KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

M.E. DEGREE IN APPLIED ELECTRONICS (FULL TIME)

CURRICULUM

(For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER – I

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
11AE101	Applied Mathematics for Electrical Engineers	3	1	0	4	50	50	100
11AE102	Advanced Digital Signal Processing	3	1	0	4	50	50	100
11AE103	Advanced Digital System Design	3	1	0	4	50	50	100
11AE104	ASIC Design	3	0	0	3	50	50	100
11AE105	Embedded Systems	3	0	0	3	50	50	100
11AE106	Computational Intelligent Techniques	3	1	0	4	50	50	100
	PRACTICAL							
11AE107	Embedded Systems Laboratory	0	0	3	1	100	0	100
				Total	**23**			

CA - Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN APPLIED ELECTRONICS (FULL TIME)

CURRICULUM

(For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER – II

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
11AE201	Design of Analog Integrated Circuits	3	0	0	3	50	50	100
11VL104	VLSI Signal Processing	3	1	0	4	50	50	100
11AE202	Digital Control Engineering	3	1	0	4	50	50	100
	Elective - I	3	0	0	3	50	50	100
	Elective - II	3	0	0	3	50	50	100
	Elective - III	3	0	0	3	50	50	100
	PRACTICAL							
11AE203	EDA Tools Laboratory	0	0	3	1	100	0	100
11AE204	Applied Electronics Laboratory	0	0	3	1	100	0	100
				Total	**22**			

CA – Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN APPLIED ELECTRONICS

CURRICULUM
((For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER – III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective - IV	3	0	0	3	50	50	100
	Elective - V	3	0	0	3	50	50	100
	Elective - VI	3	0	0	3	50	50	100
	PRACTICAL							
11AE301	Project Work - Phase - I	0	0	12	6	50	50	100
				Total	**15**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER – IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
11AE401	Project Work - Phase - II	0	0	24	12	100	100	200
				Total	**12**			

CA – Continuous Assessment, ESE – End Semester Examination

LIST OF ELECTIVES					
Course Code	**Course Title**	**L**	**T**	**P**	**Credit**
11AE011	Bio Medical Signal Processing	3	0	0	3
11AE012	Data Communication Networks	3	0	0	3
11AE013	Design and Analysis of Algorithms	3	0	0	3
11AE014	Wavelet Transforms and its Application	3	1	0	4
11AE015	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
11AE016	Electronic Product Design	3	0	0	3
11AE017	Industrial Electronics	3	0	0	3
11AE018	Industrial Robotics	3	0	0	3
11AE019	Internet Technologies and Applications	3	0	0	3
11AE020	Micro Sensors and MEMS	3	0	0	3
11AE021	Nano Electronics	3	0	0	3
11AE022	Power Quality Management	3	0	0	3
11AE023	Project Management	3	0	0	3
11AE024	SCADA and DCS	3	0	0	3
11AE025	System Identification and Adaptive Control	3	1	0	4
11AE026	Virtual Instrumentation Systems	3	0	0	3
11VL014	Low Power VLSI Design	3	0	0	3
11VL025	Digital Image Processing	3	0	0	3
11VL105	Device Modelling	3	0	0	3

11AE101 APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS

(Common to Applied Electronics and Power Electronics Branches)

3 1 0 4

Objective:

On completion of the course the students are expected

- To understand the concept of variational problems and to find out the extremals of the given functional
- To develop the concept of Linear and Non-linear programming problems and finding solutions through various methods
- To know the types of functions and relations and their application
- To know the representation of graphs.

MODULE - I **15**

Calculus of Variation: Functional –definition-Variational problem: Euler Lagrange equation-Solutions of Euler Lagrange equation – Variational problems involving one unknown function, Several unknown functions – Functionals dependent on higher order derivatives – Variational problems involving Several independent variables .Isoperimetric problems-Ritz method.

Introduction to Optimization: Linear Programming Problem: Mathematical Formulation – Basic definitions – Solutions of LPP: Graphical method, Simplex method –Big–M method and Two phase method.

MODULE - II **15**

Optimization Techniques: Duality theory – Dual simplex method -Transportation Problem (Balanced) – Initial Basic Feasible Solution by Vogel's approximation method – Solution by MODI method – Assignment problems – Hungarian method.

Non - Linear Programming: Formulation of non–linear programming problem – Constrained optimization with equality constraints – Constrained optimization with inequality constraints – Graphical method of non–linear programming problem involving only two variables – Kuhn-tucker conditions with non-negative constraints.

MODULE - III **15**

Functions and Relations: Injective – Surjective – Bijective functions – Compositions – Identity – Inverse – Relations – Properties of relations.

Graph Theory: Introduction – Basic terminology – Representation of graphs – Connected graphs – Matrix representation of graphs (excluding graphs) – Applications – Critical path method – Shortest path problems – Trees – Definition – Binary tree.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. Venkataraman. M.K, "Higher Mathematics for Engineering & Science", National Publishing Company, 2006.
2. Taha, H.A., "Operations Research- An Introduction", 6th Edition, PHI, 2000.
3. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill, New Delhi, 2008.
4. Harary.F, "Graph Theory", Narosa Publisher, New Delhi, 1990.
5. West, Douglas.B, "Introduction to Graph Theory", Prentice Hall, 1996.
6. Kanti Swarup Gupta, P.K and Man Mohan "Operations Research", S.Chand & Co ., 1997.

11AE102 ADVANCED DIGITAL SIGNAL PROCESSING

(Common to M.E. Applied Electronics, Communication Systems, Power Electronics, Control and Instrumentation, Computer and Communication)

3 1 0 4

Objective:

- To introduce the concept of discrete random signal processing.
- To understand the spectrum estimation and analysis using parametric and non-parametric approach.
- To estimate the signal by linear prediction.
- To study the concepts of adaptive filter and various error minimization algorithm.
- To understand the concepts of multirate digital signal processing.

MODULE – I **15**

Discrete Random Signal Processing: Discrete time random process – Random process: Ensemble averages- Gaussian process – stationary process – The autocovariance and autocorrelation metrices – ergodicity – white noise the power spectrum. Filtering random process – spectral factorization. Parseval's theorem – Wiener Khintchine relation.

Spectrum Estimation and Analysis: Non parmetric methods: Periodogram, performance of periodogram, modified periodogram, Bartlett's method, Welch's method.

MODULE - II **15**

Parametric methods: AR model – Yule-Walker method, MA model – ARMA model.

Linear Prediction: Forward and backward linear predictions, Solution of the normal equations – Levinson-Durbin algorithms. Least mean squared error criterion – The FIR Wiener filter – filtering – linear prediction and The IIR Wiener filters – Non causal IIR Wiener filter – the causal IIR Wiener filter.

Adaptive Filter: Concepts of adaptive filter – FIR adaptive filters – LMS algorithm – Applications: Noise cancellation

MODULE -III **15**

Adaptive Filter: Adaptive recursive filers– AR lattice structure and ARMA process, lattice – ladder filters.

Multirate Digital Signal Processing: Mathematical description of sampling rate – Interpolation and Decimation by integer factor – Sampling rate conversion by rational factor- Filter design for sampling rate conversion; direct form FIR structures, Polyphase structures, time-varient structures. Multistage implementation of sampling rate conversion. Applications – Subband coding of speech signals.

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1. Hayes, Monson H. "Statistical Digital Signal processing and Modeling", John Wiley and Sons, Inc., 1996.
2. Proakis, John G. and Manolakis, Dimitris G. "Digital Signal Processing: Principles Algorithms and Applications", PHI, 2006.
3 Ifeachor, Emmanuel C. and Jervis, Barrie N. "Digital Signal Processing: A Practical Approach", Addison-Wesley Publishing Company, 2002.
4 George Box, Gwilym M. Jenkins, Gregory Reinsel, "Time Series Analysis: Forecasting & Control", 3rd Edition,

11AE103 ADVANCED DIGITAL SYSTEM DESIGN

(Common to M.E. Applied Electronics, Control and Instrumentation)

3 1 0 4

Objective:

- To become familiarize in synchronous and asynchronous logic design
- To introduce the concept of FPGA
- To understand the concept of fault Modeling, Fault Testing and related algorithms
- To study the fault diagnosis methods in VLSI circuits

MODULE – I **15**

Advanced Topic in Sequential Logic Design: ASM Chart – ASM Realization for Synchronous Logic circuit -Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment – Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards

System Design Using VHDL: VHDL Description of Combinational Circuits – Arrays – VHDL Operators – Compilation and Simulation of VHDL Code – Modeling using VHDL – Flip Flops – Registers

MODULE - II **15**

System Design Using VHDL: Counters – Sequential Machine – Combinational Logic Circuits - VHDL Code for – Serial Adder, Binary Multiplier – Binary Divider – complete Sequential Systems – Design of a Simple Microprocessor

Field Programmable Gate Arrays: Types of FPGA - XILINX XC3000 series - Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) - Input/Output Blocks (IOB) - Programmable Interconnection Points (PIP) - XILINX XC4000 Series –Introduction to Xilinx SPARTAN, VIRTEX FPGA – Design examples

Fault Modeling and Simulation: Introduction to Testing - Faults in digital circuits - Modeling of faults

MODULE -III **15**

Fault Modeling and Simulation: Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation

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

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1. Charles H Roth, "Digital Systems Design Using VHDL," Thomson Asia,. 2004
2. Palmer, J.E., Perlman, D.E., "Introduction to Digital Systems",Tata McGraw Hill, New Delhi, Reprint 1996
3. Michael L Bushnell, Vishwani D Agrawal, "Essentials of Electronic Testing For digital memory and mixed signal VLSI circuits", Kluwer academic Publications, USA, 2001
4. Yarbrough, John M., "Digital Logic Applications and Design", Thomson Learning, 2001.
5. Lala, P.K., "Digital Circuit Testing and Testability", Academic Press, 2002.

11AE104 ASIC DESIGN

3 0 0 3

Objective:

- To study the VLSI design flow and basic CMOS technology
- To introduce the concepts of stick diagram and CMOS design
- To study the characteristics and performance of MOS devices
- To impart knowledge on logical synthesis and simulation
- To study the methods of partitioning, floor planning and routing

MODULE - I **15**

VLSI Design Process and Inverters: Types of ASICs - Design flow -VLSI Design Process – Architectural Design – Logical Design – Physical Design – Layout Styles –Full custom, Semicustom approaches. NMOS and PMOS transistors, Threshold voltage- Body effect- Design equations- Second order effects. MOS models and small signal AC characteristics. Basic CMOS technology NMOS and CMOS Inverters, Stick diagram, Inverter ratio, DC and transient characteristics , switching times, Super buffers, Driving large capacitance loads

MODULE - II **15**

CMOS Logic, Circuit Characterization and Performance Estimation: CMOS logic structures, Transmission gates, Static CMOS design, dynamic CMOS design .Résistance estimation. Capacitance estimation. MOS capacitor characteristics. Device capacitances. Diffusion capacitance. SPICE modeling of MOS capacitance. Routing capacitance. Distributed RC effects. Inductance. Switching characteristics. Rise time. Fall time. Delay time. Empirical delay models. Gate delays. CMOS gate transistor sizing. Power dissipation. Scaling of MOS transistor dimensions.

MODULE - III **15**

Logic Synthesis ,Simulation and System Partitioning: Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis. System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow –global routing - detailed routing - special routing - circuit extraction - DRC.

TOTAL : 45

REFERENCE BOOKS

1 Neil H.E. Weste and Kamran Eshraghian, “Principles of CMOS VLSI Design”, 2nd edition Pearson Education Asia, 2000.
2 Gerez S.H., "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002
3 Smith, M.J.S., "Application Specific Integrated Circuits”, Addison –Wesley, New York, 1997.
4 Wolf Wayne., “Modern VLSI Design System on chip”, Pearson Education, 2002
5 Rabaey Jan M, “Digital Integrated Circuits”, Prentice Hall of India, New Delhi, 2002
6 Nekoogar Farzad and Nekoogar Faranak, “From ASICs to SOCs”, A Practical Approach, Prentice Hall PTR, New Jersey, 2003

11AE105 EMBEDDED SYSTEMS

3 0 0 3

Objective:

- Introduce the features and concepts of PIC Microcontroller that build an embedded system.
- To understand the concepts of PIC Microcontroller interface circuits
- To understand the architecture of the ARM processor and programming.
- To enable writing of efficient programs on any dedicated processor.
- To present in lucid manner the basic concepts of systems programming like operating system, assembler compliers etc and to understand the management task needed for developing embedded system.
- To understand the concepts of RTOS

MODULE - I **15**

Introduction: Introduction to Embedded systems – Von Neumann and Harvard architecture – Need of Microcontrollers – selection criterion – Architecture – Features – Resets –Memory Organisations: Program Memory, Data Memory – Instruction Set – Simple programs using Assembly language Instruction sets.

PIC 16F87X: Human and Physical Interface Support: Interrupts – Peripherals – I/O Parallel Ports –Timers – Capture/Compare/PWM (CCP) Modules Control registers –Serial ports – Master Synchronous serial Port (MSSP) in I^2C mode and in SPI mode – USART

MODULE - II **15**

Interfacing: Analog-to-digital Converter (ADC) – Registers associated with the peripherals – Initializing the Peripheral modules using Assembly language.

ARM Processor Architecture and Programming: General concepts - ARM7 - Instruction Set Architecture, Levels in architecture, Functional description - processor and memory organization - Introduction to RISC architecture, pipelining, Instruction issue and execution - Instruction formats - Addressing modes - Data alignment and byte ordering – Simple programs using Assembly language Instruction sets.

MODULE - III **15**

Embedded Programming: Programming in Assembly Language (ALP) Vs High level language – C program elements, Macros and Functions – Use of pointers – NULL pointers – use of function calls – multiple function calls in a cyclic order in the main function pointers – Function queues and interrupt service Routines queues pointers.

Real-Time Operating Systems and System Design: RTOS Introduction - RTOS Necessity - Operating system services –I/O subsystems – Network operating systems –Interrupt Routines in RTOS Environment – RTOS Task scheduling models – IEEE standard POSIX functions for standardization of RTOS and inter-task communication functions Fifteen point strategy for synchronization between processors, ISRs, OS Functions and Tasks – OS security issues - Embedded system design and Co-Design Issues in System Development process – Design cycle in the development phase for an embedded system –Issues in Embedded System Design

TOTAL: 45

REFERENCE BOOKS

1. Raj Kamal., "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill, New Delhi, 2003.
2. Wayne Wolf., "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers, San Francisco, 2001.
3. Vahid, Frank and Givargi, Tony., "Embedded System Design: A Unified Hardware/Software Introductions", John Wiley & Sons, New York, 2000.
4. Ajay V Deshmukh, Microcontroller Theory and Applications, Tata McGraw Hill, New Delhi, 2007.

11AE106 COMPUTATIONAL INTELLIGENT TECHNIQUES

(Common to, Applied Electronics, Power Electronics and Control and Instrumentation Engineering and Mechatronics Engineering)

3 1 0 4

Objective:

- To expose the students about the different types of architecture, learning and training methods of neural networks
- To study the concept of rule based system and its modeling
- To expose the students the various optimization techniques
- To learn and analyze the modeling of neuro fuzzy systems
- To study the various real time applications of neuro fuzzy system

MODULE – I **15**

Neural Networks: Introduction to Soft computing – Neural Networks – Supervised learning-Perceptrons – Adaline – Back propagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self Organizing Networks – Learning Vector Quantization – Hebbian Learning.

Fuzzy Logic: Fuzzy Sets – Basic Definition and Terminology – Set theoretic operations – Member function formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning

MODULE - II **15**

Fuzzy Logic: Extension principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

Optimization techniques: Derivative-based Optimization: Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative free Optimization: Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

MODULE -III **15**

Neuro Fuzzy Modelling: Adaptive Neuro Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

Applications: Printed Character Recognition – Inverse Kinematics Problem – Automobile fuel efficiency prediction – Soft Computing for Color Recipe Prediction – Single MLP approaches – CANFIS modeling for color recipe prediction

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1. J.S.R Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, Pearson Education, 2004.
2. R.C.Eberhart, P.K.Simpson and R.Dobbins, "Computational Intelligence PC Tools", AP Professional, Boston 1996.
3. David E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, New York, 1989.
4. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India, New Delhi, 2004.

11AE107 EMBEDDED SYSTEMS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. RS232C Bus Interfacing with PIC Microcontroller
2. LED interface with Embedded PIC Microcontroller
3. LED and Switch Interface with Embedded PIC Microcontroller
4. LED and Key matrix Interface with Embedded PIC Microcontroller
5. EEPROM Interface with Embedded Microcontroller (I2C-Communication)
6. LCD Interface using Embedded Microcontroller
7. Rolling Display in LCD /LED using Embedded Microcontroller
8. Stepper Motor Interface using Embedded Microcontroller
9. ADC and DAC Interface using Embedded Microcontroller(I^2C-Communication)
10. RTC using Embedded Microcontroller(I^2C-Communication)
11. Design and Implementation of Convolution Algorithm using DSP Processor
12. Matrix Multiplication using DSP Processor

11AE201 DESIGN OF ANALOG INTEGRATED CIRCUITS

3 0 0 3

Objective :

- To Understand MOS and BJT model parameters
- To study and Design of analog building blocks
- To Design and characterisics of amplifiers and filters
- To Design DAC architectures

MODULE -I **15**

Device Modeling and Basic Building Blocks: Introduction to analog design. MOS device model: dc, small signal and high frequency model, Diode model: dc, small signal and high frequency model. BJT: dc, small signal and high frequency model. Measurement of model parameters. Switches, active resistors, current sources and sinks, current mirrors- simple. Wilson, cascade,

MODULE -II **15**

Analog Circuits Building Blocks and amplifiers: Voltages and Current- References- Bandgap voltage references, comparator, Multiplier. MOS and BJT inverting amplifier, improving the performance of inverting amplifier. CMOS and BJT differential amplifiers. Characteristics of Operational amplifiers- Types: Two stage BJT and CMOS- Cascade- Folded cascade- Transconductance.

MODULE -III **15**

Filters and Data Converters: Low pass filters, High pass filters, Band pass filters, Switched Capacitor filters, Data Converter fundamentals, DAC Architectures: Current Switched, Resistive, Charge redistribution, Hybrid, Segmented D/A Converters. ADC architectures: Flash, Integrating, Successive Approximation and folding A/D Converters. Over sampling Converters

TOTAL: 45

REFERENCE BOOKS

1. Allen Phillips E, and Holberg Douglas R., "CMOS Analog Circuit Design", Second Edition, Oxford University Press, Oxford, 2003.
2. Johns David A., and Martin Ken, "Analog Integrated Circuit Design", John Wiley & Sons, New York, 2002.
3. Randall L.Geiger, Phillips E. Allen, Noel R.Strader,"VLSI design Techniques for Analog and Digital circuits", MCgraw Hill International Editions, 1990.
4. Vineeta P.Gejji," Analog and mixed mode VLSI design", PHI, New Delhi, 2011.
5. Gray Hurst, Lewis and Meyer, "Analysis and Design of Analog Integrated Circuits", 4th Edition, John Wiley& Sons, New York, 2001.

11VL104 VLSI SIGNAL PROCESSING

(Common to M.E. VLSI Design, Applied Electronics, Control and Instrumentation Engineering)

3 1 0 4

Objective:

- To provide a comprehensive coverage of techniques for designing efficient DSP architectures.
- The architectural optimization both at block level as well as logic level are considered to realize architectures that can process high throughput data.
- To know the concepts of pipelined adaptive filters

MODULE – I **15**

Introduction to DSP Systems and Retiming: Introduction To DSP Systems -Typical DSP algorithms; Iteration Bound – data flow graph representations, loop bound and iteration bound, Algorithms For Computing Iteration Bound, Iteration Bound of Multirate Data Flow Graphs. Pipelining and parallel processing – Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power; Retiming - definitions and properties Retiming techniques; Solving systems of inequalities, Retiming Techniques.

MODULE– II **15**

Unfolding, Folding, Fast Convolution: Unfolding – an algorithm for Unfolding, properties of unfolding, Critical path Unfolding and Retiming applications of Unfolding- sample period reduction and parallel processing application; Folding – Folding transformation – Register minimizing techniques –Register minimization in folded architectures-Folding of Multirate systems. Fast convolution – Cook-Toom algorithm, modified Cook-Took algorithm – Wino grad Algorithm, Modified Wino grad Algorithm, Iterated Convolution – Cyclic Convolution-Design of Fast Convolution algorithm by inspection.;

MODULE-III **15**

Pipelined and Parallel Recursive and Adaptive Filters: Algorithmic strength reduction in Filters-Parallel FIR Filters, DCT and Inverse DCT, Parallel architectures for rank order Filters. Pipelined and parallel recursive and adaptive filters – inefficient/efficient single channel interleaving, Look- Ahead pipelining in first- order IIR filters, Look-Ahead pipelining with power-of-two decomposition parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters, pipelined adaptive digital filters-relaxed look-ahead, pipelined LMS adaptive filter.

Lecture: 45, Tutorial: 15, TOTAL : 60

REFERENCE BOOKS

1. Parhi, Keshab K., "VLSI Digital Signal Processing Systems, Design and Implementation", John Wiley, Inter Science, New York, 1999.
2. Isamail, Mohammed and Fiez, Terri, "Analog VLSI Signal and Information Processing", McGraw-Hill, New York, 1994**.**
3. www.pdf-search-engine.com/vlsi-signal-processing-pdf.html
4. Magdy A. Bayoumi, Magdy A. Bayoumi, E. Swartzlander, "VLSI Signal Processing Technology", Kluwer Academic Publishers.October 1994
5. Ray Liu K J, "High Performance VLSI Signal Processing, Innovative architectures and Algorithms",IEEE Press,1998

11AE202 DIGITAL CONTROL ENGINEERING

3 1 0 4

Objective:

- To give the concept of sampled data systems
- To impart the knowledge of models of Digital control devices and systems
- To introduce State Variable analysis
- To introduce different Stability analysis concepts
- To design a digital control system

MODULE - I **15**

Introduction: Overview of frequency and time response analysis and specifications of control systems - Digital control systems – basic concepts of sampled data control systems – principle of sampling, quantization and coding – Reconstruction of signals – Sample and Hold circuits – Practical aspects of choice of sampling rate -Basic discrete time signals – Time domain models for discrete time systems.

Models of Digital Control Devices and Systems: Z domain description of sampled continuous time plants – models of A/D and D/A converters – Z Domain description of systems with dead time

MODULE - II **15**

Digital PID controllers: Implementation of digital controllers – Digital PID controllers –Position, velocity algorithms – Tuning – Zeigler – Nichols tuning method.

State Variable analysis: State space representation of discrete time systems – Solution of discrete time state space equation – State transition matrix – Decomposition techniques – Controllability and Observability – Multi variable discrete systems

Stability analysis: Mapping between S plane and Z plane- Jury's stability test

MODULE - III **15**

Stability analysis: Bilinear transformation and extended Routh array- Root Locus Method –Liapunov Stability Analysis of discrete time systems.

Design of Digital Control System: Z plane specifications of control system design – Digital compensator design – Frequency response method - State feed back – Pole placement design – State Observers – Digital filter properties – Frequency response – Kalman's filter.

Lecture: 45, Tutorial: 15 TOTAL: 60

REFERENCE BOOKS

1. Gopal, M., "Digital Control and State Variable Methods", Tata McGraw-Hill, New Delhi, 2008.
2. Kuo, B.C., "Digital Control Systems", Oxford University Press, Oxford, 2003.
3. Ogata, K., "Discrete Time Control Systems", Prentice Hall, New Jersey, 2002.
4. Houpis, C.H. and Lamont, C.B., "Digital Control Systems", Tata McGraw-Hill, New Delhi, 1999.

11AE203 EDA TOOLS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Design and Simulation of an amplifier circuit and PCB layout using ORCAD.
2. Design and Simulation of Wein Bridge Oscillators and PCB layout using ORCAD.
3. Design and Simulation of three phase diode bridge rectifier and PCB layout using ORCAD.
4. Design and Simulation of three phase fully controlled bridge converter with R and RL load using PSIM.
5. Design and Simulation of Boost and Buck chopper using PSIM.
6. Design and Simulation of single phase and three phase inverter circuit using PSIM.
7. Implementation of Image Processing Algorithm using MATLAB.
8. Simulation of Adaptive and Non adaptive control systems using MATLAB.
9. Implementation of Neural networks Algorithms using MATLAB.
10. Implementation of Genetic Algorithm using MATLAB.

09AE204 APPLIED ELECTRONICS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Design and Simulation of Digital circuits using VHDL
2. Design and Simulation of Digital circuits using Verilog
3. Design of Simple NMOS/PMOS circuits using SPICE
4. Design of Dynamic latches using SPICE
5. FPGA Implementation of 4 Bit ALU & Power analysis.
6. FPGA Implementation of Real Time Clock & RTL view.
7. Design and Simulation of Operational Amplifier using SPICE
8. Design of Switched Capacitor filters using SPICE
9. Design and Simulation of Analog Multiplier using SPICE
10. Design & Simulation of Dynamic CMOS circuits using SPICE.

11AE011 BIO-MEDICAL SIGNAL PROCESSING

3 0 0 3

PREREQUISITE

Digital Signal Processing, Bio Medical Instrumentation

Objective:

- To study the various bio medical signals and filtering concepts
- To study the various modeling concepts of biomedical systems
- To analyze the characteristics of non-stationary signals and systems
- To analyze and study the pattern classification and compression technique
- To introduce the concepts of wavelet & neural networks

MODULE- I **15**

Biomedical Signals, Filtering and Modelling: Nature of Biomedical signals, Types: Action Potential, Electroneurogram (ENG), Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), Event related potentials, Electrogastrogram (EGG), Phonocardiogram (PCG), Speech signals.

Stationary versus non-stationary processes, Time domain filters, Frequency domain filters, Optional filters, Adaptive filters for removal of Interference, Selection of Appropriate filters, Applications.

Parametric System modeling, Autoregressive or All-pole modeling, Pole-zero modeling, Electromechanical Models of Signal Generation, Application: Heart – rate variability – Spectral modeling and Analysis of ECG signals.

MODULE- II **15**

Non Stationary Signals, Classification and Decision: EEG rhythms and waves, characterization of non stationary signals and dynamic systems, Fixed segmentation, Adaptive segmentation

Supervised, Unsupervised Pattern classification, Probabilistic models and Statistical Decision, Regression analysis.

MODULE- III **15**

Compression and Advanced Topics: Direct Digital compression Techniques, Transformation Compression Techniques, Other Compression Techniques and Comparison

Introduction to Wavelet Transforms, Application of Wavelet Transform on Biomedical Signals, Multi Resolution Analysis. Neural Networks in Processing and Analysis of Bio medical Signals.

TOTAL: 45

REFERENCE BOOKS

1. Rangaraj M. Rangayyan, "Biomedical Signal Analysis, A case study Approach," IEEE Press, 2001.
2. Bronzino Joseph D, "The Biomedical Engineering Handbook, CRC Press, IEEE Press, 2000.
3. Reddy D.C., "Biomedical Signal Processing, Principles and Techniques",Tata McGraw Hill, New Delhi, 2005
4. Banner Kenneth E and Arce Gonzalo R "Nonlinear Signal and Image Processing: Theory Methods and Applications", CRC Press, New York, 2003
5. Akay Metin "Nonlinear Bio Medical Signal Processing', IEEE Press, 2000.

11AE012 DATA COMMUNICATION NETWORKS

3 0 0 3

PREREQUISITE

Computer Networks

Objectives:

- To gain an understanding of the fundamentals of data communications networks
- To explain the concept of data communication
- To identify different components of computer network
- To identify different types of network
- To explain communication protocols and the concept of internetworking

MODULE - I **15**

Introduction: Definition of Networks – Classification of Networks – LAN, MAN, WAN, internet – Network Topology – Protocols and Standards – Network Models – OSI, TCP/IP Models of networking – Internet

Physical Layer: Review of Signals – Data Rate Limits – Performance Issues – Bandwidth, Throughput, Latency, Bandwidth-Delay Product, Jitter. Digital Transmission and Analog Transmission: Line coding techniques, PCM and Delta Modulation techniques – ASK, FSK, PSK, and QAM Techniques – Bandwidth Utilization: Multiplexing and Spreading

MODULE -II **15**

Communication Media: Data Transmission using Telephone Networks – Dial-up MODEMS, Digital Subscriber Line (DSL)

Data Link Layer: Error Detection and Correction techniques – Data Link Control: Framing, Flow and Error Control – HDLC and PPP protocols. Multiple Access Techniques – CSMA, CSMA/CD, CSMA/CA – Channelization – TDMA, FDMA, and CDMA

Wired LANs: Wired LANs– IEEE 802 standards - Ethernet – IEEE 802.3 MAC Frame – Token Ring LAN - IEEE 802.5 MAC Frame – Wireless LANs – IEEE 802.11 standard – Bluetooth Technology – Interconnection of LANs.

MODULE-III **15**

Wired WANs: Wired WANs -Circuit-Switched Networks, Datagram Networks, Virtual Circuit-Switched Networks, Structure of Circuit and Packet Switches - Wireless WANs – Introduction to Cellular Telephone and Satellite networks

Internetworking: Internetworking – tunneling – IP Addressing Scheme – Structure of IP Datagram – IP Routing – TCP as Transport Layer Protocol – Structure of TCP Segment – TCP Connection: Establishment and Closing – SMTP Protocol for E-Mail Application.

TOTAL: 45

REFERENCE BOOKS

1. Forouzan Behrouz A., " Data Communications and Networking", Fourth Edition, Tata McGraw-Hill, New Delhi, 2006.
2. Peterson Larry L. and Davie Bruce S., "Computer Networks: A Systems Approach", Fourth Edition, Elsevier Publications, New Delhi, 2007.
3. Rowe Stanford H. and Schuh Marsha L., "Computer Networking", Pearson Education, New Delhi, 2005.
4. Kurose James and Ross Keith," Computer Networking: Top Down Approach featuring the Internet", Pearson Education, New Delhi, 2002.

11AE013 DESIGN AND ANALYSIS OF ALGORITHMS

3 0 0 3

PREREQUISITE

Data structures

Objectives:

- To introduce basic concepts of algorithms and learn the basic tools required for analyzing algorithms
- To apply the algorithms and design techniques to solve problems
- To get exposure in mathematical aspects and analysis of algorithms
  To enrich knowledge in sorting and searching algorithms
- To Study interesting computational problems on Graph Algorithms

MODULE - I **15**

Introduction: Polynomial and Exponential algorithms, big "oh" and small "oh" notation, exact algorithms and heuristics, direct / indirect / deterministic algorithms, static and dynamic complexity, stepwise refinement.

Design Techniques: Subgoals method, working backwards, work tracking, branch and bound algorithms for traveling salesman problem and knapsack problem, hill climbing techniques, divide and conquer method

MODULE - II **15**

Dynamic Programming: Dynamic programming, greedy methods.

Searching And Sorting: Sequential search, binary search, block search, Fibonacci search, bubble sort, bucket sorting, quick sort, heap sort, average case and worst case behavior, FFT.

Graph Algorithms: Minimum spanning, tree, shortest path algorithms, R-connected graphs

MODULE - III **15**

Graph Algorithms: Even's and Kleitman's algorithms, ax-flow min cut theorem, Steiglitz's link deficit algorithm.

Selected Topics: NP Completeness Approximation Algorithms, NP Hard Problems, Strasseu's Matrix Multiplication Algorithms, Magic Squares, Introduction To Parallel Algorithms and Genetic Algorithms, Monti-Carlo Methods, Amortised Analysis.

TOTAL : 45

REFERENCE BOOKS

1. Baase, Sara., "Computer Algorithms: Introduction to Design and Analysis", Addison Wesley, New York, 1988 – 3rd Edition 2000.
2. Horowitz, E. and Sahni, S., "Fundamentals of Computer Algorithms", Galgotia Publications, New Delhi, 1988.
3. Goldberg, D.E., "Genetic Algorithms: Search Optimization and Machine Learning", Addison Wesley, New York, 1989.
4. Corman, T.H., Leiserson, C.E. and Rioest, R.L., "Introduction to Algorithms", McGraw Hill, New York, 1994.

11AE014 WAVELET TRANSFORMS AND APPLICATIONS

3 1 0 4

PREREQUISITE

Digital Signal Processing

Objectives:

- To introduce the fundamentals of wavelet transform and applications.
- To understand the Fourier Transform and drawbacks of Fourier analysis.
- To study the concepts of continuous wavelet transform.
- To study the concepts of Discrete wavelet transform.
- To understand the various techniques of wavelet packet analysis and applications.

MODULE – I **15**

Introduction: Vector spaces-properties-dot product-basis-dimension, orthogonality and orthonormality-relationship between vectors and signals-signal spaces-concept of convergence-Hilbert spaces for energy signals.

Fourier Analysis: Fourier Transform-drawbacks of Fourier analysis- window function - Short-time Fourier Transform (STFT) analysis-spectrogram plot-phase-space plot in time-frequency plane-Time and frequency

MODULE - II **15**

Limitations of STFT: Limitations-uncertanity principle-Tilling of the time-frequency plane for STFT.

Internal Wavelet Transform: Wavelet transform-properties-concept of scale and its relation with frequency-continuous Wavelet Transform (CWT)-scaling function and wavelet functions: Daubechies, Haar, Coiflet, Mexican hat, Sine, Gaussian, Bi-orthogonal-Tilling of time scale plane for CWT.

Discrete Wavelet Transform: Discrete Wavelet Transform (DWT)-Filter bank and sub-band coding principles

MODULE – III **15**

Multi-Resolution Analysis: Multi-resolution analysis-Time scale difference equations for wavelets and scaling functions-Wavelet filters-scale variation in discrete domain-Mallet's algorithm for DWT-Inverse DWT computation by filter banks.

Wavelet Packet Analysis and Applications: Haar wavelet packets – application –best basis selection and cost functions. Sub-band coding of images-Image compression-Image de-noising – image coding using wavelet tree coder – EZW code and SPIHT code.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. Strang G and Nguyen T., "Wavelets and Filter Banks", Wellesley Cambridge Press, 1996.
2. Vetterli M, and Kovacevic J., "Wavelets and Sub-band Coding", Prentice Hall, 1995.
3. Mallat, S. "A Tour on Wavelet Signal Processing", Elsevier, New Delhi, December 2005.
4. Rao .R.M and Bopardikar.A.S, "Wavelet Transforms", Addison Wesley, 1999.
5. Soman K.P. and Ramachandran K.I. "Insight into Wavelets-From Theory to Practice", Prentice Hall of India, New Delhi, 2010.

11AE015 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

(Common to M.E. Applied Electronics , VLSI Design and Communication Systems)

3 0 0 3

PREREQUISITES

Electromagnetic Theory, Circuit Theory

Objective:

- To give basics of Electromagnetic interference
- To introduce the concept of EMI coupling principles
- To impart the knowledge of EMI/EMC standards and measurements
- To design control circuits based on EMI
- To develop the EMC design of PCBs

MODULE- I **15**

EMI Environment: EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

EMI Coupling Principles: Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling

MODULE- II **15**

EMI Coupling Principles: Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

EMI/EMC Standards and Measurements: Civilian standards - FCC, CISPR, IEC,EN, Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures (462).

MODULE- III **15**

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

EMC Design of PCBs: PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

TOTAL: 45

REFERENCE BOOKS

1. Ott, Henry W., "Noise Reduction Techniques in Electronic Systems", Second Edition, John Wiley & Sons, New York, 1988.
2. Kodali, V.P., "Engineering EMC Principles, Measurements and Technologies", IEEE Press, London, 1996.
3. Keiser, Bernhard., "Principles of Electromagnetic Compatibility", Third Edition, Artech House, Dedham, 1986
4. Paul, C.R., “Introduction to Electromagnetic Compatibility”, Second Edition, John Wiley & Sons, New York, 2006.
5. Kodali. Prasad., “Engineering Electromagnetic Compatibility: Principles, Measurements, Technologies and computer models”, Second Edition, John Wiley & Sons, New York, 2001.

11AE016 ELECTRONIC PRODUCT DESIGN

(Common to M.E.Applied Electronics, Control and Instrumentation)

3 0 0 3

PREREQUISITE

Electronic Circuits , Digital Electronics

Objective:

- To introduce the basic Electronic Product Design
- To impart the knowledge about the System Design
- To understand the concept of Packaging and Quality control
- To develop the portable electronic system design ideas

MODULE - I **15**

Introduction: The basic product development process-product planning-design and engineering-procurement-manufacturing -functionality-performance-user interface-form factor- battery life- cost-time to market (TTM)- reliability-marketing and distribution-service and support.

System Design: Top down design-product concept-innovation-creativity- validation -communication-product requirements-system architecture development-trade-off analysis-cost modelling-circuit design-physical and mechanical design-Tolerance and reliability.

MODULE - II **15**

System Design: system architecture development-trade-off analysis-cost modelling-circuit design-physical and mechanical design-Tolerance and reliability

Electronic Packaging: IC packaging: Leaded package, TABITCP package-COB, flip-chip, BGA, CSP-Discrete components-Board to board connectors-substrates-Escape routing-PCA/module design metrics-Electronic packaging metrics-I/o hardware : buttons, switches, dials and touch screens, speakers , microphones, antennas, and external connectors

Mechanical Design: Housings-EMI shielding-Thermal management: High level thermal analysis, thermal issues in notebook computers-mechanical integration-DFMA analysis

MODULE - III **15**

Quality in the Design Process: Quality control -quality assurance-quality functional deployment-assignment matrices-checklist-quality in the design process-concurrent design-risk analysis-quality in production.

Portable Electronics: Digital and analog processing: microprocessor, logic devices, microcontrollers, DSP, analog devices, sensors, wireless communication, system memory and mass storage-Displays: Display technologies-LCD-micro display-pen input-power sources- Battery technologies: Ni-Cd, alkaline,Ni-MH,lithium ion, lithium polymer, photovoltaic cells, fuel cells-product implementation-high level power analysis-Case study**:** Cellular phones-portable PCs-Personal digital assistants-digital imaging products.

TOTAL: 45

REFERENECE BOOKS

1. Tony Ward and James Angus, ”Electronic Product Design”, Chapman and Hall publications,1996
2. Bert Haskell, “Portable Electronics Product Design and Development: for cellular phones, PDAs, Digital cameras, personal electronics and more”, McGraw-Hill, New York, 2004.

11AE017 INDUSTRIAL ELECTRONICS

(Common to Mechatronics, Applied Electronics and Control and Instrumentation Engg)

3 0 0 3

Objectives:

- To familiarize the Mechatronics students with power electronics and its applications in Industries
- To get an overview of different types of power semiconductor devices and phase controlled rectifiers
- To study the basic topologies in DC-DC converters and inverters

MODULE - I **16**

Power Electronic Devices and Converters: Principle of operation – Characteristics of power diodes, SCR, TRIAC, GTO, Power BJT, Power MOSFET and IGBT – Thyristor protection circuits. Phase controlled Rectifiers: Single phase full converters – Three phase half and full converters – Triggering circuits. Inverters – PWM techniques – Sinusoidal PWM, modified sinusoidal PWM and multiple PWM.

MODULE - II **12**

DC-DC and AC-AC Converters: Chopper: Principle of operation – Step up and step down chopper – Control Strategies –Voltage, Current and Load commutated chopper. AC voltage Controller: Principle of single phase AC voltage controller – Phase control – ON-OFF control – Multistage sequence control – Cycloconverters - Step up and step down operation - Three phase to single phase and three phase to three phase cycloconverters.

MODULE - III **15**

Solid State DC and AC Drives: Constructional details, principle of operation and performance characteristics of DC motors – DC motor control using rectifiers and choppers – AC drives - Constructional details, principle of operation and performance characteristics of single phase induction motor, three phase induction motor – Control of induction motor by V, V/f and slip power recovery scheme using inverters and AC power regulators.

TOTAL: 45

REFERENCE BOOKS

1. Rashid, M. H., “Power Electronics: Circuits Devices and Applications”, Third Edition, Prentice Hall International, New Delhi, 2004.
2. Mohan, Ned, Undeland and Robbins, “Power Electronics”, John Wiley and Sons, New York, 2002.
3. Singh, M. D. and Khanchandani, K. B., “Power Electronics”, Second edition, Tata McGraw-Hill, New Delhi, 2007.
4. Dubey, G. K., “Fundamental Electric Drives”, Second Edition, Narosa Publications, 2002.
5. Dubey, G. K., “Power Semiconductor Controlled Drives”, Prentice Hall International, New York, 2001.

11AE018 INDUSTRIAL ROBOTICS

(Common to M.E.Applied Electronics, Control and Instrumentation)

3 0 0 3

PREREQUISITE

Sensors and Transducers

Objectives:

- Introduction and Basics to Robotics.
- To understand the concepts of Robotics power transmission systems
- To study the characteristics and various types of sensors.
- To learn the concept of the vision systems for robotics and various types of standards.
- To study the architecture of PLC and various types of PLCs and its automation.

MODULE - I **15**

Robotics and Robotics Drives: History, Present status and future trends in Robotics and automation – Application Laws of Robotics - Robot definitions - Robotics systems and robot anatomy - Specification of Robots - resolution, repeatability and accuracy of a manipulator. Robotics applications Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drives.

Robotics Power Transmission Systems: Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws, Harmonic drives.

MODULE - II **15**

End effectors: Types of End Effector, Mechanical gripper, Types of Mechanisms, Magnetic gripper, Vaccum gripper, other types of gripper.

Rigid Transformation: Rigid motions and Homogeneous transformations, Kinematic chaim, Denavit – Harten berg representation, Forward and Inverre Kinematics, Velocity Kinematics, Manipulator Dynamics.

End effectors – Types.

MODULE- III **15**

Sensors: Sensor characteristics, Position sensors – Potentiometers – Encoders – Resolvers – LVDT, Velocity sensors – Tachogenerators - Encoders - Proximity sensors, Limit switches – Tactile sensors - Touch sensors - Force and torque sensors

Vision Systems for Robotics: Robot vision systems, Image capture- cameras – vidicon and solid state, Image representation - Gray scale and colour images, image sampling and quantization - Image processing and analysis - Image data reduction - Segmentation - Feature extraction - Object Recognition- Image capturing and communication - JPEG, MPEGs and H.26x standards, packet video, error concealment.- Image texture analysis. This is all comes under robot dynamics control without knowledge of Kinematics insister pastille to understood

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TOTAL: 45

REFERENCE BOOKS

1. Klafter, Richard D., Chmielewski, Thomas A, and Negin, Michael., "Robotics Engineering: An Integrated Approach", Prentice Hall of India, New Delhi, 1989.
2. Fu, K.S., Gomalez, R.C., and Lee C.S.G., "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill, New York, 1987.
3. Robot Dynamics and control matrix W. Spong M. Vidyasagar. Wiley Publication.

11AE019 INTERNET TECHNOLOGIES AND APPLICATIONS

3 0 0 3

PREREQUISITE

Computer Networks

Objectives:

- To introduce the principles of internet technologies and communication
- To describe the features and functions of Protocols
- To provide an understanding of the underlying technology of Internet and use of Internet for business applications
- To get knowledge in network management and security
- To get exposure in the advanced topics of WWW

MODULE – I **15**

Introduction: Introduction to course: Review networking concepts (Basics of Computer communication and networking - LAN, WAN etc.)

Internet Core: Internet core - Fundamental Protocols (IP, TCP, UDP, ICMP, ARP and an introduction to IP multicast) - IP routing and Routing protocols (RIP, RIP -II, IGRP, EIGRP, OSPF etc.) - TCP and UDP in more depth; IP network design and troubleshooting.

MODULE – II **15**

DNS and IP Protocols: The Domain Name System (DNS), DHCP, and other Important IP 'Utility' Protocols.

Internet Applications: Internet applications - Fundamental Applications (Email, Telnet, File Transfer, and News) - Directories and Distributed Applications (NFS, LDAP, ILS, NIS etc.)

Internet applications - Streaming and Real time communications (H.323 VTC, VolP, Netmeeting etc.)

World Wide Web - Part 1: The basics (HTML, HTTP and security protocols).

MODULE – III **15**

World Wide Web - Part 2: Advanced topics (CGI, Perl, D-HTML, Java, ASP, VRML & SML)

Internet Management And Security: SNMP, RMON, IPsec, L2TP, and others. The future of the Internet & Related applications - IPv6, Internet2, and NGI. Some hardwork assignments will require the use of common network troubleshooting tools, retrieval of information from the web, and basic Web-related programming assignments. (Typically Linux systems should be sufficient. Any LAN can be converted into a Linux LAN)

TOTAL: 45

REFERENCE BOOKS

1. Kurose, James F. and Ross, Keith W. "Computer Networking: A Top Down Approach Featuring the Internet", Pearson Education, New Delhi, 2005.
2. Stevens, "Unix Network Programming", Vol. 1. Second Edition, Prentice Hall, New Jersey, 1999.
3. Stevens, "Unix Network Programming", Vol. 2, Second Edition, Prentice Hall, New Jersey, 1999.
4. Comer, Dougles E., "Internetworking with TCP/IP: Vol. 1, Principles, Protocols, Architecture", Fourth Edition, Prentice Hall of India, New Delhi, 2005.

11AE020 MICRO SENSORS AND MEMS

(Common to M.E.Applied Electronics and Control and Instrumentation Engineering)

3 0 0 3

Objective:

- To gain a fundamental knowledge of standard Microsystems design fabrication and manufacturing techniques.
- Understanding the working principles of micro sensors and actuators
- The materials used for MEMS system design and its properties.
- Know the major classes, components and application of MEMS systems.

MODULE-I **15**

Introduction to Microsystems and Micro Electronics working principles of different types of Micro sensors and Micro actuators scaling laws for Micro system design – Mechanics for MEMS design: Bending of thin plates, Vibration and fracture mechanics

MODULE-II **15**

Materials for MEMS: Si, Silicon compounds: Sio_2, Si_3N_4, SIC,Poly silicon, Silicon Piezo resistors – GAS, Quartz, polymers – Piezo Electric crystels. Fabrication: Photolithography, Ion implantation, diffusion, oxidation, CVD, Sputtering, etching.

MODULE-III **15**

Microsystem manufacturing and packaging : Bulk micro machining, surface micro machining, LIGA Technique – Die level, device level and system level practices – Application ;of Microsystems in automotive industry, biomedical and consumer products.

TOTAL: 45

REFERENCE BOOKS

1. Doebelin, E.O., “Measurement Systems: Application & Design”, Fifth Edition McGraw-Hill Book Co., New Delhi, 2004.
2. Sheingold, D.H., “Transducer Interfacing Handbook: The guide to analog signal conditioning”, Analog devices Inc.,
3. Tai – Ran Hsu, “ MEMS and Microsystems design and manufactures” Tata McGraw Hill, New Delhi, 2008.
4. Mohamed Gad –el-Hak, “The MEMS Hand Book”, CRC press, 2002.
5. Fatilcow. S and Rembold U, “Microsystem Technology and Microrobotics, Springe – verlog Berlin, 1997.
6. Garden, J.W. Varadan.V.K., Osama and Awadelkarim.O., “Microsensors MEMS and Smart Devices”, John Wiley & sons Ltd., New York, 2001.

11AE021 NANO ELECTRONICS

3 0 0 3

PREREQUISITE:

Materials Science, Digital Electronics

Objectives:

- To expose the concept of terminologies and analysis of nano electronics
- To study the Structure of carbon nano tubes
- To expose the students the various logic devices
- To learn and analyze the random access memories and storage devices
- To study the various data transmission modules

MODULE – I **15**

Technology and Analysis: Classification Nano structure – Effect of nano scale dimensions on various properties – structural, thermal, mechanical, magnetic,optical, and electronics properties- Synthesis- Film Deposition Methods – Lithography – Material removing techniques – Etching and chemical – Mechanical Polishing – Scanning Probe Techniques.

MODULE - II **15**

Carbon Nano Structures: Carbon Clusters – Carbon Nano tubes – Fabrication- Electrical, Mechanical and Vibrational Properties – Applications of Carbon Nano tubes.

Logic Devices: Silicon MOSFET's – Novel materials and alternative concepts – Ferroelectric Field Effect Transistors – Super conductor digital electronics – Carbon Nano tubes for data processing.

MODULE - III **15**

Random Access Memories and Mass Storage Devices: High Permitivity materials for DRAM's – Ferro electric Random Access Memories – Giant Magneto Resistance (GMR) - Magneto-resistive RAM. Hard Disk Drives – Magneto Optical Disks – Rewriteable DVDs based on Phase Change Materials – Holographic Data Storage.

Data Transmission And Interfaces and Displays: Photonic Networks – Microwave Communication Systems. Liquid Crystal Displays – Organic Light emitting diodes - organic FET.

TOTAL : 45

REFERENCE BOOKS

1. Waser Rainer, "Nano Electronics and Information Technology", Wiley VCH, 2003.
2. Poole Charles, "Introduction to Nano Technology" Wiley Interscience, 2003.
3. Hanson George W.,"Fundamentals of Nanoelectronics" Pearson/Prentice Hall, 2008.
4. Meyyappan M. "Carbon nanotubes-science and applications" CRC Press, 2009.
5. Stallings William, "Computer organization and architecture" Seventh Edition, Prentice Hall of India, 2007.
6. Martínez-Duart J.M., Raúl J. Martín-Palma, and Fernando Agulló-Rueda, "Nanotechnology for Microelectronics and Optoelectronics".

11AE022 POWER QUALITY MANAGEMENT

3 0 0 3

PREREQUISITE

Power Quality/ Power Electronics

Objectives:

- To study the various issues affecting Power Quality, their production, monitoring and suppression.
- To under stand the interruptions, short and long. Their sources, effects and analysis.
- To study the production of voltages sags, overvoltages and harmonics and methods of control.
- To study about earthing, neutral winding and wiring
- To study various methods of power quality monitoring and provide the solutions

MODULE – I **15**

Introduction: Definitions – Power quality, Voltage quality – Power quality issues : Short duration voltage variations, Long duration voltage variations, Transients, Waveform distortion, Voltage imbalance, Voltage fluctuation, Power frequency variations – Sources and Effects of power quality problems – Power quality terms – Power quality and Electro Magnetic Compatibility (EMC) Standards.

Short Interruptions: Introduction – Origin of short interruptions : Voltage magnitude events due to re-closing, Voltage during the interruption – Monitoring of short interruptions –Influence on induction motors, Synchronous motors, Adjustable speed drives, Electronic equipments – Single phase tripping : Voltage during fault and post fault period, Current during fault period – Prediction of short Interruptions.

MODULE – II **15**

Long Interruptions: Definition – Failure, Outage, Interruption – Origin of interruptions – Causes of long interruptions – Principles of regulating the voltage – Voltage regulating devices, Applications : Utility side, End-User side –Reliability evaluation – Cost of interruptions.

Voltage Sag and Transients: Introduction – Definition – Magnitude, Duration – Causes of Voltage Sag – Three Phase Unbalance – Phase angle jumps – Load influence on voltage sags on Adjustable speed drives, Power electronics loads, Sensitive loads - Stochastic assessment of voltage sags - Overview of mitigation methods. Definition – Power system transient model – Principles of over voltage protection - Types and causes of transients – Devices for over voltage protection - Capacitor switching transients –Lightning transients – Transients from load switching.

MODULE – III **15**

Waveform Distortion and Wiring and Grounding: Introduction – Definition and terms – Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage Vs Current distortion – Harmonics Vs Transients – Sources and effects of harmonic distortion – System response characteristics – Principles of controlling harmonics – Standards and limitation Definitions and terms – Reasons for grounding – National Electrical Code (NEC) grounding requirements – Utility Power system grounding – End-User power system grounding – Wiring and grounding problems.

Power Quality Solutions: Introduction – Power quality monitoring : Need for power quality monitoring, Evolution of power quality monitoring, Deregulation effect on power quality monitoring – Brief introduction to power quality measurement equipments and power conditioning equipments – Planning, Conducting and Analyzing power quality survey – Mitigation and control techniques - Active Filters for Harmonic Reduction.

TOTAL: 45

REFERENCE BOOKS

1. Dugan, Roger C., McGranaghan, Mark F. and Beaty, H.Wayne, "Electrical Power Systems Quality", Second Edition, McGraw-Hill, New York, , 2002.

2. Kennedy, Barry W., “Power Quality Primer”, McGraw-Hill, New York, 2000.
3. Bollen, Math H.J., "Understanding Power Quality Problems: Voltage Sags and Interruptions", IEEE Press, New York, 2000.
4. Arrillaga,J., Watson, N.R and Chen, S., "Power System Quality Assessment", John Wiley & Sons Ltd., England, 2000.
5. Sankaran, C, "Power Quality", CRC Press, Washington, D.C., 2002.

11AE023 PROJECT MANAGEMENT

(Common to M.E.Applied Electronics, Power Electronics)

3 0 0 3

PREREQUISITE:

Principles of Management/ Total Quality Management

Objective:

- To know the project phases and control
- Linear programming for solving problems
- To Estimate the Project cost
- To evaluate and manage the Project

MODULE - I **15**

Project Management Systems and Controls: Need – Goals- Evolution-different forms-project management in manufacturing, service and government sectors; Systems development cycle – project life cycle – conception phase: proposal, contracting – definition phase – execution phase: production / build, implementation – operation phase- case study. Tools for project planning – work break down structure, responsibility matrix, events and mile stones- Gantt charts.

Performance Analysis – cost, schedule, work package analysis, performance indices, updating time estimates, technical performance measurement; Performance Index monitoring – variance limits, controlling changes, contract administration, control problems, case study.

MODULE - II **15**

Network Scheduling and Project Cost Estimation: Network Diagram – critical path – late times – slack – float – calendar scheduling. Time estimates – probability of finishing by target completion date – meeting the target – simulating PERT network - - criticisms of PERT ; CPM – Time cost relationship – reducing project duration – shortest duration – total project cost – scheduling with resource constraints – resource loading and leveling – constrained resources: Introduction to GERT network, class studies in PERT/CPM.

Process – classification-expert opinion, analogy, parametric estimate, cost engineering- example: Contingency amount ; Elements of budgets and Estimates – direct labour, direct non- labour, overhead, general and administrative expenses, profit and total billing;

MODULE - III **15**

Project Management Information Systems (PMIS) and Project Evaluation: Functions – Computer based PMI Systems – Web-Based project management. Review meetings, reporting, terminating, termination responsibilities, closing the contract, project extensions, project summary evaluation. Cost accounting systems- project control process ; Project control emphasis – scope change control, quality control, schedule control, time buffers

Project cost accounting and management information system – cost summaries, cost schedules and forecasts – case study.

TOTAL : 45

REFERENCE BOOKS

1. Nicholas, John M., “Project Management for Business and Technology”, Prentice Hall India, New Delhi, 2002.
2. Pagnoni, Anastasia., “Project Engineering: Computer Oriented Planning and Operational Decision Making”, Springer-Verlag, Berlin, 1990.

11AE024 SCADA AND DCS

3 0 0 3

PREREQUISITE

Digital Electronics, Logic Controllers

Objectives:

- To expose the concept of Industrial automation
- To study the necessity of automation and SCADA
- To expose the students the various communication protocols of SCADA
- To learn and analyze the Distributed control system
- To study the various applications of SCADA and DCS

MODULE- I **15**

Introduction: Introduction to factory & Process Automation, PLC – Networking standards. Vertical Integration of Industrial Automation – field bus and Ethernet.

Automation and SCADA: HMI systems, Necessity and Role in Industrial Automation, Text display – operator panels – Touch panels – Panel PCs – Integrated displays (PLC & HMI)

MODULE - II **15**

Automation and SCADA: Supervisory Control and Data Acquisition (SCADA) – overview – Developer and runtime packages – architecture – Tools – Tag – Internal & External graphics, Alarm logging – Tag logging – structured tags – Trends – history – Report generation, VB & C Scripts for SCADA application.

Communication Protocols of SCADA: Proprietary and open protocols – OLE/OPC – DDE – Server/Client Configuration – Messaging – Recipe – User administration – Interfacing of SCADA with PLC, Drive and other field devices.

MODULE- III **15**

Distributed Control System: Distributed Control Systems (DCS) – Difference between SCADA system and DCS – architecture – local control unit – programming language – communication facilities – operator interface – engineering interfaces.

Applications: Applications of SCADA & DCS – Case studies of Process plants using SCADA & DCS – Advanced features / options in SCADA & DCS – Role of PLC in DCS and SCADA – comparison – field devices (Transducers, drives etc) in DCS / SCADA.

TOTAL: 45

REFERENCE BOOKS

1. Webb John W. and Reis Ronald A., “Programmable Logic Controllers”, Prentice Hall Publications, New Delhi, 2005.
2. WiNCC Software Manual, Siemens, 2003.
3. RS VIEW 32 Software Manual, Allen Bradly, 2005.
4. CIMPLICITY SCADA Packages Manual Fanuc India Ltd, 2004.
5. Lukas, Michael P., “Distributed Control Systems”, Van Nostrand Reinfold Company, 2002.

11AE025 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL

3 1 0 4

PREREQUISITES

Control Systems/Advanced Control Theory,

Objectives:

- To produce a model of a LTI system
- To introduce the concept of Parametric and Non-Parametric Estimation methods
- To discuss about linear and Non-Linear estimation techniques
- To impart the knowledge of STR, MRAC, Gain Scheduling
- To discuss the applications of Adaptive Control

MODULE – I **15**

Systems and Models: Models of LTI systems: Linear Models-State space Models, Model sets, Structures and Identifiability-Models for Time-varying and Non-linear systems: Models with Nonlinearities – Non-linear state-space models-Black box models, Fuzzy models, Model approximation and validation-Random Process Modelling.

Estimation Methods: Transient response and Correlation Analysis – Frequency response analysis – Spectral Analysis – Least Square – Recursive Least Square.

MODULE – II **15**

Estimation Methods: Maximum Likelihood – Instrumental Variable methods – Pseudo Linear Regression.

Linear and Non-Linear Estimation Techniques: Open and Closed loop identification: Approaches – Direct and indirect identification – Joint input-output identification – Non-linear system identification – Wiener models – Power series expansions - Multidimensional Identification – State estimation techniques – FFT based, Model based Spectral estimation techniques.

MODULE – III **15**

Classification of Adaptive Control: Introduction – Uses – Auto tuning – Self Tuning Regulators (STR) – Model Reference Adaptive Control (MRAC) – Types of STR and MRAC – Different approaches to self-tuning regulators – Stochastic Adaptive control – Gain Scheduling.

Applications of Adaptive Control: Industrial adaptive controllers-General purpose toolbox for Adaptive control-SattcontrolECA40 and Fisher Control DPR 900 – Eurotherm Adaptive controller – ABB Adaptive controller – First control adaptive controller – Process control applications.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. Kari J. Astrom and Bjorn Wittenmark, "Adaptive Control", Second Edition, Pearson Education Inc., New Delhi, 2003.
2. Eveleigh, V.W., "Adaptive Control and Optimization Techniques", McGraw-Hill Book Company, New York, 1967.
3. Chalam V.V., "Adaptive Control Systems: Techniques and Applications", Marcel Dekkar Inc., New Jersey, 1987.
4. Ljung," System Identification Theory for the User", Prentice Hall of India, New Delhi, 1987.
5. Kumpathi S. Narendra, Romeo Ortega, and Peder Dorator, "Advances in Adaptive Control", IEEE Press, New Jersey 1991.

11AE026 VIRTUAL INSTRUMENTATION SYSTEMS

(Common to M.E.Applied Electronics, Power Electronics)

3 0 0 3

PREREQUISITE

Microprocessor , Instrumentation

Objectives:

- To review background information required for studying virtual instrumentation.
- To study the basic building blocks of virtual instrumentation.
- To study the various techniques of interfacing of external instruments of PC.
- To study the various graphical programming environment in virtual instrumentation.
- To study a few applications in virtual instrumentation.

MODULE - I **15**

Introduction: General Functional description of a digital instrument - Block diagram of a Virtual Instrument - Physical quantities and Analog interfaces - Hardware and Software - User interfaces - Advantages of Virtual instruments over conventional instruments - Architecture of a Virtual instrument and its relation to the operating system.

Software Overview: Lab VIEW - Graphical user interfaces - Controls and Indicators - 'G' programming - Data types - Data flow programming - Editing - Debugging and Running a Virtual instrument - Graphical programming pallets - Front panel objects - Controls, Indicators, Object properties and their configuration – Typical examples.

MODULE - II **15**

Programming Structure: FOR loops, WHILE loop, CASE structure, formula node, Sequence structures - Arrays and Clusters - Array operations - Bundle - Bundle/Unbundle by name, graphs and charts - String and file I/O - High level and Low level file I/O's - Attribute modes Local and Global variables

Hardware Aspects: Installing hardware, installing drivers - Configuring the hardware - Addressing the hardware in Lab VIEW - Digital and Analog I/O function

MODULE - III **15**

Data Acquisition: Data Acquisition - Buffered I/O - Real time Data Acquisition

Lab VIEW Applications: Motion Control: General Applications - Feedback devices, Motor Drives – Machine vision – Lab VIEW IMAQ vision – Machine vision Techniques – Configuration of IMAQ DAQ Card - Instrument Connectivity - GPIB, Serial Communication - General, GPIB Hardware & Software specifications - PXI / PCI: Controller and Chassis Configuration and Installation.

TOTAL: 45

REFERENCE BOOKS

1. Johnson Garry W, "LabView Graphical Programming", Third Edition, Tata McGraw Hill, New Delhi, 2001.
2. Sanjay Gupta and Joseph John, “Virtual Instrumentation Using LabVIEW”, Tata McGraw-Hill, Ist Edition, 2008.
3. LabView: Basics I & II Manual, National Instruments, 2006.
4. Barry Paron, "Sensors, Transducers and LabVIEW", Prentice Hall , 2000.
5. Buchanan William and Buchanan Bill, “Computer Basics”, CRC Press, 2000.
6. Javitha Jerome, “ Virtual Instrumentation using Lab View”, PHI, 2008.

11VL014 LOW POWER VLSI DESIGN

(Common to M.E. Applied Electronics and VLSI Design)

3 0 0 3

Objective:

- To understand the concepts of power dissipation and power optimization in CMOS circuits.
- To learn the concepts of designing low power CMOS circuits
- To study the concepts of software design for low power

PREREQUISITE: VLSI Design Techniques.

MODULE – I **15**

Power Dissipation and Power Optimization in CMOS: Hierarchy of limits of power: Fundamental Limit, Material Limit, Device Limit,Circuit Limit, System Limit and Practical Limit – Sources of power consumption –Physics of power dissipation in CMOS FET devices: MIS Structure, Long channel andSubmicron MOSFET- Basic principle of low power design.Power optimization: Logical level power optimization: Combinational circuits technology, Sequential circuits technology, Technology dependent optimization.Circuit level low power design: Introduction, Latches and FlipFlops, Transistor sizing and Ordering.

MODULE- II **15**

Design of Low Power CMOS Circuits and Power Estimation: Circuit techniques for reducing power consumption in adders and multipliers- Logic stylesComputer Arithmetic techniques for low power systems: LNS, RNS. Reducing powerconsumption in memories: SRAM, DRAM. Low power clock, Interconnect and layout design. Power estimation techniques: Logic level power estimation: Simulation power analysis: Monte Carlo Power Estimation, Advanced Sampling Techniques and Vector Compaction. Probabilistic power analysis: Combinational Circuits, Real Gate delay power Estimation, Sequential circuits.

MODULE-III **15**

Synthesis and Software Design for Low Power: Synthesis for low power: Behavioral level transforms: Algorithm Level Transforms forlow power, Architecture driven voltage scaling, PCLS optimization for Adaptive andNon adaptive filters. Power optimization using operation reduction, substitution.Software design for low power: Sources of power dissipation, Software power optimization, Automated low power code generation, codesign for low power.Advanced techniques: Adiabatic computation, Pass Transistor Logic Synthesis,Asynchronous Circuits. Special techniques: Power reduction in clock networks, LowPower Swing bus, Delay balancing.

TOTAL: 45

REFERENCE BOOKS

1. Soudris, Dimitrios, Pignet, Chirstian, and Goutis, Costas., “Designing CMOS Circuits for Low Power”, Kluwer Academic Publishers, Dordrecht, 2002.
2. Yeap, Gary., “Practical Low Power Digital VLSI Design”, Kluwer Academic Publihsers, Dordrecht, 1998
3. Roy, K. and Prasad, S.C., “Low Power CMOS VLSI Circuit Design”, John Wiley, New York, 2000.
4. Chandrakasan, A.P., and Broadersen, R.W, “Low Power Digital CMOS VLSI Design”, Kluwer Academic Publishers, Dordrecht, 1995.
5. G.K Yeap and F. N Najm, “Low Power VLSI Design and Technology”, Springer, 1997.
6. Iman. Sasan, Pedlum Klassard, “Logic Synthesis for Low Power VLSI Design”, Springer. Kluwer Academic Publishers, 1997.

11VL025 DIGITAL IMAGE PROCESSING

(Common to M.E. Mechatronics, Applied Electronics and Computer Science and Engg.)

3 0 0 3

PREREQUISITE

Digital Signal Processing

Objectives:

- To introduce the fundamentals and techniques of digital image processing.
- To understand the various 2D image transformations.
- To study the concepts of image processing techniques like image enhancement and restoration.
- To study the various techniques in image segmentation and representation.
- To understand the various techniques of Image compression and its standards.

MODULE– I **15**

Introduction: Elements of Digital Image processing – Elements of visual perception: light - luminance – brightness, contrast, hue, saturation – Mach band effect – simultaneous contrast. Color image fundamentals – RGB model and HIS model – converting colors from HIS to RGB. Two dimensional sampling theory – practical limits in sampling and reconstruction.

Image Transforms: Two dimensional systems - Block matrices and Kronecker products. Two dimensional orthogonal and unitary transforms – DFT, cosine, sine,Walsh, problems

MODULE– II **15**

2D Transforms: Hadamad, Haar and KL transforms, Radon transforms, problems

Image Enhancement and Restoration: Image enhancement - Point operations - contrast stretching - clipping and thresholding - digital negative intensity level slicing - bit extraction. Histogram processing - histogram equalisation -modification. Spatial operations – smoothing spatial filters, sharpening spatial filters. Transform operations. Color image enhancement. Image Restoration – degradation model, Noise models, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering.

Image Segmentation: Point, line and edge detection –Image segmentation based on thresholding– Region based segmentation – region growing – region splitting and merging.

MODULE– III **15**

Image Representation: Representation: chain codes – polynomial approximations – signatures – boundary descriptors – Regional descriptors: Texture regional descriptor.

Image Compression: Image Compression – Need for data compression – Run length encoding – Huffman coding – Arithmetic coding – predictive coding- transform based compression, Image compression standards – JPEG 2000, MPEG 4. - vector quantization – block truncation coding, Wavelet based image compression.

TOTAL: 45

REFERENCE BOOKS

1. Gonzalez, Rafel C. and Woods, Richard E., "Digital Image Processing", Second Edition, Prentice Hall, New York, 2006.
2. Jain, Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi, 2003.
3. Rosenfield, Azriel and Kak, Avinash C., “Digital Picture Processing”, Academic Press Inc, New York, 1982.
4. Jayaraman. S, Esakkirajan. S, and Veerakumar. T, “Digital Image Processing” Tata McGraw-Hill, New Delhi 1st ed 2009

11VL105 DEVICE MODELING

(Common to M.E. VLSI Design and Applied Electronics)

3 0 0 3

Objective:

- To introduce the properties of Semiconductor Devices
- To understand second order effects of Semiconductor Devices
- To understand how the properties of Semiconductor Devices are modeled and simulated

MODULE -I **15**

Semiconductor Physics and Diode Modeling: Quantum Mechanical Concepts- Carrier Concentration- Transport Equation- Mobility and Resistivity- Carrier diffusion- Carrier Generation and Recombination- Continuity equation- Tunneling and High field effects- Abrupt and linear graded PN junction- Ideal diode current equation- Static, Small signal and Large signal models of PN junction Diode-SPICE model for a Diode- Temperature and Area effects on Diode Model Parameters- Structure of Photo Conductors and PIN Photo Diode- Modeling of Photo Conductor- Structure of LASER- LASER rate equation - Static and dynamic modeling of LASER.

MODULE -II **15**

Bipolar Device Modeling and Parameter Measurements: Transistor Action-Terminal currents - Switching- Static, Small signal and Large signal Eber-Moll models of BJT- Gummel Poon Model- SPICE modeling - temperature and area effects- Bipolar Junction Transistor Static Parameter Measurement Techniques – Large signal parameter Measurement Techniques- Gummel Plots

MODULE- III **15**

MOSFET Modeling and Parameter Measurements: MOS Transistor – NMOS- PMOS – MOS Device equations - Threshold Voltage – Second order effects - Temperature Short Channel and Narrow Width Effect- Models for Enhancement- Depletion Type MOSFET- MOS Models in SPICE- MOSFET: Long and Short Channel Parameters and Measurement of Capacitance

TOTAL : 45

REFERENCE BOOKS

1. Massobrio Giuseppe and Antognetti Paolo, “Semiconductor Device Modeling with SPICE”, Second Edition, McGraw-Hill Inc, New York, 1993.
2. Sze S. M., “Semiconductor Devices-Physics and Technology”, 2nd Edition, John Wiley and Sons, New York, 2002.
3. Pallab Bhatacharya, “Semiconductor Opto-electronic Devices” 2nd Edition, Prentice Hall of India, New Delhi, 1996.
4. M.S. Tyagi, “Intorduction to Semiconductor Materials and Devices”, John Wiley, New York, 2003
5. Ben,G.Streetman, “Solid State Circuits”, 5th Edition, Prentice Hall of India, New Delhi, 2005.
6. De Graaf H.C and Klaasen F M.- “Compact Transistor Modeling for Circuit Design”, Springer-Verlag, New York,1990.