Kodali V P, "Engineering Electromagnetic Compatibility", Wiley India, 2nd Edition,2010.
4. Henry W Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons Inc,Newyork,2009.
5. Scott Bennett W, "Control and Measurement of Unintentional Electromagnetic Radiation",John Wiley& Sons Inc., Wiley Interscience Series, 1997.

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	1	-	-	3	1	-
2	-	-	1	-	-	2	1	-
3	-	-	1	-	-	3	1	-
4	-	-	1	-	-	3	1	-
5	-	-	1	-	2	3	1	-
Avg	-	-	1	-	2	3	1	-

CHAIRMAN 27/05
BOS/ECE

PG24AE210PE SENSORS AND ACTUATORS **L T P C**

3 0 0 3

OBJECTIVES:

The Student should be made to:

- Understand static and dynamic characteristics of measurement systems.
- Acquire knowledge in various types of sensors.
- Study basic concepts of self generating sensors and signal conditioning methods.
- Gain knowledge about different types of actuators.
- Study State-of-the-art digital and semiconductor 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 and dynamic characteristics of measurement systems, zero-order, firstorder, 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 LVDT.

UNIT III 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 IV ACTUATORS DRIVE CHARACTERISTICS AND APPLICATIONS **9**

Relays, Solenoid drive, Stepper Motors, Voice-Coil actuators, Servo Motors, DC motors and motor control, 4-to-20 mA Drive, Hydraulic actuators, variable transformers: synchros, resolvers, Inductosyn, resolver-to-digital and digital-to-resolver converters.

CHAIRMAN 27/05
BOS/ECE

UNIT V DIGITAL SENSORS AND SEMICONDUCTOR DEVICE SENSORS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, the students will be able to,

- Have an exposure to basics and general concepts of measurement systems.
- Design a different applications by using resistive and reactive sensors
- Analyze the performance of self-generating Sensors.
- Analyze the performance of resistive and reactive sensors.
- Evaluate digital sensors and semiconductor device sensors performance metrics

REFERENCES:

1. Andrzej M. Pawlak,"Sensors and Actuators in Mechatronics Design and Applications", 2006.
2. D. Johnson, "Process Control Instrumentation Technology", 8th Ed, 2014, John Wiley and Sons.
3. D.Patranabis, "Sensors and Transducers", TMH 2003
4. E.O. Doeblin, "Measurement System: Applications and Design", McGraw Hill publications,1996
5. Graham Brooker, "Introduction to Sensors for ranging and Imaging", Yesdee, 2009.
6. Herman K.P. Neubrat, "Instrument Transducers – An Introduction to TheirPerformance and Design", Oxford University Press. 22,1999.
7. Ian Sinclair, Sensors and Transducers, Elsevier, 3rd Edition, 2011.
8. Jon Wilson , "Sensor Technology Handbook", Newne 2004.
9. Kevin James, PC Interfacing and Data acquisition, Elsevier, 2011Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2002.
10. Ramon PallásAreny, John G. Webster, "Sensors and Signal conditioning", 2nd edition, John Wiley and Sons, 2000.
11. Sensors and Actuators: Control System Instrumentation, Clarence W. de Silva CRC Press, 2007
12. B.Razavi ,"RF Microelectronics" , Prentice-Hall ,1998.

CHAIRMAN 27/05
BOS/ECE

MAPPING OF COs WITH POs AND PSOs

Course Outcomes	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
1	-	-	1	2	-	3	1	-
2	1	-	2	1	-	2	1	-
3	2	-	1	2	1	3	1	-
4	-	-	1	2	1	2	1	-
5	1	-	1	2	3	3	1	1
Avg	1	-	1	2	1	3	1	1

CHAIRMAN 27/05
BOS/ECE