Shivaji University Kolhapur

Structure for M.E. (Electronics Engg.) Course

To be implemented from academic year 2014-15 onwards

Semester-I

Sr. No.	Subject	Teaching Scheme in Hrs			Examination Scheme in Marks			
		L	T	P	TH	TW	POE	Total
1	Advanced Digital Signal Processing	3	-	2	100	-	25	125
2	CMOS VLSI Design	3	-	2	100	25	-	125
3	Random Signal Processing	3	1	-	100	25	-	125
4	Elective I	3	-	2	100	25	-	125
5	Elective II	3	1	-	100	25	-	125
6	Research Methodology	-	-	2	-	25	-	25
7	Comprehensive Viva Voce &Common Assessment of Term Work	-	-	-	-	-	25	25
	Total	15	2	8	500	125	50	675

Note: Comprehensive Viva Voce & Common Assessment of Term Work will be done by Internal and External Examiners as ORAL EXAMINATION

Elective-I (P)	Elective-II
• High Performance Communication Network.	• Image Processing & Applications
• Design of Digital Circuit & Logic Design	• Design of VLSI Systems
• Optimization Techniques	• Robotics & Applications
• Advance Communication Systems	• Wireless Sensor network
• Software Defined Radios	• Industrial DC Drives

Semester-II

Sr. No.	Subject	Teaching Scheme in Hrs			Examination Scheme in Marks			
		L	T	P	TH	TW	POE	Total
1	Real Time Embedded System design	3	-	2	100	-	25	125
2	Advanced Process control	3	-	2	100	25	-	125
3	Power Electronics Systems	3	1	-	100	25	-	125
4	Elective III	3	-	2	100	25	-	125
5	Elective IV	3	1	-	100	25	-	125
6	Seminar-I			2	-	25	-	25
7	Comprehensive Viva Voce &Common Assessment of Term Work	-	-	-	-	-	25	25
	Total	15	2	8	500	125	50	675

Note: Comprehensive Viva Voce & Common Assessment of Term Work will be done by Internal and External Examiners as ORAL EXAMINATION

Elective-III(P)	Elective-IV
• Design & analysis of Algorithms • Design of analog & Mixed Mode VLSI Circuits • Artificial Neural Networks • Cryptography & Network Security • Cognitive Radio Communications And Networks	• Fuzzy systems • VLSI in Digital Signal Processing • RF & Microwave Circuits • Renewable & Distributed Energy Systems • Advanced Computer Architecture

ELECTRONICS ENGINEERING LAB: Each student will be required to complete a course on Lab Work comprising of advanced Experiments related to Electronics Engineering. The experiments in the Lab Work will be decided by the concerned teacher/section-in charge. The student will be required to

complete the prescribed Lab Course and other requirements related to evaluations of the Practical Course. The evaluation will be done by the committee of examiners constituted by Head of Department.

SELF STUDY AND SEMINAR: Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electronics Engineering including interdisciplinary fields. The topic/title will be chosen by the student in consultation with the Faculty Advisor allocated to each student. The student will be required to submit the Seminar Report and present a talk to an audience of Faculty/Students in open defense in front of the Seminar Evaluation Committee having Faculty Advisor as one of its members. The Head of Department will constitute the Seminar Evaluation Committee.

Semester-III

Sr. No.	Subject	Teaching Scheme in Hrs			Examination Scheme in Marks			
		L	T	P	TH	TW	POE	Total
1	Seminar-II	-	-	1	-	50	-	50
2	Dissertation Phase-I	-	-	4	-	50	50	100
	Total	-	-	5	-	100	50	150
Note: Seminar-II should be on Dissertation topic.								

Semester-IV

Sr. No.	Subject	Teaching Scheme in Hrs			Examination Scheme in Marks			
		L	T	P	TH	TW	POE	Total
1	Seminar-III	-	-	1	-	100	-	100
2	Dissertation Phase-II	-	-	4	-	-	200	200
	Total	-	-	5	-	100	200	300
Note: Seminar-III should be on Dissertation topic.								

DISSERTATION

Each student will be required to complete a Dissertation and submit a written hard bound Report on the topic on any of the areas of modern technology related to Electronics Engineering including interdisciplinary fields in the Final semester of M.E. course. The title and objectives of the Dissertation will be chosen by the student in consultation with the Supervisor (s) and the same will be required to be defended by the student in open defense in front of the **Dissertation Monitoring Committee** approved by the Head of Department. The title and objectives will be approved by the Dissertation Monitoring Committee having main Supervisor (Guide) as one of its members. The progress will also be monitored at weekly coordination meetings with the Supervisor (s). The student will be required to present a talk to the gathering in open defense in front of the Dissertation Monitoring Committee having main Supervisor as one of its members. The Dissertation Monitoring Committee will be constituted by Head of Department for the purpose examining the suitability of the work carried out by the student in the Dissertation for its evaluation by the external examiner. The external evaluation will be done jointly by the main Supervisor and External Examiner appointed by the University. The dissertation (non-credit course) will be either approved or rejected. The External Examiner will evaluate the dissertation and the viva-voce will be fixed by the University. After Viva-voce, the examiners (internal and external) will approve/reject the dissertation. In case, the dissertation is rejected, the candidate will rework and resubmit the dissertation. The dissertation will be again be evaluated jointly by the same external examiner and the Main Supervisor (Guide).

M.E. (Electronics Engineering) Revised (Sem. I) with effect from July 2014 onwards

ADVANCED DIGITAL SIGNAL PROCESSING

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2 Hrs/ week **POE: 25 Marks**

Unit-1: Design of Digital Filters (5)

FIR filter design using Kaiser window., Design of FIR differentiator, Design of Hilbert transformers, Design of optimum equiripple linear phase FIR filters, Pade approximation method, Least squares Design methods.

Unit-2: Adaptive digital filters (7)

Introduction, wiener filter, steepest Descent method,Gradient Descent method, Block diagram of adaptive filter , minimum MSE criteria, LMS algorithm, RLS algorithm, Kalman Filter, Application of adaptive digital filter.

Unit-3: Linear Prediction (8)

Forward Linear Prediction Backward Linear Prediction Levinson—Durbin Algorithm ,Properties of Prediction-Error Filters , Schur –Cohn Test, Autoregressive modeling of a stationary stochastic process, Lattice Predictors, all pole ,all pass lattice filter, Joint process estimation, Predictive modeling of Speech

Unit-4: Multirate Digital Signal Processing (6)

Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Polyphase filters, Filter design & Implementation of sampling rate conversion.

Unit-5: Spectral Estimation: (7)

Estimation of spectra from finite duration signals, nonparametric methods: Periodogram, Modified periodogram, Blackman-Tukey methods, Parametric methods: Relation between auto correlation & model parameters, Yule-Walker method, MA & ARMA models for power spectrum estimation.

Unit-6: DSP Processors (7)

Implementation of DSP Applications on TMS320C 67XX DSP Processor,FIR Digital filter, Multrate Signal Processing, Adaptive Filtering

REFERENCE BOOKS:

1. John J. Proakis, Dimitris G. Manolakis, : Digital Signal Processing‘, Pearson Education, 2002.
2. Simon Haykin –_Adaptive Filter Theory _ Fifth edition,Pearson Education
3. E.C.Ifeachor Barrie,W.Jervis,—Digital Signal Processing||, Pearson Education. Second Edition
4. Alan V Oppenheim,R.W.Shafer –_Digital Signal Processing‘,PHI Publication
5. A. Anandkumar _Digital Signal Processing‘ PHI Publication
6. S.Salivahanan, A.Vallavaraj, Gnanapriya, Digital Signal Processing, McGraw-Hill / TMH, 2000

M.E. (Electronics Engineering) Revised (Sem. I) with effect from July 2014 onwards

CMOS VLSI Design

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2 Hrs/ week **Term Work: 25 Marks**

Unit 1: Basics of CMOS **6Hrs**

VLSI Design: History, Trends, Principles, Metrics, CMOS transistors (n-channel and p-channel), The CMOS Switch model, CMOS Inverter mode, Logic devices and interconnect, CMOS circuit analysis: transistors, inverters, interconnect modeling, CMOS parasitic, CMOS Process and Layout, CMOS Devices: SPICE and deep sub-micron issues.

Unit 2: CMOS: Design Issues **9Hrs**

Design of FSM, Moore & Mealy machines, Metastability, Solutions to metastability, Synchronization methods, VHDL codes for complex sequential machines, Hazards, Types of hazards, Method to eliminate hazards, case studies. Design calculations for different logic ckts, Calculations for Area on chip, Power dissipation, PDP, Transmission gate, Domino logic, NORA logic, CMOS layout techniques, Transient response, Advance trends of elements & Alloys for ultra fast logic clock, CMOS Inverter: speed, power and scaling, Static CMOS Gates, Dynamic CMOS Gates, Power Estimation and Optimization

Unit 3: Modeling **6Hrs**

Analytical modeling: Ellmore Delay, Transmission models, RC, RLC lumped parameter models, Layout for custom logic: Sea of Gates (SoG) model, Design rules, Circuit fabrication methods for CMOS, Levels of abstraction.

Unit 4: Circuits to Systems **7Hrs**

VLSI circuits to systems, Circuit modeling and layout (demo using standard tools), CMOS design and layout tools, Nano-electronics circuits versus CMOS microelectronics circuits, Nano-computing techniques and device platforms

Unit 5: Digital IC Design **7Hrs**

Digital CMOS IC design: Sequential Logic Circuits, Implementation Strategies for Digital ICs, Interconnects, Timing and Clocking, Datapath Design, Memory Design, Capactitiveparasitics, Resistive parasitics, Inductive parasitics

Unit 6: Timing issues for Digital CMOS circuits **5Hrs**

Timing Issues, Clock skew, clocking styles, Self-timed circuit design, Case study of Kitchen timer chip. ultra fast VLSI circuits and systems with GaAs system

Reference Books:

1. N.H.E. Weste and K. Eshraghian, “Principles of CMOS VLSI Design”, New York: Addison-Wesley, 1993.
2. Christopher Saint and Judy Saint, “IC Layout Basics”, McGraw Hill Publications.
3. Weste and Harris, “CMOS VLSI Design, a Circuits and Systems Perspective” (3 rd edition)
4. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, Digital Integrated Circuits (2nd Edition) Prentice Hall, 2003.
5. Douglas Holberg, “CMOS Analog circuit design”, Oxford Publication.
6. Rabey, Chandrakasan, “Digital IC Design”. Artech House Publications
7. Ken Martin “Digital Integrated Circuit Design” Oxford Press 2000
8. Pucknell and Kamran “Basic VLSI Design” EEE PHI 3rd Edition
9. Allen and Holberg “CMOS Analog Circuit Design”. Oxford Pub. (2nd Edn.)

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RANDOM SIGNAL PROCESSING

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 2 Hrs/ week **Term Work: 25 Marks**

UNIT - 1 : PROBABILITY [6]

Definition of probability, Axioms of probability ,thrum on probability of events, Laws of probability, Conditional probability, Independents of events, Burnoli’s trial , Total probability - Baye's theorem,

UNIT - 2 : Random Variables [7]

Introduction and Definition of a Random Variables, Probability / Cumulative Distribution Function, Properties of Distribution Function ,Probability Density Functions, Properties of Probability Density Functions. Uniform, Gaussian, Exponential ,Rayleigh Random Variables. Estimation of Mean, expected values, Variance, Co- VarianceProperties of sum of Random Variables, Conditional distributions and densities, Joint distributions and densities

UNIT - 3 : Two dimensional Random Variables [7]

Introduction and Definition of a Two dimensional Random Variables, Probability / Cumulative Distribution Function of a Two dimensional Random ,Probability Density Functions of a Two dimensional Random, Marginal Distribution function & Marginal Density Functions

Unit 4 : Random Processes [7]

Basic Definitions and Important Random Processes, Useful classifications of Random , 1st &2nd order statistics, Types of Random Processes, strict sense stationary Processes, Wide- sense stationary Processes, Properties of Auto-correlation & Cross- correlation.

Unit 5 : Markov Chains [6]

Introduction , Definition of Markov Chains , Transition Probability Matrix, Transition Diagram, Homogenous Markov Chains, Chapman-Kolmogorvov Equation, Classification of states, Semi - Markov Chains, Waiting time for A Change of state, Counting Process, Poisson Process, Properties of Poisson Process,

Unit 6 : Queuing Theory [6]

Introduction, Cost Equation ,steady state probability, Exponential models , Network of queues, The system M/G/1 ,Multisurver queues.

REFERENCE BOOKS:

1. Introduction to Probability Models ,(Third edition) By Sheldon M. Ross.
2. Introduction to Probability and Random Processes. By Jorge L. Aunin , V. Chandrasekar.
3. Random Signal Analysis.By G.V.Kumbhojkar.
4. Probability & Queueing Theory.By Dr. P.Kandasamy, Dr.K.Thilagavathi , Dr.K.Gunavathi.
5. Random Processes , Filtering, Estimation & Detection.By Lonnie C. Ludeman.

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RESEARCH METHODOLOGY

Teaching Scheme **Examination Scheme**
Practical: 2 Hrs./Week **Term Work: 25 Marks**

Unit 1: Research Problem **3 Hrs.**

Meaning of research problem, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Unit 2: Basic instrumentation **3 Hrs.**

Instrumentation schemes, Static and dynamic characteristics of instruments used in experimental set up, Performance under flow or motion conditions, Data collection using a digital computer system, Linear scaling for receiver and fidelity of instrument, Role of DSP is collected data contains noise.

Unit 3: Applied statistics & Techniques of Hypotheses, Parametric or Standard Tests **5 Hrs.**

Basic concepts, Tests for Hypotheses I and II, Important parameters, Limitations of the tests of Hypotheses, Chi-square Test, Comparing Variance, as a non-parametric Test, Conversion of Chi to Phi, Caution in Using Chi- square test, Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis, Moments and response curve methods, State vector machines and uncertainty analysis.

Unit 4: Modeling and prediction of performance **5 Hrs.**

Setting up a computing model to predict performance of experimental system, Multi-scale modeling and verifying performance of process system, Nonlinear analysis of system and asymptotic analysis, Verifying if assumptions hold true for a given apparatus setup, Plotting family of performance curves to study trends and tendencies, Sensitivity theory and applications.

Unit 5: Developing a Research Proposal **3 Hrs.**

Format of research proposal, Individual research proposal, Institutional proposal Proposal of a student – a presentation and assessment by a review committee consisting of Guide and external expert only. Other faculty members may attend and give suggestions relevant to topic of research.

Reference Books:

1. 'Research methodology: an introduction for science & engineering students', by Stuart Melville and Wayne Goddard
2. 'Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
3. 'Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar, 2nd Edition
4. 'Research Methodology: Methods and Trends', by Dr. C. R. Kothari
5. 'Operational Research' by Dr. S.D. Sharma, Kedar Nath Ram Nath & co.
6. Software Engineering by Pressman

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ELECTIVE-I: ADVANCE COMMUNICATION SYSTEMS

Lect : 3Hrs/ week **Theory: 100 Marks**
Pract: 2Hrs/ week **Term Work: 25 Marks**

UNIT-1: **[6]**

Overview of digital communication principles, base-band and band-pass digital modulation-demodulation schemes and coding techniques in digital communication.

UNIT-2: **[5]**

Communication through band limited linear filter channels, Digital Transmission and Transmission Impairments, Optimum receiver for channels with ISI and AWGN,

UNIT-3: **[7]**

Linear equalization, Decision feedback equalization, Iterative equalization and decoding, Adaptive equalization,

UNIT-4: **[9]**

WDM, TDM, Telecommunication Infrastructure, Switching, 3G systems, SONET, SDH, Architecture of Optical Transport Network, Link Management Protocols, Solutions. Spread Spectrum signals for digital communication, DS-SS and FHSS systems, CDMA,

UNIT-5: **[9]**

Digital communication through fading multi-path channels, Characterization of fading path channels, Effect of signal characteristics on the choice of a channel model, Mobile telephone service, Transmission protocols, Introduction to GSM, GPRS, CDMA, Switching techniques, Fading, Quality of service (QOS).

UNIT-6: **[4]**

Diversity techniques for fading multi-path channels.

REFERENCE BOOKS:

1.J ohn G. Proakis, Digital Communications, 4th edition, McGraw Hill.
2. John R. Barry, Edward A. Lee and David G. Messerschmitt, Digital Communication, Springer 2003 edition.
3.Bernard Sklar, Digital Communication – Fundamentals and Applications, Pearson Education Asia Edition.
4.Andrew J. Viterbi, CDMA: Principles of Spread Spectrum Communications, Prentice Hall, USA

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ELECTIVE-I: DESIGN OF DIGITAL CIRCUIT AND LOGIC DESIGN

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **Term Work: 25 Marks**

UNIT 1 **[5]**

Digital System Design aspects for RISC and CISC CPU architectures, Control and Data path units of Processor,

UNIT2 [7]

Practical design aspects for high frequency digital design such as clock skew and synchronous / asynchronous input signal handling.

UNIT3 **[8]**

Hazard analysis, fault tree analysis. Estimation of digital system reliability. System integrity. Design of digital system for network applications such as ATM switch design, ATM packet generator, ATM packet decoder.

UNIT4 **[7]**

Hardware testing and design for testability: Testing combinational and sequential logic, scan testing, boundary scan and BIST.

UNIT5 **[6]**

VHDL models for memories and buses such as SRAM memory, 486 bus model and memory interfacing with microprocessor bus.

UNIT6 **[7]**

Floating point arithmetic operations such as multiplications and others. Digital system design for asynchronous serial data transfer.

Reference Books:

1. John F. Wakerly,"Digital Design principles and practices", 3rd edition, PHI publications
2. Charles H. Roth, "Digital system design using VHDL", Thomson Publication
3. Balabanian, "Digital Logic Design Principles", Wiley publication.
4. Stephen Brown, "Fundamentals of digital logic", TMH publication.

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ELECTIVE-I: HIGH PERFOMANCE COMMUNICATION NETWORKS

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **Term Work: 25 Marks**

1. PACKET SWITCHED NETWORKS **[6]**

OSI & IP models – Ethernet (IEEE 802.3) – Token Ring (IEEE 802.5) Wireless LAN (IEEE 802.11), FDDI-DQDB-SMDS: Internetworking with SMDS

2. ISDN & BROADBAND ISDN **[7]**

ISDN – overview –interfaces and functions- Layers and Services – Signaling System 7- Broadband ISDN architecture and protocols.

3. ATM AND FRAME RELAY **[8]**

ATM : Main features – addressing- signaling & routing – ATM header structure – adaptation layer – management & control – ATM switching & transmission.

Frame relay Protocols & services – congestion control – internetworking with ATM – Internet and ATM – Frame relay via ATM

4.OPTICAL NETWORKS: **[5]**

Optical Links, WDM system, Optical cross-connects, Optical LANs, Optical paths and networks

5. BLUETOOTH TECHNOLOGY **[5]**

Overview, protocol stack, link manager, Host controller interface, Service discovery protocol, WAP Applications, encryption and security, QoS.

6. ADVANCED NETWORK ARCHITECTURE **[9]**

IP forwarding architectures overlay model –Multi protocol Label switching (MPLS) – integrated services in the Internet – Resource Reservation Protocol (RSVP) – Differentiated services

Apllication Layer Protocols: FTP – File access and transfer, Online shared access, sharing by file transfer, The Major view of FTP TFTP, SMTP, and HTTP.

REFERENCE BOOKS:

1. "High performance communication networks",2nd edition by Jean Walrand, PravinVaraiya, Morgan Kaufmann Publication. (CH-1, 4)
2. "ISDN and Broadband ISDN with Frame Relay and ATM" 4th Edition by William Stallings, Pearson.(CH- 2, 3)
3. "Bluetooth connect without cables" by Jennifer Bray and Charles Sturman , Pearson education Asia, LPE.(CH-5)
4. "Communication Networks-Fundamental concepts and Key architectures" by Leon Gracia, IndraWidjaja, McGraw Hill Companies.(CH- 6)
5. "Internetworking with TCP/IP – Principles, Protocols and Archtecture" 5th Edition by Douglas Comer, PHI Learning. (CH-7)
6. "Data Communications and Networking" 4th Edition by BehrouzForouzan, McFraw Hill Companies.

ELECTIVE-I: OPTIMIZATION TECHNIQUES

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **Term Work: 25 Marks**

Unit-I **[4]**

Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.

Unit-II **[8]**

Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn –Tucker Sufficient Conditions.

Unit-III **[8]**

Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg- Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Liner Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue.

Unit-IV **[8]**

Optimization and Functions of a Complex Variable and Numerical Analysis: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Method and the Runga-Kutta Method for Ordinary Differential Equations, Gaussian Quardative Tranzoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method.

Unit-V **[5]**

Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods,

Unit-VI **[7]**

Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods.

REFERENCEBOOKS:.

1. Winston W L: Operations Research: Applications and Algorithms
2. Rao S.S., Optimization: Theory and Applications.
3. Walsh G R: M methods of Optimization.
4. Williams H.P.: Model Building in Mathematics Programming.
5. Williams H.P.: Model Solving in Mathematics Programming
6. G.L. Nemhauser and L.A. Wolsey: Intger and Combinational Optimization.
7. R.G. Parker and R.L. Rardin:Discrete Optimization

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ELECTIVE-I: SOFTWARE DEFINED RADIO

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **Term Work: 25 Marks**

UNIT 1: **[5]**

SDR concepts & history, Benefits of SDR, SDR Forum, Ideal SDR architecture, SDR Based End-to-End Communication, Worldwide frequency band plans, Aim and requirements of the SCA.

UNIT 2: **[7]**

Architecture Overview, Functional View, Networking Overview, Core Framework, Real Time Operating Systems, Common Object Request Broker Architecture (CORBA), SCA and JTRS compliance.

UNIT 3: **[7]**

Radio Frequency design, Baseband Signal Processing, Radios with intelligence, Smart antennas, Adaptive techniques, Phased array antennas, Applying SDR principles to antenna systems, Smart antenna architectures.

UNIT 4 : **[6]**

Low Cost SDR Platform, Requirements and system architecture, Convergence between military and commercial systems, The Future For Software Defined Radio, Cognitive Radio.

UNIT 5. **[8]**

Software Radio platforms: GNU radio- Python introduction, developing GNU Radio, signal processing blocks, scheduler, Basic GR development flow, case study- any application, Open source SCA implementations-Embedded , All other software radio framework- Microsoft research software radio, Frontend for Software radio- Sound card front ends, Universal Software radio peripherals (USRP), SDR front end for Navigation applications, Network based front ends.

UNIT 6 **[7]**

Development tools and flow: Requirement capture, System simulation, Firmware development: Electronics System level design,Block based system design, and Final Implementation, Software

development: Real-time versus Non Real-time software, Optimization, and Automatic Code generation.

Reference Books:

1. Dillinger, Madani, Alonistioti (Eds.): Software Defined Radio, Architectures, Systems and Functions, Wiley 2003
2. Reed: Software Radio, Pearson
3. Software Defined Radio for 3G, 2002, by Paul Burns.
4.Tafazolli (Ed.): Technologies for the Wireless Future, Wiley 2005
5. Bard, Kovarik: Software Defined Radio, The Software Communications Architecture, Wiley 2007
6. Eugene Grayver, Implementing Software Defined Radio, Springer
7. Cory Clark, Software Defined Radio: With GNU Radio and USRP, McGraw-Hill Companies,Incorporated, 29-Nov-2008

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ELECTIVE-II: DESIGN OF VLSI SYSTEMS

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

UNIT I Fundamentals of Sequential Logic Design: [8]

Concept of FSM and use of state diagrams, use of ASM charts, S-R Latch, D Latch J-K flip-flop, Master Slave Flip-flops and their characteristic equations, excitation tables and timing diagrams, metastability. Moore, Melay and mixed type synchronous state machines, synchronous design procedure, sync. Counter design, design using programmable devices.

UNIT II Asynchronous Sequential logic Circuit Design: [6]

Asynchronous design fundamentals, differences with synchronous design, Timing diagram specification, merger diagrams, making race-free state assignment using transition diagram, essential hazards.

UNIT III ASIC, FPGA and CPLD: [7]

Concept of ASIC, architecture of Xilinx 95XX series CPLD, 4XXX series FPGA, specifications and noise considerations, Typical applications, choice of target devices, speed grade, I/O pins & various resources.

UNIT IV Introduction to VHDL and Elements of VHDL: [8]

Features of VHDL, concurrency, sequential behavior, used as test language, design hierarchies, levels of abstraction. Basic building blocks like entity, architecture, language elements, concurrent statements, sequential statements, signals and variables, configuration, operators, operator overloading, data types, component instantiation. Generate statement, process, loop statements, case statements, next statements, exit statements.

UNIT V Simulation Issues and Test Benches : [6]

Steps in simulation, simulation process, simulation delta, types of delays, types of simulation. Function o test bench, design methodologies for test benches, interpreting the test bench reports.

UNIT VI Synthesis Issues : [5]

Introduction to synthesis, synthesis tools and their features, hardware modeling examples,

synthesis guidelines

REFERENCE BOOKS:

1. J. F. Wakerly, "Digital Design- principles and practices", 3rd Ed, PHI
2. Donald Givone," Digital Principles and Design" , Tata McGraw-Hill
3. Bradley Carlson, "Digital Logic Design Principles", Wiley
4. Sudhakar Yalamanchili," Introductory VHDL from Simulation to Synthesis", Pearson
5. Charles Roth, "Digital System Design using VHDL", McGraw Hill

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ELECTIVE-II: IMAGE PROCESSING & APPLICATIONS

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

Unit 1: Edge and Line Detection **7 Hrs.**

Introduction, Edge Detection, Derivative (Difference) Operators, Morphologic Edge Detection,

Watershed Segmentation, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection, Two dimensional orthogonal transforms - DFT, FFT, WHT, Haar transform, KLT, DCT

Unit 2: Image Enhancement & Image Restoration **7 Hrs.**

Filters in spatial and frequency domains, histogram-based processing, homomorphic filtering PSF, de-convolution, restoration using inverse filtering, Wiener filtering, maximum entropybased methods.

Unit 3: Color Image Processing **7 Hrs.**

Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Image Segmentation Based On Color, Noise in Color Images, Color Image Compression, Morphological Image processing –dilation and erosion, basic morphological algorithms

Unit 4: Registration& Multiresolution Processing **7 Hrs.**

Introduction, Geometric Transformation, Registration by Mutual Information Maximization,

Stereo Imaging, Other Methods.

Background, Multiresolution Expansions, Wavelet Transforms in One Dimension, the Fast

Wavelet Transform, Wavelet Transforms In Two Dimensions, Wavelet Packets

Unit 5: Representation & Description **6 Hrs.**

Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components For

Description, Relational Descriptors

Unit 6: Object Recognition **5 Hrs.**

Patterns and Pattern Classes, Recognition Based On Decision- Theoretic Methods, Structural methods.

REFERENCE BOOKS:

1. Gonzalez and Woods, Digital Image Processing, Pearson Education.

2. Woods and Eddins, Digital Image Processing using Matlab, Gonzalez, Pearson Education.

3. Milan Sonka, Vaclav Hlavac,Roger Bole, Image processing , Analysis and Machine Vision, ITP

4. Chanda D. Majumdar, Digital Image Processing and Analysis, PHI.

5. Pratt W.K, Digital Image Processing, John Wiley & Sons

M.E. (Electronics Engineering) Revised (Sem. II) with effect from July 2014 onwards

ELECTIVE-II: INDUSTRIAL DC DRIVES

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

1. DC MOTORS FUNDAMENTALS AND MECHANICAL SYSTEMS [8]

DC motor- Types, induced emf, speed-torque relations; Speed control – Armature and field speed control; Ward Leonard control – Constant torque and constant horse power operation - Introduction to high speed drives and modern drives.
Characteristics of mechanical system – dynamic equations, components of torque, types of load; Requirements of drives characteristics – multi-quadrant operation; Drive elements, types of motor duty and selection of motor rating.

2. CONTROLLER BRIDGE RECTIFIER WITH DC MOTOR LOAD [6]

Principle of rectification – Fundamental relations; Analysis of series and separately excited DC motor with single-phase full converter& semi converter and three-phase converters – waveforms, performance parameters, performance characteristics.

3. CONTINUOUS AND DISCONTINUOUS ARMATURE CURRENT OPERATIONS [6]

Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.

4. DC MOTOR CONTROL USING DC CHOPPER [7]

Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control - Chopper based implementation of braking schemes; Multi-phase chopper.

5. CLOSED LOOP CONTROL [7]

Modeling of drive elements – Equivalent circuit, transfer function of self, separately excited DC motors; Linear Transfer function model of power converters; Sensing and feeds back elements - Closed loop speed control – current and speed loops, P, PI and PID controllers – response comparison. Simulation of converter and chopper fed d.c drive.

6. DIGITAL CONTROL OF D.C DRIVE [6]

Phase Locked Loop and micro-computer control of DC drives – Program flow chart for constant horse power and load disturbed operations; Speed detection and gate firing.

REFERENCE BOOKS

1. Power Electronics & Motor Control Shephard, Liang, Cambridge
2. Bimal K Bose, “Modern Power Electronics and AC Drives”, Pearson Education Asia 2002.
3. Vedam Subramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw Hill, 1994.
4. Gopal K Dubey, “Power Semiconductor controlled Drives”, Prentice Hall Inc., New Yersy, 1989.
5. R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.

6. W.Leonhard, "Control of Electrical Drives", Narosa Publishing House, 1992.
7. Murphy J.M.D and Turnbull, "Thyristor Control of AC Motors", Pergamon Press, Oxford, 1988

ELECTIVE-II: ROBOTICS AND APPLICATIONS

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

UNIT I Basic Concepts: [6]
Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT II Power Sources and Sensors: [8]
Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination

UNIT III Micro machines in robotics: [6]
Micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT IV Manipulators, Actuators and Grippers: [7]
Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT V Kinematics and Path Planning: [6]
Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill climbing techniques – robot programming languages.

UNIT VI Case Studies: [7]
Multiple robots – machine interface – robots in manufacturing and non-manufacturing applications – robot cell design – selection of robot.

REFERENCE BOOKS:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G Industrial Robotics, McGraw-HillSingapore. 1996
2. Ghosh Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai. 1998
3. Deb.S.R. Robotics technology and flexible Automation, John Wiley, USA. 1992
4. Asfahl C.R. Robots and manufacturing Automation, John Wiley, USA. 1992
5. Klafter R.D., Chimielewski T.A., Negin M Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi. 1994
6. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA. 1991
7. Issac Asimov I Robot Ballantine Books, New York. 1986

ELECTIVE-II: WIRELESS SENSOR NETWORKS

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

UNIT 1: **6 Hrs.**

Introduction and overview: Overview of the course; overview of sensor network protocols, architecture, and applications; simulation and experimental platforms;

UNIT 2: **7 Hrs.**

Main features of WSNs; research issues and trends, Enabling technologies, Fundamentals of 802.15.4, Bluetooth, and UWB; Physical and MAC layers, Sensor nodes

UNIT 3: **7 Hrs.**

Hardware and software, Hardware: mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (OS): tiny OS, MANTIS, Contiki, and Ret OS,

UNIT 4: **6 Hrs.**

Programming tools: C, nesC, Mate, Localization, connectivity, and topology Sensor deployment mechanisms; coverage issues; node discovery protocols, Network layer protocols,

UNIT 5: **6 Hrs.**

Data dissemination and processing; multi-hop and cluster based protocols; routing. Middleware and application layers, Data dissemination; data storage;

UNIT 6: **8 Hrs.**

Query processing; sensorWeb; sensorGrid, Open issues for future research, Energy preservation and efficiency; security challenges; fault-tolerance;

Reference Books :

1. Protocols and Architectures for Wireless Sensor Networks. H. Karl and A. Willig. John Wiley & Sons, June 2005.
2. Wireless Sensor Networks: Technology, Protocols, and Applications. K. Sohraby, D. Minoli, and T. Znati. John Wiley & Sons, March 2007.
3. Wireless Sensor Networks. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors. Springer Verlag, Sep. 2006.
4. Wireless Sensor Networks: Architectures and Protocols. E. H. Callaway, Jr.AUERBACH, Aug. 2003.
5. Networking Wireless Sensors. B. Krishnamachari. Cambridge University Press, Dec. 2005.
6. Wireless Sensor Networks: An Information Processing Approach. F. Zhao and L. Guibas. Morgan Kaufmann, Jul. 2004.
7. Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications. N. P. Mahalik. Springer Verlag, Nov. 2006.
8. Wireless Sensor Networks: A Systems Perspective, N. Bulusu and S. Jha, Editors, Artech

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ADVANCED PROCESS CONTROL

Lect : 3Hrs/ week **Theory: 100 Marks**
Term Work: 25 Marks

1) **Process dynamics & mathematical modeling :-** **[7]**
   General modeling principle, Degree of freedom analysis, Dynamic model of representative process, Process dynamic & mathematical model, Transfer function model, Transfer function of simple & complicated models, Properties of transfer function, Linearization of non-linear model

2) **Dynamic behavior of first order & second order process & characteristics of complicated process :-** **[6]**
Response of first order processes, Response of second order processes
Integrating & Non – integrating processes, State space & transfer function matrix models, Multiple input multiple output processes.

3) **Empirical model identification & development :-** **[7]**
Model development using linier & non-linier regression, Fitting first & second order models using step tests, Neural network models, Development of discrete time dynamic model, Identifying discrete time models from experimental data, Process reaction curve method, Statistical model identification.

4) **Programmable logic controllers :-** **[5]**
Scanning consideration ladder diagrams, Timer & counter functions
Data handling functions, Analog PLC operation, PID control, Basic & advance PLC function.

5) **Controller Principle:-** **[6]**
Process characteristics, Control system parameters, Discontinues control modes, Continues control modes, Proportional, Int. derivative control modes, Composite control modes, PID – Controller tuning relation, controller with two degree of freedom online controller tuning.

6) **Cascade Control :-** **[9]**
Cascade control design criterion, Cascade performance, Control algorithm & tuning implementation issues.Feed forward Controller **:**Design criterion, Feed forward performance, Control algorithm & tuning Implementation issues, Analysis nonlinear process with linear feedback control, Different issues in improving non linear process performance.

- **Hardware & simulation based minimum 8 expt.**

Reference Books : -

1) "Process Dynamics & Control" – 3rd edition – EDGAR, DOYLE, WILEY.
2) "Process Control & Instrumentation", C D Johnson, PHI Publication
3) "Process control designing process & control systems for dynamics performances",Thomos Marlin, Tata McGrow Hill Publication
4) "Process control instrumentation handbook", Bela G Liptak

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POWER ELECTRONICS SYSTEMS

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hrs/ week **Term Work: 25 Marks**

1 BASIC ELEMENTS IN POWER ELECTRONICS : [5]
Relative elements in power electronics system, Design of inductor, design of transformer, Capacitors for power electronic applications

2 RESONANT CONVERTER: [6]

Classification of resonant converters, Basic resonant circuit concept, load resonant converters, Resonant switch converters, Zero voltage switching, Resonant link inverter, Bidirectional resonant converters, Control of Resonant converters.

3. ANALYSIS AND DESIGN OF DC-DC CONVERTERS: [8]

Converter Classification, Switching Mode Regulators: Buck Regulators, Boost Regulators, Buck-Boost Regulators, Buck Regulators, converter Ckt Design, State-space analysis of Regulators. Two quadrant converter, Full bridge converters, isolated dc-dc converter.

4. DC TO CONTROLLED AC: [8]

Controlled inversion, Full bridge inverter(VSI) with square controlled inversion switching, PWM control of VSI, current mode control of PWM VSI, current source PWM full Bridge inverter, pruning of harmonic profile, sine PWM inverter, control signal generation, 3phase full bridge inverter, Rectifier mode operation of inverter.

5. MULTILEVEL INVERTERS: [8]

Diode multilevel inverters, Flying – capacitors multilevel inverters, Cascade multilevel inverters. Design of Feedback compensators, unity power factor rectifier, resistor emulation, principle & applications to rectifier.

6. ELECTRIC UTILITY INTERFACE: [6]

Electric utility distribution system, passive filtering, Active current shaping, power factor correction, interface for Bidirectional power, Three phase utility interface, Static UAR compensator, Power factor improvement techniques- twelve pulsed converters and Dual converters.

REFERENCE:

1. Philoph Krein- "Elements of Power electronics" Oxford press
2. Jai P. Aagrawal-"Power Electronic Sytems Theory & Design" PEARSON pub.

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REAL TIME EMBEDDED SYSTEMS

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **POE: 25 Marks**

UNIT I INTRODUCTION TO EMBEDDED COMPUTING [8]

Complex systems and microprocessors – Design example: Model train controller –Embedded system design process – Formalism for system design – Instruction sets Preliminaries – ARM Processor – CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor – Memory system mechanism – CPU performance – CPU power consumption.

UNIT II COMPUTING PLATFORM AND DESIGN ANALYSIS [6]

CPU buses – Memory devices – I/O devices – Component interfacing – Design withmicroprocessors – Development and Debugging – Program design – Model of programs–

UNIT III ASSEMBLY AND LINKING [6]

Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT IV PROCESS AND OPERATING SYSTEMS [7]
Multiple tasks and multi processes – Processes – Context Switching – Operating Systems – Scheduling policies - Multiprocessor – Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes.

UNIT V HARDWARE ACCELERATES & NETWORKS [6]
Accelerators – Accelerated system design – Distributed Embedded Architecture –Networks for Embedded Systems – Network based design – Internet enabled systems.

UNIT VI CASE STUDY [7]
Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set Top Box. – System-on-Silicon – FOSS Tools for embedded system development.

REFERENCE BOOKS:
1) Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.
2) K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", dreamtech press, 2005.
3) Tim Wilmshurst, "An Introduction to the Design of Small Scale Embedded Systems", Pal grave Publisher, 2004.
4) Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc-Graw Hill, 2004.
5) Tammy Noergaard, "Embedded Systems Architecture", Elsevier,2006
6) David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.

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ELECTIVE-III: ARTIFICIAL NEURAL NETWORKS

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **Term Work: 25 Marks**

Unit 1:-Fundamental Concepts and Models Of Artificial Neural Systems [6]
Biological Neurons and Their Artificial Models, models of artificial neural networks, Neural processing, Learning and adaptation, Neural Network learning rules, Overview of neural networks

Unit 2:-Single Layer Perceptron Classifiers [8]
Classification model ,features and decision regions , Discrimininant functions , Linear machines and minimum distance classifications , Nonparametric training concept , .training and classification using the discrete perceptron algorithm and example, Single layer continuous perceptron networks for linearly separable classification, . Multi category Single layer perceptron networks

Unit 3:-Multi Layer Feed Forward networks [6]
Linearly non separable pattern classification , Delta learning rule for multi perceptron layer, Generalized delta learning rule, Feed forward recall and error back propagation training , Learning factors , Classifying and expert layered network , Functional link networks

Unit 4: Single Layer Feed Forward networks [7]
Basic concept of dynamical systems, Mathematical foundation of discrete time Hopfield networks, Mathematical foundation of gradient type Hopfield network, transient response of continuous time

networks, relaxation modeling in single layer feedback network, example solution of optimization problem

Unit 5: Matching & self organizing networks **[7]**

Hamming net & MAXNET, unsupervised learning of clusters, counter propagation network, feature mapping, self organizing feature maps, cluster discovery network (art1)

Unit 6: Applications of Neural algorithms & systems **[6]**

Linear programming modeling network, character recognition network, neural networks control applications, networks for robot kinematics, connectionist expert systems for medical diagnosis, self organizing semantic maps

Reference Books :

1. " Introduction to artificial neural systems", by Jacek M. Zurada
2. " Element of artificial neural networks", by Kishan Mehrotra, Chilukuri K. Mohan, Sanjay Ranka, 2nd edition, 2010.
3. "Artificial Neural networks", by B. Yegnanarayana.

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ELECTIVE-III: COGNITIVE RADIO COMMUNICATIONS AND NETWORKS

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2 Hrs/ week **Term Work: 25 Marks**

UNIT 1: **[5]**

Software Defined Radio Architecture - Digital Signal Processor and SDR Baseband Architecture, Reconfigurable Wireless Communication Systems , Unified Communication Algorithm , Reconfigurable OFDM Implementation ,Reconfigurable OFDM and CDMA , Digital Radio Processing , Conventional RF, Digital Radio Processing (DRP) Based System Architecture

UNIT 2: **[6]**

Cooperative Communications and Networks - Information Theory for Cooperative Communications , Fundamental Network Information , Multiple-access Channel with Cooperative Diversity ,Cooperative Communications , Three-Node Cooperative Communications ,Multiple-Node Relay Network,Cooperative Wireless Networks , Benefits of Cooperation in Wireless Networks , Cooperation in Cluster-Based Ad-hoc Networks

UNIT 3: **[8]**

Cognitive Radio Communications : Cognitive Radios and Dynamic Spectrum Access ,The Capability of Cognitive Radios , Cognitive Radio cycle, Spectrum Sharing Models of DSA, Opportunistic Spectrum Access: Basic Components , Networking The Cognitive Radios,Analytical Approach and Algorithms for Dynamic Spectrum Access , Dynamic Spectrum Access in Open Spectrum ,Opportunistic Spectrum Access , Opportunistic Power Control ,Fundamental Limits of Cognitive Radios , Mathematical Models Toward Networking Cognitive Radios , CR Link Model, Overlay CR Systems , Rate-Distance Nature .

UNIT 4: **[8]**

Spectrum Sensing:

Primary Signal Detection such as Energy Detector,Cyclostationary Feature Detector ,Matched Filter , Cooperative Sensing etc. , Spectrum Sensing to Detect Specific Primary System , conventional Spectrum Sensing, Power Control , Power-Scaling Power Control ,Cooperative Spectrum Sensing , Spectrum Sensing for Cognitive OFDMA Systems , Discrimination of States of the Primary System, Spectrum Sensing Procedure, Spectrum Sensing for Cognitive Multi-Radio Networks , Multiple System Sensing , Radio Resource Sensing.

UNIT 5: **[7]**

Cognitive Radio Networks : Network Coding for Cognitive Radio Relay Networks , System Model , Network Capacity Analysis on Fundamental CRRN Topologies , Link Allocation , Numerical Results, Cognitive Radio Networks Architecture , Network Architecture ,Links in CRN , IP Mobility Management in CRN ,Terminal Architecture of CRN ,Cognitive Radio Device Architecture , Re-configurable MAC ,Radio Access Network

Selection ,QoS Provisional Diversity Radio Access Networks , Cooperative/Collaborative Diversity and Efficient Protocols , Statistical QoS Guarantees over Wireless Asymmetry Collaborative Relay Networks.

UNIT 6: [6]

Spectrum access and sharing: Unlicensed Spectrum Sharing ,Licensed Spectrum Sharing , Secondary(SSA) Spectrum Access ,Non-Real-Time SSA , Real-Time SSA, Negotiated Access , Is Quality of Service Provisioning Possible in a Shared Band, Opportunistic Access ,Overlay Approach , Underlay Approach

REFERENCE BOOKS:

1. Kwang-Cheng Chen,Ramjee Prasad, Cognitive Radio Networks, John Wiley & Sons Ltd
2. Alexander M. Wyglinski, Maziar Nekovee, Y. Thomas Hou ,Cognitive Radio Communications and Networks Principles and Practice, Elsevier publication.
3. Qusay H. Mahmoud, Cognitive Networks, John Wiley & Sons Ltd.

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ELECTIVE-III: CRYPTOGRAPHY & NETWORK SECURITY

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **Term Work: 25 Marks**

1. **Overview:** Services, Mechanisms, and attacks, The OSI Security Architechure. A model for network security, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Mechines, Steganography (6)

2. **Block Ciphers and the Data Encryption Standard**: Simplied DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation, Contemporary symmetric Ciphers: Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, Confidentially using symmetric Encryption: Placement of Encryption Function, Traffic Confidentiality,KeyDistribution,RandomNumberGeneration. (9)

3. **Public Key Cryptography and RSA:** Principles of Public Key cryptosystems, The RSA Algorithm, Key Management, other Public Key Cryptosystems key Management, Diffle-Hellman Key exchange. (5)

4**. Message Authentication and hash functions**: Authentication Requirements, Authentication Function, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs. (6)

5. **Hash Algorithms**: MD5 Message Digest Algorithm, Secure Hash Algorithm. Authentification Applications: Kerberos, X. 509 Authentication Service. (8)

6. **Electronic Mail Security**: Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentifications, Header, Encapsulating Security Payload,Combining Security Associations, Key Management. Web Security: Web Security Considerations, System Security: Intruders, Malicious Software, Viruses, Viruses and Related Threats, Firewalls: Firewall Design Principles (8)

Reference Books

1. Willam Stallings, Cryptography and Network Security, Third Edition, Pearson Education

2. Cbarlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Provate Communication in a public world, Second Edition, Pearson Education Asia, 2002.
3. Atul Kahate, Cryptography and Network Security, Tata McGrawhill, 2003

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ELECTIVE-III: DESIGN & ANALYSIS OF ALGORITHMS

Lect : 3Hrs/ week **Theory: 100 Marks**
Pract: 2Hrs/ week **Term Work: 25 Marks**

UNIT I [7]

Introduction to algorithms and its importance, mathematical foundations: growth functions, complexity analysis of algorithms, summations, recurrences, sorting algorithms

UNIT II [7]

Design and analysis: Insertion sort, divide and conquer, merge sort, heap sort, radix sorting. Hash table, B trees, Binomial Heaps, Fibonacci Heaps.

UNIT III [6]

Dynamic Programming: Introduction, Matrx chain multiplication, Greedy Algorithms. Elementary Graph algorithms: Minimum spanning trees, Single source shortest path, all pair shortest path..

UNIT IV [7]

String matching: Robin – Karp algorithm, Knuth – Morris Pratt algorithm, Algorithm for parallel computers, parallelism, the PRAM models, simple PRAM algorithms. P and NP Class, some NP – complete problems.

UNIT V [6]

Backtracking: General Method – 8 Queens problem – sum of subsets – graph coloring – Hamiltonian problem – knapsack problem.

UNIT VI [7]

Graph Traversals – Connected Components – Spanning Trees – Biconnected components – Branch and Bound: General Methods (FIFO & LC) – 0/1 Knapsack problem – Introduction to NP-Hard and NP-Completeness.

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest.. Algorithms, Prentice Hall of India Publications, New-Delhi.
2. Sara Baase and Allen Van Gelder.. Computer Algorithms: Introduction to Design and Analysis , Pearson education (Singapore) Pte. Ltd, New Delhi.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman.. The Design and Analysis of Computer Algorithms, Pearson Education (Singapore) Pte. Ltd New Delhi.

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ELECTIVE-III: DESIGN OF ANALOG AND MIXED MODE VLSI

Lect : 3Hrs/ week **Theory: 100 Marks**

Pract: 2Hrs/ week **Term Work: 25 Marks**

UNIT I [6]

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

UNIT II [8]

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

UNIT III [6]

Non-Linear Analog Circuits: Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Stimulation), Level Shifting
(Excluding InputLevel Shifting For Multiplier).

UNIT IV [6]

Data Converter SNR: Improving SNRUsing Averaging (Excluding Jitter &Averaging onwards),DecimatingFilters for ADCs (ExcludingDecimatingwithout Averaging onwards), Interpolating Filters for DAC, B and pass and High pass Sync filters.

UNIT V [8]

Su-Microns CMOS circuit design:Process Flow, Capacitors and Resistors, MOSFETSwitch (upto Bidirectional Switches),Delay and adderElements, Analog CircuitsMOSFET Biasing (upto MOSFET Transition Frequency).

UNIT VI [6]

OPAmp Design (Excluding CircuitsNoise onwards)

REFERENCE BOOKS:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G Industrial Robotics, McGraw-HillSingapore. 1996
2. Ghosh Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai.1998
3. Deb.S.R)- Robotics technology and flexible Automation, John Wiley, USA. 1992
4. Asfahl C.R.)- Robots and manufacturing Automation, John Wiley, USA. 1992
5. Klafter R.D., Chimielewski T.A., Negin M Robotic Engineering – An integrated approach,Prentice Hall of India, New Delhi. 1994
6. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA. 1991
7. Issac Asimov I Robot Ballantine Books, New York. 1986

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ELECTIVE IV: ADVANCED COMPUTER ARCHITECTURE

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

Unit 1: -Pipelining and ILP **[7]**

Fundamentals of computer design-Measuring and reports performance-Instruction level parallelism and its exploitation –Concepts and challenges- Overcoming data hazards with dynamics scheduling –Dynamic branch prediction- Speculation- Multiple issue processors- Case studies.

Unit 2: -Advanced Techniques for Exploiting ILP [7]

Complier techniques for exposing ILP –Limitation on ILP for realizable Processors –Hardware versus software speculation –

Unit 3: -Multithreading [5]

Using ILP support to exploit thread –level parallelism- performance and efficiency in advanced multiple issue processors- Case studies.

Unit 4: - Multiprocessors [6]

Symmetric and distributed shared memory architectures – Cache coherence issues –Performance issues-Synchronization issues- Models of memory consistency – Interconnection networks – Buses, crossbar and multi –stage switches.

Unit 5: - Multicore Computers [7]

Hardware performance issues, Software performance issues, Multicore organization, Intel x 86 multicore organizations, ARM11 MPC core 699.

Unit 6: -Memory Hierarchy Design [8]

Introduction – Optimization of cache performance – Memory technology and optimization – introduction: Virtual memory and virtual machines – Design of Memory hierarchies – Case studies.

REFERENCE BOOKS:

1. John L. Hennessey & David A. Patterson," Computer Architecture-A quantitative approach", Morgan Kaufmann/ Elsevier,4th. Rdition,2007.
2. David E.CULLER , Jaswinder pal Singh, "parallel computing architecture : A hardware / software approach ", Morgan Kaufmann / Elsevier ,1997
3. William Stallings, " Computer organization and Architecture- Designing for performance ",Pearson education , 8th Edition ,2006

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ELECTIVE-IV: FUZZY SYSTEMS

Lect : 3Hrs/ week **Theory: 100 Marks**

Tutorial: 1 Hr **Term Work: 25 Marks**

UNIT I: [6]

Fuzzy Sets, Fuzzy Relations, Fuzzy Graphs, and Fuzzy Arithmetic

UNIT II: [7]

Fuzzy If-Then Rules, Fuzzy Implications and Approximate Reasoning

UNIT III: [8]

Fuzzy Logic, Fuzzy Logic and Artificial Intelligence, Fuzzy Logic in Database and Information Systems

UNIT IV: [7]

Fuzzy Logic in Pattern Recognition, Fuzzy Logic Control

UNIT V: [7]

Fuzzy Logic Control Applications
UNIT VI: [5]
Fuzzy Discrete Event Systems

REFERENCE BOOKS:

1. John Yen and Reza Langari, *Fuzzy Logic: Intelligence, Control, and Information*, Prentice Hall, 1999.
2. Hao Ying, *Fuzzy Control and Modeling: Analytical Foundations and Applications*, IEEE Press, 2000.

Course Structure: major portion of Chapters 1 to 7, 11, 12, and 13 of the book by Yen and Langari. There will be homework assignments and computer projects for some of the chapters.

ELECTIVE-IV: RENEWABLE DISTRIBUTED ENERGY SYSTEMS

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

1. **TYPES OF RENEWABLE ENERGY SOURCE** [**7]**

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

2. MACHINES FOR RENEWABLE ENERGY CONVERSION [7]

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

3. POWER CONVERTERS CLASSIFICATION-SOLAR [6]

Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing

4. POWER CONVERTERS CLASSIFICATION-WIND [7]

Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

5. PHOTOVOLTAIC & WIND SYSTEMS [6]

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS-Grid Integrated solar system

6. HYBRID SYSTEMS [7]

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV-Maximum Power Point Tracking (MPPT).

REFERENCE BOOKS:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi.
6. Advance power Electronic Interface for Distributed Energy System Technical report NREL/TP-581-42672 March 2008.

7. Wind Power Plants & Project development , Joshua Earnst & + Wizelins PHI new Delhi.
8. Handbook of renewable energy topology, World Scientific Singapore 2011

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ELECTIVE-IV: RF AND MICROWAVE CIRCUITS

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

UNIT I TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION [7]
Low frequency parameters-impedance ,admittance, hybrid and ABCD. High frequency parameters- Formulation of S parameters, properties of S parameters-Reciprocal and lossless networks, transmission matrix, Introduction to component basics, wire, resistor, capacitor and inductor, applications of RF

UNIT II RFTRANSISTOR AMPLIFIER DESIGN AND MATCHING NETWORKS [6]
Amplifier power relation, stability considerations, gain considerations noise figure,impedance matching networks, frequency response, T and Π matching networks,microstripline matching networks

UNIT III MICROWAVE PASSIVE COMPONENTS [7]
Microwave frequency range, significance of microwave frequency range - applications of microwaves. Scattering matrix -Concept of N port scattering matrix representation- Properties of S matrix- S matrix formulation of two-port junction. Microwave junctions - Tee junctions - Magic Tee - Rat race - Corners - bends and twists - Directional couplers - two hole directional couplers- Ferrites - important microwave properties and applications – Termination - Gyrator-Isolator-Circulator - Attenuator - Phase changer – S Matrix for microwave components – Cylindrical cavity resonators.

UNIT IV MICROWAVE SEMICONDUCTOR DEVICES [7]
Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs -Principles of tunnel diodes - Varactor and Step recovery diodes – Transferred Electron Devices -Gunn diode- Avalanche Transit time devices- IMPATT and TRAPATTdevices.

UNIT V PARAMETRIC DEVICES -Principles of operation, applications of [7]
parametric amplifier .Microwave monolithic integrated circuit (MMIC) - Materials and fabrication techniques

UNIT VI MICROWAVE TUBES AND MEASUREMENTS [6]
Microwave tubes- High frequency limitations - Principle of operation of Multicavity Klystron, Reflex Klystron, Traveling Wave Tube, Magnetron. Microwave measurements: Measurement of power, wavelength, impedance, SWR, attenuation, Q and Phase shift.

REFERENCE BOOKS:

1. Samuel Y Liao, “Microwave Devices & Circuits” , Prentice Hall of India, 2006.
2. Reinhold.Ludwig and Pavel Bretshko ‘RF Circuit Design”, Pearson Education, Inc.,2006
3. Robert. E.Collin-Foundation of Microwave Engg –Mc Graw Hill.
4. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata Mc GrawHill Inc., 2004.
5. M.M.Radmanesh , RF & Microwave Electronics Illustrated, PearsonEducation, 2007.

6. Robert E.Colin, 2ed "Foundations for Microwave Engineering", McGraw Hill, 2001
7. D.M.Pozar, "Microwave Engineering.", John Wiley & sons, Inc., 2006.

M.E. (Electronics Engineering) Revised (Sem. II) with effect from July 2014 onwards

ELECTIVE-IV: VLSI IN DIGITAL SIGNAL PROCESSING

Lect : 3Hrs/ week **Theory: 100 Marks**
Tutorial: 1 Hr **Term Work: 25 Marks**

UNIT I Introduction to Digital Signal Processing [6]

Linear System Theory- Convolution- Correlation - DFT- FFT- Basic concepts in FIR Filters and IIR Filters - Filter Realizations. Representation of DSP Algorithms - Block diagram-SFG-DFG.

UNIT II Iteration Bound, Pipelining and Parallel Processing of FIR Filter [8]

Iteration Bound: Data-Flow Graph Representations- Loop Bound and Iteration Bound- Algorithms for Computing Iteration Bound-LPM Algorithm. Pipelining and Parallel Processing: Pipelining of FIR Digital Filters- Parallel Processing- Pipelining and Parallel Processing for Low Power. Retiming: Definitions Properties and problems- Solving Systems of Inequalities.

UNIT III Fast Convolution and Arithmetic Strength Reduction in Filters [8]

Fast Convolution: Cook-Toom Algorithm- Modified Cook-Toom Algorithm.Design of Fast Convolution Algorithm by Inspection. Parallel FIR filters-Fast FIR algorithms-Two parallel and three parallel. Parallel architectures for Rank Order filters-Odd Even Merge sort architecture-Rank Order filter architecture-Parallel Rank Order filters-Running Order Merge Order Sorter-Low power Rank Order filter.

UNIT IV Pipelined and Parallel Recursive Filters [7]

Pipelined and Parallel Recursive Filters : Pipeline Interleaving in Digital Filters- Pipelining in 1st Order IIR Digital Filters- Pipelining in Higher- Order IIR Filters-Clustered Look ahead and Stable Clustered Look ahead- Parallel Processing for IIR Filters and Problems.

UNIT V Scaling and Roundoff Noise [6]

Scaling and Roundoff Noise : Scaling and Roundoff Noise- State Variable Description of Digital Filters-Scaling and Roundoff Noise Computation-Round Off Noise Computation Using State Variable Description- Slow-Down- Retiming and Pipelining.

UNIT VI Fast Convolution, Filters and Transforms [5]

Cook-toom algorithm, modified cook- toom algorithm, winogard algorithm, iterated convolution Algorithm strength reduction in filters and transforms.

REFERENCE BOOKS

1. K.K Parhi, "VLSI Digital Signal processing", John-Wiley, 1999.
2. John G.Proakis, Dimitris G.Manolakis, "Digital Signal Processing", Prentice Hall of India, 1995.
3.Keshab k. Parhi," VLSI Digital Signal Processing Systems: Design and Implementation", Wiley, inter science.
4.S.Y.kung, H.J.White house, T. Kailath," VLSI and Modern Signal Processing", Prentice hall,

EQUIVALANCE FOR OLD SYLLABI SUBJECTS TO NEW SYLLABUS SUBJECTS

SEMESTER	OLD SUBJECT	NEW SUBJECT	REMARK
I	Advanced Digital Signal Processing	Advanced Digital Signal Processing	
	CMOS VLSI Design	CMOS VLSI Design	
	Random Signal Processing	Random Signal Processing	
	Elective I		Same old subject
II	Real Time Embedded System design	Real Time Embedded System design	
	Advanced Process control	Advanced Process control	
	Elective II		Same old subject
	Elective III		Same old subject
	Seminar-I	Seminar-I	
III	Seminar-II	Seminar-II	
	Dissertation Phase-I	Dissertation Phase-I	
IV	Seminar-III	Seminar-III	
	Dissertation Phase-II	Dissertation Phase-II	