MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI
PG COURSES – AFFILIATED COLLEGES
Course Structure for M.Sc . Electronics
(Choice Based Credit System)
(with effect from the academic year 2016- 2017 onwards)
(45th SCAA meeting held on 09.02.2017)

Sem.	Sub. No.	Sub. status	Sub Title	Hrs/ Week	Credits	Marks				
						Maximum			Passing Minimum	
						Int.	Ext.	Tot.	Ext	Tot.
III	12	Core-7	Electromagnetic Theory	6	5	25	75	100	38	50
	13	Core-8	Nano Electronics	6	5	25	75	100	38	50
	14	Core-9	Digital design using VHDL	6	5	25	75	100	38	50
	15	Core 10	Research Methodology for Electronics	6	5	25	75	100	38	50
	16	Practical III	Digital Signal Process Lab	6	--	-	--	--	--	--
IV	17	Core-11	Advanced medical Electronics	6	4	25	75	100	38	50
	18	Core -12	Micro Electro Mechanical systems	6	4	25	75	100	38	50
	19	Core -13-	Advanced microcontrollers	6	4	25	75	100	38	50
	20	Project		6	5	50	50	100	25	50
	21	Practical-III	Digital Signal Process	--	4	50	50	100	25	50
	22	Practical - IV	Embedded Systems	6	4	50	50	100	25	50

ELECTROMAGNETIC THEORY

UNIT I

REVIEW OF VECTOR ANALYSIS

Cartesian, Cylindrical and Spherical co-ordinates systems- Co-ordinate transformations. Static electric field: Coulomb's Law of point charges- Electric flux- Gauss's Law- Electrical scalar potential- different types of potential distribution- Potential gradient- Boundary conditions Capacitance: Capacitance of isolated sphere- capacitance between two concentric sphere shells- capacitance between coaxial cylinders- capacitance between parallel wires. Vector fields: Divergence and curl- Divergence theorem- Stokes theorem.

UNIT II

MAGNETIC FIELD

Steady current and current density in a conductor- Biot-Savarts Law- Ampere's Law- Helmholtz theorems- Faraday's law of electromagnetic induction- Solenoid, toroid, inductance of transmission line- Mutual inductance energy stored in magnetic fields- Magnetic dipole- Electric and Magnetic boundary conditions- vector magnetic potential.

UNIT III

MAXWELL'S EQUATIONS AND TRAVELLING WAVES

Conduction current and displacement current- Maxwell's equations- Plane waves- Poynting theorem and Poynting vector- Plane electromagnetic waves- Solution for free space condition- Uniform plane wave-wave equation for conducting medium- Wave polarization- Poisson's and Laplace equations.

UNIT IV

GUIDED WAVES

Guided waves between parallel planes- transverse electric and transverse magnetic waves and its characteristics- Rectangular wave guides- modes of propagation.

UNIT V

TRANSMISSION LINES

Transmission line equations- transmission line parameters- Skin effect- VSWR- Characteristic impedance- Stub matching- Smith chart - Phase velocity and group velocity.

REFERENCES

1. Engineering Electromagnetics: W. H. Hayt, Mc Graw Hill Publications.
2. Electromagnetics: J. D. Kraus, Mc Graw Hill Publications.
3. Engineering electromagnetics: E. C. Jordan.
4. Field & Wave Electromagnetic: Cheng, Pearson Education.
5. Electromagnetics: Edminister, Schaum series, 2 Edn.
6. Electromagnetic Theory: B. Premlet.
7. Electromagnetic Theory: Sadiku, Oxford University Press.

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NANO ELECTRONICS

UNIT I

INTRODUCTION TO NANOTECHNOLOGY

Background to nanotechnology: Types of nanotechnology and nanomachines – periodic table – atomic structure – molecules and phases – energy – molecular and atomic size – surface and dimensional space – top down and bottom up; Molecular Nanotechnology: Electron microscope – scanning electron microscope – atomic force microscope – scanning tunnelling microscope – nanomanipulator – nanotweezers – atom manipulation – nanodots – self assembly – dip pen nanolithography. Nanomaterials: preparation – plasma arcing – chemical vapor deposition – sol-gels – electrodeposition – ball milling – applications of nanomaterials;

UNIT II

FUNDAMENTALS OF NANOELECTRONICS

Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation:- power dissipation limit – dissipation in reversible computation – the ultimate computer.

UNIT III

SILICON MOSFETs & QUANTUM TRANSPORT DEVICES

Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions& contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling:- Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications:- Single electron devices – applications of single electron devices to logic circuits.

UNIT IV

CARBON NANOTUBES

Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic propertics – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nanotube for memory applications – prospects of carbon nanotube nanoelectronics.

UNIT V

MOLECULAR ELECTRONICS

Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devices.

TEXTBOOK

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002
2. T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
3. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003

DIGITAL DESIGN USING VHDL

UNIT – I

INTRODUCTION & BASIC LANGUAGES

Introduction to HDLs: Difference between HDL and other software languages – Different HDLs in vogue. Overview of digital system design using HDL Basic VHDL Language Elements: Identifiers, Data objects, scalar and composite data types, Operators

UNIT – II

BEHAVIORAL MODELING

Behavioral Modeling with examples: Entity declaration, Architecture body, Process statement and sequential statements. Inertial and transport delay models, creating signal waveforms, signal drivers, effect of transport and inertial delays on signal drivers.

UNIT – III

DATA FLOW AND STRUCTURAL MODELING

Data Flow Modeling with examples: Concurrent signal assignment statement, Concurrent versus sequential signal assignment, Delta delays, Multiple drivers, Conditional signal assignment statement, selected signal assignment statement, concurrent assertion statement. Structural Modeling with examples: Component declaration, Component instantiation and examples, direct instantiation of component.

UNIT – IV

SUBPROGRAMS AND PACKAGES

Subprograms and Overloading: Functions and procedures with simple examples - Subprogram overloading, Operator overloadingPackages and Libraries: Package declaration, package body, design file, design libraries, order of analysis, implicit visibility, explicit visibility, library clause and use clause. Advanced Features: Entity statements, Generate statements, Attributes, Aggregate targets, ports and their behavior.

UNIT – V

SIMULATION AND HARDWARE MODELING

Model Simulation: Simulation – Writing a Test Bench for a Half and a Full adder. Hardware Modeling Examples: Modeling entity interfaces, Modeling simple elements, Different styles of modeling, Modeling regular structures, Modeling delays, Modeling conditional operations, Modeling a clock divider and a pulse counter.

REFERENCE BOOKS

1. A VHDL Primer - By J.Bhasker ., 3rd edition - PHI, New Delhi, 2007
2. Circuit design with VHDL by Volnei . Pedroni – PHI, New Delhi, 2007
3. Digital Systems Design using VHDL by Charles H.Roth Jr.- PWS Pub.,1998
4. Introductory VHDL : From Simulation to Synthesis – by Sudhakar Yalamanchili.- Pearson Education Asia., 2001
5. VHDL Programming by Example – By Douglas L.Perry.- 4th Ed - TMH., 2002
6. Fundamentals of Digital Logic with VHDL Design – by Stephen Brown & Zvonko Vranesic - TMH. 2002
7. VHDL – Analysis & Modeling of Digital Systems – By Zainalabedin Navabi- 2nd Ed - TMH, 1998
8. The Designer's Guide to VHDL - By Peter J. Ashenden -2nd Ed., 1st Indian Reprint- Harcourt India Pvt. Ltd., 2001

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RESEARCH METHODOLOGY FOR ELECTRONICS

UNIT I

Research methodology: An Introduction Objectives of Research, Types of Research, Research Methods and Methodology, Defining a Research Problem, Techniques involved in Defining a Problem. Research Design Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs.

UNIT II

Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling. Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques.

UNIT III

Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation.

UNIT IV

Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters limitations of the tests of Hypotheses. Chisquare Test, Comparing Variance, As a nonparametric Test, Conversion of Chi to Phi, Caution inusing Chisquare test.

UNIT V

Analysis of Variance and Covariance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA Assumptions in ANOCOVA, Multivariate Analysis Technique Classification of Multivariate Analysis, factor Analysis, Rtype Q Type factor Analysis, Path Analysis.

REFERENCE BOOKS

1. “Research Methodology”, C.R. Kothari, Wiley Eastern.
2. “Formulation of Hypothesis”, Willkinson K.P, L Bhandarkar, Hymalaya Publication, Bombay.
3. “Research in Education”, John W Best and V. Kahn, PHI Publication.
4. “Research Methodology A step by step guide for beginners”, Ranjit Kumar, Pearson Education
5. “Management Research MethodologyIntegration of principles, methods and Techniques”, K.N. Krishna swami and others, Pearson Education.

DIGITAL SIGNAL PROCESSING LABORATORY

All experiments have to be conducted compulsorily

A. LIST OF EXPERIMENTS USING MATLAB/SCILAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.

B. LIST OF EXPERIMENTS USING DSP PROCESSOR

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications .The input can be a signal from function generator / speech signal.
5. Realization of an IIR filter to meet given specifications.
6. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms
7. Noise: Add noise above 3kHz and then remove; Interference suppression using 400 Hz tone.
8. Impulse response of first order and second order system
9. Waveform Generation.
10. Correlation of two discrete signals.

REFERENCE BOOKS

1. Sanjeet Mitra, Digital signal processing using MATLAB, TMH, 2001
2. J.G.Proakis & Ingale, Digital signal processing using MATLAB,.MGH, 2000
3. B.Venkataramani and Bhaskar, Digital signal processors, TMH,2002

ADVANCED MEDICAL ELECTRONICS

UNIT I

Biomedical instruments- parameters- Man-instrument system- components- physiological systems of human body- cardiovascular system- The heart- Respiratory system- blood purification- The Kidney- Nervous system- Bioelectric potentials- Resting and Action potentials- propagation- bio-potential electrodes- Transducers- ECG-EEG-EMG.

UNIT II

Biomedical measurements:ECG measurement- electrodes and leads- ECG recorder- different recorders. Blood pressure measurements- indirect measurement- sphygmomanometer- direct measurement techniques. Respiratory measurements- Lung volume and capacities- Spirometer- Gas exchange measurements. Clinical measurements: Blood cells- tests on blood cells- chemical tests- colorimeter- spectro photometer- continuous flow analyzer.

UNIT III

Ultrasonic measurements: Characteristics of Ultrasound- Attenuation- Doppler effect- basic modes of transmission- pulsed, continuous, pulsed Doppler- Ultrasonic imaging- Block schematic of A mode, B mode, M mode instruments- Electronic scanners: Linear and Phased array- Applications of Ultrasound: Gynecology and obstetrics- blood flow measurements- cardiac imaging- echocardiography- echoencephalography.

UNIT IV

X ray imaging and measurements: x ray generation- x ray machine- C arm machine- image intensifiers- x ray films- photographic imaging- Fluoroscopy- computed tomography- CAT scan: block schematic- Gantry- detectors.

UNIT V

Bio-telemetry: components in telemetry system- transmitter-receiver- pulse modulators- implantable units- applications. Intensive care unit: Planning and location of different instruments- Bedside monitors- Prosthetic instruments- artificial heart- pump oxygenators- hemodialysis- artificial kidney- different dialysers. Electrical safety: Physiological effects of electric current- let go current- shock hazards- need of grounding- isolation of patients- isolated power distribution system.

REFERENCES

1. Introduction to biomedical technology: Joseph J Carr, Pearson Edn.
2. Biomedical Instrumentation & Measurements: Leslie Cromwell, PHI.
3. Biomedical Instrumentation: John G Webster, Houghton Mifflin Company.
4. Handbook to biomedical instrumentation: R S Khandpur, Tata Mc Graw Hill Pub.

MICRO ELECTRO MECHANICAL SYSTEMS

UNIT I

INTRODUCTION

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Microfabrication - 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-I

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Thermal Sensing and Actuation – Thermal expansionThermal couples – Thermal resistors – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators.

UNIT III

SENSORS AND ACTUATORS-II

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV

MICRO MACHINING

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 micromachining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods Assembly of 3D MEMS – Foundry process.

UNIT V

POLYMER AND OPTICAL MEMS

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA –Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TEXT BOOKS

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2006.

REFERENCES

1. Nadim Maluf, " An introduction to Micro electro mechanical system design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.
4. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim,micro sensors mems And smart devices, John Wiley & son LTD,2002
5. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

ADVANCED MICRO-CONTROLLERS

UNIT I

LOW PIN COUNT CONTROLLERS

Atmel AVR family – ATTiny15L controller - architecture – pin descriptions – features – addressing modes – I/O space – reset and interrupt handling – reset sources - Tunable internal oscillator.

UNIT II

TIMERS

Watch dog timer – EEPROM – preventing data corruption – Analog comparator – A/D converter – conversion timing – ADC noise reduction – PortB – alternate functions – memory programming – fuse bits – high voltage serial programming – algorithm.

UNIT III

NATIONAL SEMICONDUCTOR

COP8 family - COP8CBR9 processor – features – electrical characteristics – pin descriptions – memory organization –EEPROM - security – brownout reset – in system programming – boot ROM. Idle timer – Timer1, Timer2, Timer3 -operating modes – PWM mode – event capture mode

UNIT IV

POWER SAVING MODES

Dual clock operation – Multi input wake up – USART – framing formats – baud rate generation – A/D conversion – operating modes – prescaler – Interrupts – interrupt vector table – Watch dog – service window – Micro-wire interface – waveforms.

UNIT V

MICROCHIP

PIC16 family – PIC16F873 processor – features – architecture – memory organization - register file map – I/O ports – PORTA - PORTB – PORTC – Data EEPROM and flash program memory – Asynchronous serial port – SPI mode – I2C mode.

REFERENCES

1. Design with PIC micro-controllers: John B Peatman, Pearson Education.
2. DS101374: National Semiconductor reference manual.
3. National semiconductor web site – www.national.com
4. 1187D: Atmel semiconductor reference manual.
5. Atmel semiconductor web site – www.atmel.com
6. DS30292B: Microchip reference manual.
7. Microchip semiconductor web site – www.microchip.com

PROJECT WORK

The objective of the project work is to motivate the students for doing research and to inculcate in them the self confidence to work independently. each student should do an individual project and they can freely choose their own topic of experimental nature. the project should be of investigative type not a hobby project one.

Students are encouraged to take the project work as a challenge so that their project will boost up their industrial career.

Periodic Seminars should be conducted to assess the students. The students should present the progress of the project to their respective guides and get the required assistance from them

At the completion of the project .The student will submit Project Report in the form of Dissertation which will be examined by the examiners.

The examination shall consist of i) evaluation of the dissertation and ii) comprehensive viva-voce

DIGITAL SIGNAL PROCESSING LABORATORY

All experiments have to be conducted compulsorily

A. LIST OF EXPERIMENTS USING MATLAB/SCILAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
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3. B.Venkataramani and Bhaskar, Digital signal processors, TMH,2002

EMBEDDED SYSTEMS LABORATORY

Perform a total of 20 Experiments choosing 10 from each group

A.8051 BASED EMBEDDED SYSTEMS (Any 10 Experiments)

1. Arithmetic and Logic programs
2. Square wave generation using ports
3. Matrix Key Board interfacing
4. LED Interfacing
5. Seven segment display interfacing
6. Solid state relay interfacing using interrupts
7. Traffic light control system
8. ADC interface
9. DAC interface
10. Stepper motor interface
11. Timer/Counter operation
12. Serial port interfacing using RS232C
13. Digital clock
14. LCD interface
15. Object counter
16. Water level controller
17. Flow measurement
18. Temperature measurement

B.PIC 16F87X BASED EMBEDDED SYSTEMS & RTOS (Any 10 Experiments)

1. Arithmetic and Logical programs
2. Square wave generation using ports
3. Matrix Key Board & LED interfacing
4. Single digit timer using seven segment displays
5. DC motor driving via H Bridge
6. DAC interface
7. ADC INTERFACE
8. LCD interface
9. Stepper motor control
10. PWM generation
11. Compare and capture operation program
12. Serial communication using RS232C
13. PIC to PIC communication using I2 C bus

PROGRAMMING WITH RTOS

14. Semaphore & flag related functions
15. Queue & Mailbox related functions
16. Memory related functions
17. Embedded system for an adaptive cruise control system in a car
18. Embedded system for a smart card.

REFERENCE

1. Mohamammad Ali Mazidi & Mazidi ‘ 8051 Microcontroller and Embedded Systems’, Pearson Education
2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, ‘PIC Microcontroller and Embedded Systems’ Pearson Education
3. Jan Axelson ‘Embedded Ethernet and Internet Complete’, Penram publications
4. Kraig Mitzner, ‘Complete PCB Design using ORCAD Capture and Layout’, Elsevier
5. Woon-Seng Gan, Sen M. Kuo, ‘Embedded Signal Processing with the Micro Signal Architecture’, John Wiley & Sons, Inc., Hoboken, New Jersey 2007
6. U. Meyer-Baese ‘Digital Signal Processing using Field Programmable Gate Arrays’, Springer
7. Dogan Ibrahim, ‘Advanced PIC microcontroller projects in C’, Elsevier 2008