Ph.D. Course work

Pre-Ph.D. Examination Syllabus

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING,
K L UNIVERSITY,
VADDESWARAM - 522502, ANDHRA PRADESH, INDIA.

KL UNIVERSITY
Green Fields, Vaddeswaram.

List of Pre-Ph.D Courses
L-T-P-S: 3-0-0-0

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

S.No	Paper 1	Subject Code
1	RESEARCH METHODOLOGY	21RES104

S.N	Code	PAPER – 2	Code	PAPER – 3
1.	21EC201	Global Positioning Systems	21EC301	Bio Medical signal Processing
2.	21EC202	Machine Learning	21EC302	Advanced Embedded Processor Architecture
3.	21EC203	Embedded Networking	21EC303	Wireless Cellular Communications
4.	21EC204	Modern Digital Communication	21EC304	Natural Language Processing
5.	21EC205	SOFT COMPUTING	21EC305	Advanced Computational Mathematics
6.	21EC206	Digital Video Processing	21EC306	EMI/EMC
7.	21EC207	Radiating systems	21EC307	MEMS Measurement Techniques
8.	21EC208	Micro Electro Mechanical Systems	21EC308	Antenna Measurements
9.	21EC209	RF & Microwave System Design	21EC309	VLSI System Design
10.	21EC210	Low Power VLSI Circuits	21EC310	MOS Circuit Design
11.	21EC211	Detection and Estimation Of Signals	21EC311	Testing of VLSI Circuits
12.	21EC212	Adaptive Signal Processing	21EC312	Advanced Analog IC Design
13.	21EC213	Real Time Concepts for Embedded Systems	21EC313	Microwave and Millimeter wave Circuits
14.	21EC214	Image Processing and Computer Vision	21EC314	Pattern Recognition
21.	21EC215	ASIC Design Flow	21EC315	CMOS RF Circuit Design

Code:21EC____

Natural Language Processing

Introduction to NLP. Language Structure and Analyzer - Overview of language, requirement of computational grammar. Words and their Analysis. Tokenization. Stemming. Morphological Analysis. POS tagging.

Local word grouping. Paninian Grammar - The semantic model, Free word order and vibhakti, Paninian theory, Active, Passive, Central. Paninian Parser - Core parser, constraint parser, preference over parses, lakshan charts, sense disambiguation. Machine Translation.

Lexical functional grammar, LFG and Indian languages, Tree Adjoining Grammar, Comparing TAG and PG. Automatic parsing: rules based and statistical. Introduction to some other NLP applications, depending on availability of time.

Some applications of machine learning in NLP such as Shallow Discourse Parsing. Statistical machine translation.

TEXTBOOK:

1. Speech and Language Processing by Jurafsky and Martin

2. Natural Language Processing: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya and Rajeev Sangal

Code:21EC____

Pattern Recognition

Pattern & Pattern classes, Pattern recognition Design Cycle, Feature Extraction: Feature processing & normalization, Learning (Supervised, Unsupervised, Reinforced). Preliminary concepts and pre-processing phases, coding, normalization, filtering, linear prediction, Feature extraction and representation thresholding, contours, regions, textures, template matching, Hidden Markov Models, Taxonomy of pattern classifiers Performance measurement metrics: Confusion matrix, Accuracy, Precision, Recall, ROC curve, Area Under Curve (AUC), Confidence intervals. Data partitioning (K-fold cross validation, Leave one out , Leave m-out)

Data structure for pattern recognition, statistical pattern recognition, clustering Technique and application. Study of pattern classifiers: Supervised and unsupervised.

Pattern Classifiers: Statistical: Bayesian theorem, Bayesian classifier: Minimum distance, Maximum likelihood), Naïve Bayes, Linear Discriminant Analysis, k- nearest neighbour (KNN), Artificial Neural Network etc. and Case studies.

Clustering techniques and algorithms Deep learning Selected topics from research papers

TEXTBOOK:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
2. K. Fukunaga, Statistical pattern Recognition; Academic Press, 2000.
3. Devi V.S.; Murty, M.N., Pattern Recognition: An Introduction, Universities Press, Hyderabad, 2011

Advanced Computational Mathematics

Introductory Topics ALGEBRA, VECTORS AND GEOMETRY: *Solution of equations *Linear algebra : Determinants, matrices * Vector algebra & solid geometry CALCULUS: *Differential calculus and its applications *Partial calculus and its applications *Integral calculus and its applications *Multiple integrals and beta, gamma functions *Vector calculus and its applications SERIES: *Infinite series *Fourier series

DIFFERENTIAL EQUATIONS: *Differential equations of first order *Applications of differential equations of first order *Linear differential equations *Applications of linear differential equations *Differential equations of other types *Series solution of differential equations and special functions *Partial differential equations *Applications of partial differential equations

Probability, random variables and stochastic processes: Fundamentals of probability and statistics: The Concept of a Random Variable, functions of one and two random variables, probability distribution functions, statistics. Stochastic Processes: General concepts, Random Walks and Other Applications, Spectral Representation, Spectrum Estimation, Mean square estimation, Entropy. Markov Chains, Markov Processes and Queueing Theory.

NUMERICAL TECHNIQUES: (Selected topics) *Empirical laws and curve-fitting *Statistical methods *Probability and distributions *Sampling and interface *Finite differences and interpolation *Numerical differentiation and integration *Difference equations *Numerical solution of ordinary differential equations *Numerical solution of partial differential equations *Linear programming

TEXTBOOK:

1. Higher Engineering Mathematics: BS Grewal

2. Probability, random variables, and stochastic processes: A. Papoulis, S. Unnikrishna Pillai, MacGraw Hill

Image Processing and Computer Vision

Image enhancement and restoration Image Enhancements: Point processing functions, Piece-wise linear functions, Histogram base methods (histogram equalization, specification and modification), Bit extraction, and other topics. Restoration (in spatial domain): Image restoration and degradation model, Noise types (Gaussian, Rayleigh, Poisson, other) and their pdfs (Probability Distribution Functions), Averaging Filter (Mean Filters (Arithmetic, Geometric & Harmonic), Inverse filtering, Weiner Filter, Tikhonov Regularization, LMMSE filters, constrained least squares filters, Other related optimization problems.

Edge Detection: Mathematical concepts, Operators based on first order derivative (Roberts, Prewitt and Sobel), Laplacian (Second order derivative based edge detection),LOG. Image Segmentation: Thresholding based (Local, Global, Adaptive), Region based (Region split & merge, Region growing), Cluster based (K-means, Fuzz c-means), Contour based (Snakes' method), Graph based (book/literature)

Feature extraction: Spatial Features, Amplitude, Transform based features, Fourier Descriptors (FDs), Histogram based statistical features, Based on statistical moments (e.g., mean, variance, kurtosis, etc), Shape/geometry based features & moment based features(Radii, perimeter, area, compactness, max boundary rectangle, orientation etc.), Texture features (GLCM and texture features, Gabor features), Color features

Object representation and description Boundary representation: Chain codes, Polygon approximations, Signatures, Boundary segments, Skeletons Boundary description: Shape numbers, FDs, Statistical moments Region representation: Data structures used for representing region (quad tree, RLE, projection) Region description: Topological description, Texture, Moments, Principal components

Object recognition a. Patterns & pattern classification b. Recognition based on decision theoretic methods c. Structural methods

TEXTBOOK::

1. Fundamental of image processing by R.C. Gonzalez

2. Digital image processing by A.K. Jain

Code: 21EC___

Machine Learning

SYLLABUS

Introduction to Machine Learning, Probability Theory, Model Selection, The Curse of Dimensionality, Decision Theory, Information Theory

Probability Distributions: Binary Variables, Multinomial Variables, The Gaussian distribution, The Exponential Family, Nonparametric Methods

Linear Models for Regression: Linear Basis Function Models, The Bias-Variance Decomposition, Bayesian Linear Regression, Bayesian Model Comparison, The Evidence Approximation, Limitations of Fixed Basis Functions

Linear Models for Classification: Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models, The Laplace Approximation, Bayesian Logistic Regression, Neural Networks and Kernel Methods

TEXTBOOK:

Christopher M. Bishop. 2006. Pattern Recognition and Machine Learning (Information Science and Statistics). Springer-Verlag New York, Inc., Secaucus, NJ, USA.

SOFT COMPUTING

Syllabus

Foundation of Evolutionary theory, Evolutionary Strategies, Evolutionary programming, Evolutionary Algorithms, Evolutionary Algorithm Case Study, Genetic Algorithm, Genetic Representations, Initial Population, Fitness Function, Selection and Reproduction,

Genetic Operators (Selection, Crossover, Mutation), Artificial Immune Systems, Other Algorithms Harmony Search, Honey-Bee Optimization, Memetic Algorithms, Co-evolution, MultiObjective Optimization, Artificial Life, Constraint Handling

Neural Networks: Neuron Models, Neuron Architecture, Mathematical Model of Neural Networks, Artificial Neural Network Learning Methods and Learning Strategies, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Activation Functions, Pattern Classification and Linear Separability, Single and Multilayer Perceptron Network, SelfOrganizing Map (Kohonen network), Hopfield Network, Back Propagation Network, Radial Basis function Network

Collective Behavior and Swarm Intelligence, Particle Swarm Optimization and Ant Colony Optimization, Artificial evolution of Competing Systems, Artificial Evolution of cooperation and competition. Recent topics from research papers.

Introduction to Neuro-Fuzzy and soft computing: computing constituents and conventions, characteristics. Fuzzy set theory: basic definitions and terminology, settheoretic operations, Mf formulation and parameteization. Fuzzy rules and reasoning: extension principles and fuzzy relations, fuzzy if-then rules, fuzzy reasoning. Fuzzy inference systems: mamdani fuzzy models, sugeno fuzzy models, Tsukamoto fuzzy models, other considerations.

TEXTBOOK:

- Dario Floreano, Claudio Mattiussi, “Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies”, MIT Press, 2008.
- Eberhart, E. and Y. Shi., “Coputational Intelligence: Concepts and Implementations”, Morgan Kauffmann, San Diego, 2007.

Digital Video Processing

Syllabus

Basic steps of Video Processing: Analog Video, Digital Video, Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block-Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Application of 2D motion estimation, Parametric motion models.

Optical Flow methods, Motion-compensated filtering, Video processing operations including noise reduction, restoration, super resolution, de-interlacing and video sampling structure conversion, and compression (frame-based and object-based methods), Video quality assessments.

Video segmentation, motion segmentation, tracking, optimization Topics from latest research papers.

Code: 15 EC302

ADVANCED EMBEDDED PROCESSOR ARCHITECTURE

SYLLABUS

ARM Processor as System-on-Chip: Acorn RISC Machine – Architecture inheritance – ARM programming model. 3 and 5 stage pipeline ARM organization – ARM instruction execution and implementation – ARM Co-processor interface.

ARM Assembly Language Programming: ARM instruction types – data transfer, data processing and control flow instructions – ARM instruction set – Co-processor instructions, Thumb Instruction Set.

Architectural Support for System Development: Advanced Microcontroller bus architecture – ARM memory interface – ARM reference peripheral specification – Hardware system prototyping tools – ARMulator – Debug architecture.

ARM Processor Cores: ARM7TDMI, ARM8, ARM9TDMI, ARM10TDMI, the AMULET Asynchronous ARM Processors- AMULET1

Embedded ARM Applications: The VLSI Ruby II Advanced Communication Processor, The VLSI ISDN Subscriber Processor, The OneC™ VWS22100 GSM chip, The Ericsson-VLSI, Bluetooth Baseband Controller, The ARM7500 and ARM7500FE.

Text Books:

1. ARM System on Chip Architecture – Steve Furber – 2nd ed., 2000, Addison Wesley Professional.
2. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st ed., 2004, Springer

References:

1. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM
2 System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer AcademicPublishers.

ADVANCED EMBEDDED PROCESSOR ARCHITECTURE

Time:3hours Max. Marks =100

Answer any five of the following

1 a) Explain the Architectural inheritance of Acorn RISC Machine based on the features accepted andrejected.

b) Describe the ARM programmer's model with neat diagrams highlighting the register and memoryorganization.

2 Discuss the operation of 3-stage pipeline of ARM processor, what its limitations are and how they are eliminated in ARM 5-stagepipeline.

3 A) Discuss the Data Transfer Instructions of ARMProcessor

B) Write an ALP using ARM instructions for the comparison of two null-terminated strings and store zero in R2 register if they match, -1otherwise.

4 A) Explain the Branch Instructions of ARMProcessor.

B) Explain the Co-processor interface in ARM7processor.

5 A) Explain the Advanced Microcontroller Bus Architecture(AMBA).

Discuss Hardware system prototyping tools with reference to Rapid Silicon Prototyping.

6 a) Explain the following signals with reference to ARM7TDMIcore.

i) MemoryInterface

ii) BusControl

iii) Boundary ScanExtension

b) Compare the features of ARM7, ARM9 and ARM10 cores.

7 With the Block diagram of AMULET1 processor explain the followingmechanisms

i) AddressNon-determinism

ii) RegisterCoherency

iii) Register Locking

8 Why ARM cores are most suitable for System on chip applications. With a block diagram explain in detail about The OneC™ VWS22100 GSMchip.

REAL TIME CONCEPTS FOR EMBEDDED SYSTEMS

SYLLABUS

Introduction: Examples of Embedded Systems, Definition of Embedded Systems, Architecture of Embedded Systems, Real- Time Embedded Systems , Design Issues and Current Trends for Embedded Systems

Hard versus soft Real- Time Systems: Jobs and Processes, Release Times, Deadlines and Timing Constraints, Hard and Soft Timing Constraints, Hard Real Time Systems, Soft Real Time Systems.

A Reference Model of Real – Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency, Functional Parameters- pre-emptivity of jobs, criticality of jobs, Resource Parameters of Jobs and Parameters of Resources, Scheduling Hierarchy- Scheduler and Schedules, Feasibility, Optimality and Performance Measures.

Classification of Real Time Scheduling Approaches: Clock- Driven Approach, Weighted Round- Robin Approach, Priority- Driven Approach, Dynamic versus Static Systems, Effective Release Times and Deadlines, optimality of the EDF and LST algorithms, Non optimality of the EDF and LST algorithms, Challenges in validating timing constraints in priority –driven systems Off-line versus On-line Scheduling.

Clock-Driven Scheduling :Notations and Assumptions, Static, Timer -Driven Scheduler, General Structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of Aperiodic Jobs, Scheduling Sporadic Jobs-Acceptance test ,EDF Scheduling of accepted jobs and implementation, Pros and Cons of Clock Driven Scheduling.

Priority-Driven Scheduling of Periodic Tasks: Static Assumption, Fixed Priority v/s Dynamic Priority Algorithms, schedulability test for the EDF algorithm, a schedulability test for fixed priority tasks with short response times-time demand analysis, schedulability test for fixed priority tasks with arbitrary response times: busy intervals, general schedulability test, sufficient schedulability conditions for RM & DM algorithms: schedulable utilization of the RM algorithm for tasks with Di=pi, schedulable utilization of fixed priority tasks with arbitrary relative deadlines

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers- Operations of Deferrable Servers, Constant utilization server Scheduling of sporadic jobs-a simple acceptance test in deadline driven systems, a simple acceptance test in fixed- priority drivensystems.

Resources and Resource Access control: Assumptions on Resources and Their Usage, Effects of Resource Contention and Resource Access Control, Non-preemptive Critical Sections, Basic Priority Inheritance Protocol, Basic Priority Ceiling Protocol- Definition, computation of blocking time, controlling accesses to Multiple Unit Resources

Real-Time Operating Systems: Overview- Threads and Tasks, The Kernel, Time Services and Scheduling Mechanisms- Time Services, Scheduling Mechanisms, Other Basic Operating System Functions- Communication and Synchronization, Event Notification and Software Interrupt, Memory Management, I/O andNetworking

TEXT BOOKS:

1. Real Time Systems – By Jane W.S.Liu -Low Price Edition , Pearson EducationAsia
2. Real-Time Concepts for Embedded Systems - Qing Li with Caroline Yao published by CMPBooks

REAL TIME CONCEPTS FOR EMBEDDED SYSTEMS

Time: 3 hours Max. Marks = 100M

Answer any five of the following

1. a) Define Jobs, Processes, Release Time andDeadlines.

   b) Bring out the differences between Hard Real Time Systems and Soft Real Time Systems.

2. a) Define real time embedded system. Describe the design issues for real time embedded system. Explainthe

b) Architecture of Embedded Systems. Discuss the current trends for Embedded Systems.

3.

a. Describe periodic task model for designing the real timesystem?

b. Explain Temporal Parameters of Real time workload

c. Explain Functional Parameters of Real time workload

4. A system uses the cyclic EDF algorithm to schedule the sporadic jobs. The cyclic schedule of periodic tasks in the system uses a frame size of 5, and a major cycle contains 6 frames. Suppose that the initial amounts of slack time in the frames are 1, 0.5, 0.5, 0.5, 1, and1.

a. Suppose that a sporadic job S1 (23, 1) arrives in frame 1, sporadic jobs S2 (16, 0.8) and S3 (20, 0.5) arrive in frame 2. In which frames are the accepted sporadic jobsscheduled?

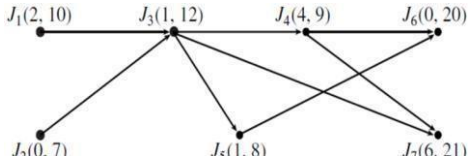
b. Suppose that an aperioidic job with execution time 3 arrives at time 1. When will itbe completed, if the system does not do slack stealing?

5.

a. Discuss sufficient schedulability conditions for RM and DMalgorithms

b. Find the effective release times & deadlines of the jobs in the precedence graph shownbelow.

i.



6. State the implementation of priority ceiling protocol in dynamic priority systems

7.

a. What are the pros and cons of clock driven scheduling

b. Describe in detail about temporal, interconnection, functional and resource characteristics ofjobs

c. Differentiate between fixed priority and dynamic priority algorithms for scheduling periodictasks

8.

a. Explain about the time services and scheduling mechanisms provided by operating systems to real time applications

Explain the Optimality of the EDF and LST algorithm

Code: 15 EC204

MODERN DIGITAL COMMUNICATION

SYLLABUS

Modern Digital Modulation Techniques: Introduction, Information Capacity, Bits, Bit Rate, Baud rate & M-ary Encoding, ASK, FSK, PSK QAM Bandwidth Efficiency Carrier Recovery, Clock Recovery, DPSK, Trellis Code Modulation, Probability of Error & Bit Error Rate, ErrorPerformance.

Baseband Data Transmission: Introduction – Baseband Binary PAM Systems – Baseband Pulse Shaping, Optimum Transmitting and Receiving Filters – Duobinary Baseband PAM System – Use of Controlled ISI in Duobinary Signaling Schemes, Transmitting and Receiving Filters for OptimumPerformance.

M-ary Signaling Schemes – Analysis and Design of M-ary Signaling Schemes, Binary Versus M-ary Signaling Schemes - Shaping of the Transmitted Signal Spectrum – Effect of Pre coding on the Spectrum, Pulse Shaping by Digital Methods - Equalization - Transversal Equalizer, Automatic Equalizers.

Block and Convolutional Channel Codes: Linear Block Codes - The Generator Matrix and Parity Check Matrix, Cyclic Codes, Bounds on Minimum Distance of Linear Block Codes, Non Binary Block Codes – Convolutional Codes – Transfer Function of a Convolutional Code, Optimum Decoding of Convolutional Code –Distance Properties of Binary Convolutional Codes.

Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System – Direct Sequence Spread Spectrum Signals – Error Rate Performance of the Decoder, Some Applications of DS Spread Spectrum Signals, Generation of PN Sequences – Frequency Hopped Spread Spectrum Signals – Performance of FH Spread Spectrum Signals in an AWGN Channel, CDMA System Based on FH Spread Spectrum.

Signals Emerging Digital Communication Technologies.: The North American Hierarchy, Digital Services, Broad band Digital Communication: SONET, Digital Switching Technologies, Broadband Services for Entertainment and Home office Applications, Video Compression, High Definition Television(HDTV)

TEXT BOOKS

1. Advanced Electronic Communications Systems, by Wayne Tomasi, 6 Edition Pearson Education.
2. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley and sons (Asia) PvtLtd.

REFERENCES

1. Simon Haykin, Digital communications, John Wiley and sons,1998
2. Wayne Tomasi, Advanced electronic communication systems, 4th Edition Pearson Education Asia,1998
3. B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford Universitypress
4. Ravindranathan" Communication Systems Modeling Using Matlab& Simulink" UniversitiesPress

MODERN DIGITAL COMMUNICATION

Answer any Five of the following Max Marks: 100

1. Briefly explain Digital ModulationTechniques.

2. a) Explain the Baseband PAM signalling and state and prove the necessary condition on the pulseshape

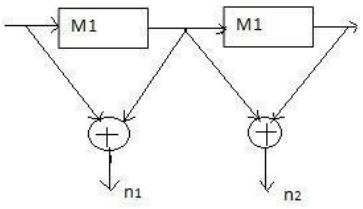
b.) Discuss the requirement on transmitting and receiving filters in baseband binary PAM system.

3. Derive the Probability of error of coherent PSK, and QPSK and compare their error performance.

4. Derive the transfer function of duo-binary signalling and give its drawbacks and how to overcome from these drawbacks using modified duo-binarysignalling.

5 A Parity check matrix H= [101100; 110010;011001] . a) determine the generator matrix. (b) Decode the received code word110110.

6 Find the output codeword of the Convolution encoder shown, if the input data is 11010 and explain about syndromecalculation



7 Compare FH-SS and DS-SS and explain itsmethodology.

8 Write short notes on ISI, HDTV, VideoCompression.

Code: 15 EC207

RADIATING SYSTEMS

SYLLABUS

Basics Concepts Of Radiation: Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of Antennas, Impedance concept-Balanced to Unbalanced transformer.

Radiation from Apertures Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas.

Synthesis of Array AntennasTypes of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques.

Micro Strip Antennas Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Micro-strip dipole, Micro-striparrays.

EMI/EMC/Antenna Measurements: Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Traveling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase measurement, Gain, Directivity, Impedance and polarization measurement, Antenna range, Design and Evaluation.

TEXT BOOKS

1. Kraus.J.D.,"Antennas"II Edition, John wiley andSons.
2. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, NewYork, 1982

REFERENCES

1. RF System Design, Peter Kinget Bell Laboratories, Lucent Technologies MurrayHill,
2. Practical RF system design, Wiley-IEEE, 2003 - Technology &Engineering

RADIATING SYSTEMS

ANSWER ANY FIVE OF THE FOLLOWING QUESTIONS5x20=100MARKS

1. Explain Radiation from surfacecurrent

2. Explain Design considerations of Slotantennas

3. a)Explain.RadiationmechanismCurrentdistributionofAntennas,
b) Describe Rectangular apertures

4. Explain Babinets principle and Describe Geometrical theory ofdiffraction

5. Explain current distribution in linear arrays, and Describe Phasedarrays

6. Explain Input impedance of patch antenna and Describe Microstripdipole,

7. a) Explain Log spiral ridge Guide
b)Describe Traveling Waveantenna

8. Write short noteon

a) polarization measurement b) Hornantenna

MICROWAVE AND MILLIMETER WAVE CIRCUITS

SYLLABUS

Analysis of Microwave Circuits: Introduction, Microwave Components – E-plane Tee, H-plane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering.

Transformers & Resonators: Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators.

Filters And Periodic Structures: Design of Narrow Band Low Pass, Band Pass and High Pass Filters, Maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures.

Obstacles In Wave Guides: Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures.

Millimeter Wave Circuits: Wave Propagation in micro-strip lines, Discontinues in Micro-strips, Parallel Coupled lines, Power Dividers and Directional Couplers, Microwave and Millimeter Wave Integrated Circuits

TEXT BOOKS

1. Roger F. Harrington, "Time-Harmonic Electromagnetic Fields", Mc graw-hill
2. Robert E Collin, "Foundation For Microwave Engineering", McGraw-Hill.

REFERENCE BOOKS

1. Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission Line Structures by Cam Nguyun.

MICROWAVE AND MILLIMETER WAVE CIRCUITS

Answer any FIVE of the following questions
Max Marks : 100

1. a Derive the S Matrix forCiculator

   b) Derve the S matrix for DirectionalCouploer

2. (a) State and prove the properties of scatteringparameters.

   (b) Derive the S-matrix of Magic Tee.

3 (a) Explain the methods of microwave filterdesign

   (b) Design Narrow band Low pass filter using Butterworth and chebyshev methods.

4. (a) Draw the frequency response of a quarter wavetransformer.

   (b) Explain the field analysis of a rectangular cavity resonator.

5. (a) Why do we need Slow-wavestructures

   (b) State and prove floquets theorem

6. (a)Why Microstrip transmission line is preferred over any other type of transmission line

   (b) What are the technologies used for MMICs.

7. (a) Write short notes on Powerdividers

   (b) Compute the Power available at the straight through port if the directional coupler hasan insertion loss of 0.5 dB and input power is 10mW.

8. a) Write short noteson

   b) Wave guide diaphragms Posts in wave guides

Code: 15 EC303

WIRELESS CELLULAR COMMUNICATIONS

SYLLABUS

Introduction to Cellular Mobile Systems: Cellular Mobile Telephone Systems, A Basic Cellular System, Operation of Cellular Systems.

Elements of Cellular Mobile Radio System Design: General Description of the problem, Concept of Frequency reuse channels, Co-Channel Interference Reduction Factor, Handoff Mechanism, Cell Splitting.

Speech Coding for Wireless Systems Applications: Introduction to Digital Signal Processing (DSP) Techniques in Wireless Telephone and Broadcast Systems, Speech Coding Techniques for Audio and Voice – Pulse Code Modulation, DPCM, Delta Modulation, Vocoder and Linear Predictive Coding, Performance Comparison of Speech Processing Techniques.

Radio Propagation and Cellular Engineering Concepts: Fundamental Radio Propagation and System Concepts, Propagation Characteristics, Models of Multipath-faded radio signals – Un modulated Carrier, Envelope and Phase faded, Level Crossing rate and fade Duration, Delay Spread Measurements.

Digital Modulation-Demodulation (Modem) Principles and Architectures: Coherent Modem – Baseband Modem Equivalence, Coherent and Differentially Coherent Binary Phase Shift Keying Systems, Synchronization – Carrier Recovery and Symbol Timing Recovery, Differential Encoding and Decoding Requirement, Quadrature Phase shift Keying – Coincident and offset Types, Pi/4 DQPSK Modems – Architecture.

Interference In Wireless Digital Communication: Carrier-to-Interference and Carrier-to-Noise Limited Systems, Co-channel Interference, Adjacent Channel Interference. Externally caused Co-channel Interference, Definitions and performance of Spectral and Power Efficiency, Relationship of the Bit-Energy to Noise-Density Ratio and the Carrier-to-Noise Ratio, Power Efficiency and Bit-Error-Rate performance in an Additive White Gaussian Noise Environment, Concepts of Diversity Branch and Signal paths; Combining and Switching Methods.

TEXT BOOKS

1. DR Kamilo Feher Wireless Digital Communications, Prentice Hall of India, New Delhi –1999
2. William Cy Lee, Mobile Cellular Telecommunications, 2nd Edition, MC GrawHill.

WIRELESS CELLULAR COMMUNICATIONS

MODEL PAPER

Time:3hrs Maxmarks:100

Answer any five of the following

1.(a) Explain in detail 1G,2G,3G,4G generation systems and their standards

(b) Write a short notes on WLL &Bluetooth

2.What is the need for frequency reuse? Prove that for a hexagonal geometry ,th eco-channel reuse ratio isgiven by $\frac{}{}$ where $N= i^2+ij+j^2$.

3.a) Mention the various techniques used to expand the capacity of cellular system. b)Describe the microzone and picozone concept in a cellular system.

4. Explain the co-channel interference reduction factor and derive the general formula for C/I.

5.a) What are causes of fast and slow fading? Distinguish between them.

b)Explain at least two problems that can occur as a result of multipath interference. 6.Write a note on QPSK and differential QPSK

7.a) Express the spectral efficiency in the form of transmission rate and required bandwidth.

b)Derive the expression for power efficiency and bit error rate performance of AWGN.

8. Explain in detail about the delta modulation along with quantization noise & slope overload distortions.

Code: 15 EC209

RF & MICROWAVE SYSTEM DESIGN

SYLLABUS

Introduction: Importance of RF and Microwave Concepts and Applications- and Units-Frequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.

The Smith Chart: Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart, Distributed Circuit Applications, Lumped Element Circuit Applications. SINGLE AND MULTIPORT NETWORKS: Basic Definitions, InterconnectingNetworks.

Scattering Parameters: Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion between S and Z-parameters, Signal Flow Chart Modeling.

Stability and Gain Considerations – RF Design RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, and Stabilization Methods-Unilateral and Bilateral Design for Constant Gain- Noise Figure Circles- Constant VSWR Circles.

RF Filters, Amplifiers And Oscillators Design Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters-Filter Implementation using Unit Element and Kuroda's Identities Transformations. Introduction, Types and Characteristics of Amplifiers, Small Signal Amplifiers, Design of different types of amplifiers (NBA, HGA, MGA, LNA, MNA, BBA), Design of Large Signal Amplifiers Oscillator vs Amplifier Design, Design procedure of TransistorOscillators.

TEXT BOOKS

1. Mathew M. Radmanesh, “Radio Frequency & Microwave Electronics”, Pearson Education Asia, SecondEdition,
2. Reinhold Ludwig and Powel Bretchko,” RF Circuit Design – Theory and Applications”, Pearson Education Asia, FirstEdition.

REFERENCES

1. Joseph. J. Carr, “Secrets of RF Circuit Design”, McGraw Hill Publishers, Third Edition.
2. Ulrich L. Rohde and David P. New Kirk, “RF / Microwave Circuit Design”, John Wiley & Sons USA,2000.
3. Roland E. Best, “Phase - Locked Loops: Design, simulation and applications”, McGraw Hill Publishers 5TH
4. Devendra K. Misra, “Radio Frequency and Microwave Communication Circuits – Analysis and Design “John Wiley & Sons,Inc.
5. Jon B. Hagen, “Radio Frequency Electronics ", Cambridge university press, Cambridge,1996.
6. James Hardy, “High Frequency Circuit Design ", Resto Publishing Co., NewYork, 1979.
7. Ian Hickman, “RF Handbook ", Butter Worth Heinemann Ltd., Oxford,1993.
8. Ulrich L.Rohde, T.T.N.Bucher, “Communication Receivers ", McGraw-Hill, New York,1998.

RF & MW SYSTEM DESIGN

MODEL QUESTION PAPER

Max. Marks: 100

1. Derivation of Smith Chart and give the description of two types of smithchart

2. With the help of kuroda identities and Richards Transformations, realize the conversion between lumped and distributed circuitdesigns.

3. What are different classes of amplifiers? Derive the expressions for efficiency for any two configurations.

4. Explain the behavior of transmission line for open, short and quarter wave line with necessary diagrams.

5. (a) Derive S- parameters for a two portnetwork.

(b) Explain all the basic theory behind the various methods of Signal Flow graph modeling.

6 (a) For the reflection coefficients and characteristic impedances given, find the reflecting impedance ineach case:
(i) $\Gamma = 0.7 \angle 30^0$, $Z_0 = 50\Omega$ (ii) $\Gamma = 0.9 \angle -35^0$, $Z_0 = 100\Omega$ (iii) $\Gamma = 0.1 - j0.2$, $Z_0 = 50\Omega$ (iv) $\Gamma = 0.5 - j0$, $Z_0 = 600\Omega$

(b). what is a standard Smith chart? What range of resistor and reactive values is mapped into a standard Smith chart?

7. (a) Explain the detail the stability circle, noise figure circles.

(b)List of steps involved in amplifier and oscillator design considerations?

8. (a) Assume that dielectric and conductor losses in a transmission line are small, show that propagation constant k can be written as

$$k = \alpha + j\beta = \tfrac{1}{2}(R/Z_0 + GZ_0) + j\, W \sqrt{LC}$$

Where $Z_0 = \sqrt{L/C}$ is the characteristic impedance of the line in absence of loss.

(b) A distortion less transmission line result R = G = 0, which result in $k = j\, w\sqrt{LC} = \alpha + j\beta$, or $\alpha = 0$ and $\beta = \frac{w}{vp}$ with the phase velocity independent of frequency. A signal propagating along this line will not suffer any pulse distortion or attenuation. If we allow $R \neq G \neq 0$, Find the condition for which $\alpha = \sqrt{RG}$ and $\beta = W\sqrt{LC}$ In other words, the line is attenuative but remains distortion less

ANTENNA MEASUREMENTS

SYLLABUS

Antenna Pattern Measurements: Basic Considerations, Pattern Formats, Fresnel Region Measurements, Modeling Techniques.

Antenna Range Design and Evaluation: Introduction, Electromagnetic Design Consideration, Antenna Range Evaluation.

Antenna Testing: Introduction, Types of Ranges: Elevated Ranges, Ground Ranges, Near Field Ranges, Radar Cross Section Ranges.

Far Field Range Design: Introduction, Designing the Range, Source Design, Receiving Site Design, Ground Ranges.

Far Field Antenna Tests: Introduction, Pattern Testing, Gain and Directivity, Polarization.

Far Field Pattern Errors: Introduction, Error Estimates, Error Correction, Antenna Errors.

Compact Ranges: Introduction, Room Design, Feed Design, Reflector Design.

Near Filed Testing: Introduction, Planar Near Field Ranges, Errors, Cylindrical and Spherical Scanning.

TEXT BOOKS

1. Evans, Gray E," Antenna measurements techniques", Artech House,Inc
2. J S Hollis, T J Lyon, L Clayton," Microwave Antenna Measurements" , Scientific Atlants,Inc

ANTENNA MEASUREMENTS

Time: 3Hrs
Max.Marks:100

Answer any five questions from the remaining

1) What are the types of antenna ranges? Explain them withexamples?

2) What are the types of modeling techniques in antenna pattern measurements and explainthem?

3) a) Write the importance of elevated ranges in antennatesting?

b) Explain Radar cross sectionranges?

4) a) Write the design considerations of far fieldrange?

b) Explain receiving sitedesign?

5) Explain with block diagram of gain and directivity of far field measurements?

6) a) What are the types of antenna errors in far field pattern measurements andexplain?

b) Write the techniques for errorestimates?

7) a) Write the limitations for compactranges?

b) Explain about feed design and reflectordesign?

8) a) Explain the importance of cylindrical and sphericalscanning?

b) What are the types of errors that occur in near field testing? Give your suggestions to minimize those errors?

Code: 15 EC305

IMAGE AND VIDEO PROCESSING

SYLLABUS

Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.

Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region basedsegmentation.

Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.

Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.

2-D Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in videocoding.

TEXT BOOKS

1. Gonzalez and Woods , “Digital Image Processing”, 3rd edition ,Pearson
2. Yao wang, JoemOstarmann and Ya – quin Zhang, “Video processing and communication”, 1st edition,PHI.

REFERENCE TEXT BOOK

1. M. Tekalp, “Digital video Processing”, Prentice HallInternational

SIMULATION TEXT BOOKS

1. Relf, Christopher G.,"Image acquisition and processing with LabVIEW", CRCpress
2. Aner ozdemi R, "Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms", John Wiley &Sons.
3. Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab", John Wiley &Sons.

IMAGE AND VIDEO PROCESSING

Pre PhD Model Question Paper

Time: 3Hrs Max.Marks:100

Answer any five questions from the remaining 5 X 20=100 M

1 a) Explain about fundamental steps of Image Processing

b) Describe the elements of visual perception.

2. a) Explain in detail about sampling and Quatization ?(10M)

b) Discuss about Discrete Wavelet transforms? (10M)

3. a) Explain in detail about Histogram Processing ?(10M)

b) Write about Image Smoothing and Sharpening? (10M)

4. Explain the 2D filters in the frequencydomain

5. a) Explain in detail about segmentation?

(10M) b) Discuss about Edge Detection?(10M)

6. a) Explain in detail about Huffmann Coding?(10M)

b) Write about Wavelet coding? (10M)

7. a) Explain sampling of Video signals?(10M)

b) Write about Photometric and Geometric Image formation? (10M)

8. a) Explain Global Motion Estimation ?(10M)

b) Explain Block based transform coding ? (10M)

Code: 15 EC202

ADVANCED DIGITAL SIGNAL PROCESSING

SYLLABUS

Multi-rate Digital Signal Processing Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion

Multi-rate Digital Signal Processing Multistage Implementation of Sampling Rate Conversion, Applications of Multi-rate Signal Processing, Sampling Rate Conversion of Band-pass Signals

Linear Prediction And Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, Properties of linear prediction-Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

Power Spectral Estimation: Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

Parametric Method Of Power Spectrum Estimation: Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Un-constrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

TEXT BOOKS

1. Proakis JG and Manolakis DG Digital Signal Processing Principles, Algorithms and Application,PHI.
2. Openheim AV & Schafer RW, Discrete Time Signal ProcessingPHI.

SIMULATION TEXT BOOKS

1. Samuel D Stearns, "Digital Signal Processing with examples in Matlab", CRCPress.
2. ES Gopi. "Algorithm collections for Digital Signal Processing Applications using Matlab",Springer.
3. TaanS.Elali, "Discrete Systems and Digital Signal Processing with Matlab", CRC Press,2005.

ADVANCED DIGITAL SIGNAL PROCESSING
MODEL QUESTION PAPER

Answer anyFivequestions Max. Marks: 100M

==========

1. Show that the variance of the Bartlett power spectrum estimate has been reduced by the factor K.

2. A signal x[n] is sampled at and you want to play it on a sound card at a forms the sampling rate at . Assume you have ideal filters. Design a system that performs the sampling rate conversion.

3. a)Derive the power spectral density for AR Models using Burg Method.

b) Obtain MA model for power spectrum estimation

4. An AR(3)process{x(n)}is characterized by the autocorrelation sequence (0)=1, (1)==1/2, (2)=1/8, (3)=1/64. Determine the three reflection coefficients and .

b) Explain Yule-walker method for AR model parameters estimation

5. Determine the frequency, its power, and the variance of the additive noisehaving autocorrelation values (0)=3, (1)==1 and (2)=0.

6. Design the analysis and synthesis sections of a maximally decimated DFT filter bank that deco mopes the signal in to M=8 frequency components.

7. A sequence x(n) is up sampled by I=2, it passes through an LTI system (Z), and then it is down sampled by D=2. Can we replace this process with a single LTI system (Z)? if the answer is positive, determine the system function of this system.

8. a)Explain how the polyphase filters are used ininterpolation?

b)What are the issues in spectral estimation? What is the effect of these issues on the spectral characteristics in practice?

Code: 15 EC304

SPEECH PROCESSING

SYLLABUS

Basic Concepts: Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Speech Analysis: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementationissues.

Speech Recognition: Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; applications and present status.

Speech Synthesis: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

TEXT BOOKS

1. Lawrence RabinerandBiing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education,2003.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, PearsonEducation.

REFERENCES

1. Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, California TechnicalPublishing.
2. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, PearsonEducation.
3. Claudio Becchetti and Lucio PrinaRicotti, “Speech Recognition”, John Wileyand Sons, 1999.
4. Ben gold and Nelson Morgan, “Speech and audio signal processing”, processing and perception of speech and music, Wiley- India Edition, 2006Edition.
5. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MITPress.

SPEECH PROCESSING

Answer anyfivequestions 5 *20 =100 marks

1. a) Draw the Acoustic wave forms for several American English vowels

b). Discuss the Linear Predictive Analysis ?

2. Briefly explain about discrete time model for speechproduction?

3. Discuss about wave propagation in concatenated lossless tubes and its boundary conditions?

4. a) Analyze the design of filter banks in SpeechCoding?

b) Give the techniques to analyze Sub-band coding of speech?

5) a)discuss homographic systems for convolution with neat block diagrams?

b)what are the properties of complex cepstrum?

6) explain channel vocoder analyzer and synthesizer with neat block

diagrams? 7a). Explain about word recognisation system?

b). Justify whether the DTW (dynamic time warping) algorithm suitable to recognize the large vocabulary?

8a)Explain the process of speaker recognition systems ?

b) write a short notes on speaker verification system?

Code: 15 EC301

BIO MEDICAL SIGNAL PROCESSING

SYLLABUS

Introduction To Biomedical Signals - Examples of Biomedical signals - ECG, EEG, EMG etc., Tasks in Biomedical Signal Processing - Computer Aided Diagnosis. Origin of bio potentials - Review of linear systems - Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals- Processing of Random & Stochastic signals – spectral estimation – Properties and effects of noise in biomedical instruments - Filtering in biomedicalinstruments.

Concurrent, Coupled and Correlated Processes - Illustration with case studies – Adaptive and optimal filtering - Modeling of Biomedical signals - Detection of biomedical signals in noise -removal of artifacts of one signal embedded in another -Maternal-Fetal ECG - Muscle-contraction interference. Event detection - case studies with ECG & EEG - Independent component Analysis - Cocktail party problem applied to EEG signals - Classification of biomedical signals.

Cardio Vascular Applications : Basic ECG - Electrical Activity of the heart- ECG data acquisition – ECG parameters & their estimation - Use of multi-scale analysis for ECG parameters estimation - Noise & Artifacts- ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection - Arrhythmia analysis

Data Compression: Lossless & Lossy- Heart Rate Variability – Time Domain measures - Heart Rhythm representation - Spectral analysis of heart rate variability - interaction with other physiological signals.

Neurological Applications: The electroencephalogram - EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models – Non-linear modeling of EEG - artifacts in EEG & their characteristics and processing – Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis – correlation analysis of EEG channels - coherence analysis of EEG channels.

TEXT BOOKS

1. D.C.Reddy ,“Biomedical Signal Processing: Principles and techniques” ,Tata McGraw Hill, New Delhi, 2005
2. Willis J Tompkins , Biomedical Signal Processing -, ED, Prentice – Hall,1993

REFERENCES BOOKS

1. R. Rangayan, “Biomedical Signal Analysis”, Wiley2002.
2. Bruce, “Biomedical Signal Processing & Signal Modeling,” Wiley,2001
3. Sörnmo, “Bioelectrical Signal Processing in Cardiac & Neurological Applications”, Elsevier
4. Semmlow, “Bio-signal and Biomedical Image Processing”, MarcelDekker
5. Enderle, “Introduction to Biomedical Engineering,” 2/e, Elsevier,2005

BIO-MEDICAL SIGNAL PROCESSING

Pre-PhD ModelQuestionPaper MaxMarks:100

ANSWER ANY FIVEQUESTIONS

1) a) There are four different bandwidths that are used in electrocardiograph. Describe the principle and applications of these bandwidths? Draw the frequency response.10M.

b) What are the some other techniques of measuring the ST segment level? 10M

2) a) Describe the characteristics of different stages of sleep in terms of frequency,voltage levels.10M

b) Explain the EEG rhythms and transients with waveforms. 10M

3) a)Write the differences between static filter and adaptive filter.

10M b) Explain the principle of an adaptive filter.10M

4) Draw and explain the block diagram of ECG preprocessing.20M

5) a) Classify the signals according to their characteristics and explain in detail.

10M b) Explain the genesis of heart sounds.10M

6) a) Write the properties of auto correlation.10M

b) Write the properties of power spectral density.10M

7) a) Enumerate the origin of bio-potentials with example7M

b) Explain the use of computers in analysis of biomedical signals.7M

c) Explain how time frequency analysis is helpful in biomedical signal processing6M

8) a) Discuss the electric activity of the heart. What is the significance of the Einthoven's triangle?10M

b) Write a note on spectral estimation in biomedical signals. 10M

Code: 15 EC214

OPTICAL SIGNAL PROCESSING

SYLLABUS

Basics of signal processing and optics, Characterization of a General signal, examples of signals, Spatial signal. Basic laws of geometrical optics, Refractions by mirrors, the lens formulas, General Imaging conditions, the optical invariant, Optical Aberrations.

Physical Optics, The Fresnel Transforms, the Fourier transform, Examples of Fourier transforms, the inverse Fourier transform, Extended Fourier transform analysis, Maximum information capacity and optimum packing density, System coherence.

Spectrum Analysis and Spatial Filtering, Light sources, spatial light modulators, the detection process in Fourier domain, System performance parameters, dynamic range. Some fundamentals of signal processing, Spatial Filters.

Binary Spatial Filters, Magnitude Spatial Filters, Phase Spatial Filters, Real valued Spatial Filters, Inter-ferometric techniques for constructing Spatial Filters. Optical signal processor and filter generator, Applications for optical signal processing.

Acousto-optic cell spatial light modulators, Applications of acousto-optic devices. Basic Acousto-optic power spectrum analyzer. Heterodyne systems: Interference between two waves, the optical Radio.

TEXT BOOKS

1. Anthony Vanderlugt ,"Optical signal processing",Wiley-Interscience
2. Hiroshi Ishikawa ,"Ultrafast All-Optical Signal Processing Devices",Wiley

REFERENCES

1. D. Casasent, "Optical data processing-Applications", Springer-Verlag,Berlin,
2. H.J. Caulfield, "Handbook of holography", Academic Press New York1979
3. P.M. Dufffieux, "The Fourier Transform and its applications to Optics", John Wiley and sons
4. J. Horner ,"Optical Signal Processing ",Academic Press1988
5. Joseph W. Goodman," Introduction to Fourier Optics", second edition McGrawHill.
6. Francis T. S. Yu, SugandaJutamulia, "Optical Signal Processing, Computing, and Neural Networks", Krieger Publishing Company; 2ndedition

OPTICAL SIGNAL PROCESSING

Answer any five from the following Max.Marks:100

1a) Discuss anamorphic magnification. Explain the concept of Beam magnification by a prism.

b) With a neat diagram, explain the concept of Refraction at a curved surface for lenses

2. a). Classify the examples of a signal depending on bandwidth.

b). Interpret the effect of an aperture on a bundle of rays oflight

3. a)Write a brief notes on Law of reflection from Basic laws of geometrical optics. b) List out all the characteristics of a general signal and explain thembriefly

4. a)Derive the Fresnel transform equation in a one dimensionalnotation.

(b). Explain Rayleigh resolution criterionfora impulse response.

5. a)With neat diagram, analyze the working of liquid-crystalSLM.

b) Draw the block diagram of optical system justifying the Fourier transform is a basic to a spectrum analysis.

6. a)Develop a special photodetector array for detection process in the Fourier domain. b) Explain briefly the concept of lightsources..

7. a)llustrate various techniques for using Heterodyne detection in recovering both the magnitude and phase of a timesignal.

b) If we unblock the reference beam, interference between the signal and reference beam is restored. Justify

8. a)The reference beam is blocked in direct detection.Discuss.

b) Summarize the concept of Acousto-optic cell SLMs in Rama-Nath mode in detail

Code: 15 EC310

MOS CIRCUIT DESIGN

SYLLABUS

Introduction: Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS n-well process, layout design rules.

MOS Transistor and Circuit Modeling: MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modeling of MOS transistor using SPICE.

MOS Inverter static characteristics and Interconnect Effects: Introduction, Resistive- Load Inverter, Inverter with n-type MOSFET load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

Combinational and Sequential MOS logic Circuits: Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bi-stable elements, SR latch circuit, clocked latch and flip-flop circuits, CMOS D-latch and Edge-triggered flip-flop.

Dynamic logic Circuits: Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, High-performance dynamic CMOS circuits.

TEXT BOOKS

1. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits” TMH2003
2. Neil H. E. Weste and David. Harris AyanBanerjee,, “CMOS VLSI Design” - Pearson Education,1999.

REFERENCES

1. Jan M. Rabaey, AnanthaChandrakasan, Borivoje Nikolic, “Digital Integrated Circuits” Pearson Education,2003
2. Uyemura, “Introduction to VLSI Circuits and Systems” Wiley-India,2006.
3. Wayne Wolf, “Modern VLSI Design ", 2nd Edition, Prentice Hall,1998.
4. Kamran Ehraghian, Dauglas A. Pucknell and SholehEshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition.

SIMULATION BOOKS

1. Etienne Sicard, Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, TMH, EEE, 2005.

MOS CIRCUIT DESIGN

Model Question Paper

Answer any five of theFollowingQuestions Max. Marks: 100

1. a) Explain the Process flow of the n-type MOSFET on P-type silicon. (10 M)

   b) Draw the circuit design flow and explain each step. (10 M)

2. a) What is λ-based design rules. Explain CMOS transistor design rules. (10 M)

   b) Design transistor level schematic of the one-bit full-adder CMOS circuit. (10 M)

3. a) Compare the performance of MOS system under external bias. (10 M)

   b) Explain MOSFET scaling and small-Geometry effects (10 M)

4. a) What is SPICE? Explain LEVEL 1 Model Parameters (10 M)

   b) Define Noise Margins. Explain the resistive-load inverter circuit. (10 M)

5. a) Draw the Two-input NAND gate. Give the transient analysis. (10 M)

   b) Define Sequential logic. Draw and explain the AOI-based clocked NOR-based SR latch circuit. (10 M)

6. a) What is bootstrapping. With a good example explain domino CMOS logic. (10 M)

   b) Explain about delays in CMOS Inverter (10 M)

7. a) Derive MOS DC equation (10 M)

   b) Explain about Power Dissipation in CMOS Circuits (10 M)

8. a) Explain in detail about high performance dynamic CMOS circuits. (10 M)

   b) Illustrate the concept of Switching Power Dissipation in CMOS Inverters. (10 M)

Code: 15 EC210

LOW POWER VLSI CIRCUITS

SYLLABUS

Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches.

Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing& gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Low Power Circuit's: Transistor and gate sizing, network restructuring and Reorganization. Special Flip Flops & Latches design, high capacitance nodes, low power digital cells library.

Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmeticcomponents.

Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

Special Techniques: Power Reduction in Clock networks, CMOS Floating Node, Low Power Bus Delay balancing, and Low Power Techniques forSRAM.

TEXT BOOKS

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP,2002
2. Rabaey, Pedram, "Low Power Design Methodologies" KluwerAcademic

REFERENCES

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley,2000
2. Yeo, "CMOS/BiCMOS ULSI Low Voltage Low Power" PearsonEducation

LOW POWER VLSI CIRCUITS

Model Question paper

Answer any five questions Max Marks 100

1 a) What is the effect of short-circuit current, charging and discharging capacitances of power dissipation on digital CMOS circuits performance? 10M

1 b) List out and discuss the basic principles for low power design. 10M

2 a) Define entropy? How can you estimate power in combinational and sequential circuits using entropy analysis? 10M

2 b) How can you perform simulation based gate-level timing analysis for different parameters? 10M

3 a) To achieve low power goals what are the techniques that manage the performance and throughput of a system. 10M

3 b) Discuss the techniques to reduce the switching activities cause of power dissipation in CMOS digital system. 10M

4 a) For controlling the timing of computations, how can you design static flip-flops, dynamic flip-flops and latches? What is the process to estimate their power consumption? 10M

4 b) Briefly explain the Monte Carlo simulation approach to power analysis on the dynamic simulation of circuits. 10M

5 a) How can you produce locally equivalent networks with qualities for power, area and delay. 10M

5 b) Explain the architecture of bus invert logic encoding. 10M

6 a) What are the different clocking driving schemes for the clock distribution system? 10M

6 b) Explain architecture synthesis for distributive memory. 10M

7 a) Explain the steps involved in low power design flow. 10M

7 b) Discuss the algorithm level approaches to power estimation process. 10M

8 a) Explain different CMOS logic circuit techniques. What is the effect of the activity ratio on combinational logic power consumption? 10M

8 b) Explain the concept of control data flow graph and its mapping to hardware architecture. 10M

Code: 15 EC309

VLSI SYSTEM DESIGN

SYLLABUS

Design Methodology: Structured design techniques; Programmable logic; Gate array and sea of gates design; cell based design; full custom design; Design flow; Design Economics.

Data path Subsystems: Adders; One/zero Detectors; Comparators; Counters; Shifters; Multipliers; Power and Speed Trade-off.

Memory and Array Subsystems: SRAM, DRAM, ROM, Serial access memories; CAM, PLAs; Array yield, reliability; Power dissipation in Memories.

Special-purpose Subsystems: Packaging; power distribution; I/O pads;

Interconnect: Interconnect parameters; Electrical wire models, capacitive parasitics; Resistive parasitics; Inductive parasitic; Crosstalk; Advanced Interconnect Techniques.

Timing Issues: Timing classification; Synchronous design; Self-timed circuit design;

Clock Synthesis and Synchronization: Synchronizers; Arbiters; Clock Synthesis; PLLs; Clock generation; Clock distribution; Synchronous Vs Asynchronous Design.

TEXT BOOKS

1. Neil H. E. Weste, David. Harris and AyanBanerjee,, “CMOS VLSI Design” -Pearson Education, Third Edition,2004.
2. Jan M. Rabaey, AnanthaChandrakasan, Borivoje Nikolic, “Digital IntegratedCircuits” Pearson Education, SecondEdition.

REFERENCES:

1. 1.Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits” TMH, Third Edition, 2003
2. Wayne Wolf, “Modern VLSI Design ", 2nd Edition, PrenticeHall,1998.

SIMULATION BOOKS

1. Etienne Sicard, Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, TMH, EEE, 2005.

VLSI SYSTEM DESIGN

MODEL QUESTION PAPER

Answer anyFive Questions Max. Marks: 100Marks

1. Design a circuit for X= { 1 3 5 11 13} & Y = {1 2 10 12} by using PLA. (20 M)

2. Explain about Carry look ahead adder for 4 bits and what happen when we are using more than 4 bits explain withexamples. (20 M)

3. (a) Justify all the four design styles by taking one example. (10 M) (b) Sketch the Full adder by using transistor level by using CMOS Technology (10 M)

4. Design the Conditional sum adder for given input A = 10110110 & B= 00101101 (20 M)

5. (a) Design the SRAM & DRAM using Transistor (10 M)

(b) Explain the Power Distribution for Subsystem design (10 M)

6. Design the multiplier for X=011001(25_{10}) & Y=101110(-18_{10}) using Booth multiplier. (20 M)

7. (a) Explain the cell-based design methodology using example. (10 M) (b) Comparison of Design styles (10 M)

8. a) Illustrate the concept of clock distribution. (10 M)

b) Compare synchronous and asynchronous design issues. (10 M)

Code: 15 EC315

CMOS RF CIRCUIT DESIGN

SYLLABUS

Introduction to RF Design and Wireless Technology: Design and Applications, Complexity and Choice of Technology. Basic concepts in RF design: Nonlinearly and Time Variance, Inter symbol interference, random processes and noise. Sensitivity and dynamic range, conversion of gains and distortion

RF Modulation: Analog and digital modulation of RF circuits, Comparison of various techniques for power efficiency, Coherent and non-coherent detection, Mobile RF communication and basics of Multiple Access techniques. Receiver and Transmitter architectures, Direct conversion and two-step transmitters

RF Testing: RF testing for heterodyne, Homodyne, Image reject, Direct IF and sub sampled receivers.

BJT and MOSFET behavior at RF Frequencies: BJT and MOSFET behavior at RF frequencies, modeling of the transistors and SPICE model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation

RF Circuits Design: Overview of RF Filter design, Active RF components & modeling, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise Amplifier design in various technologies, Design of Mixers at GHz frequency range, Various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Radio frequency Synthesizers- PLLS, Various RF synthesizer architectures and frequency dividers, Design issues in integrated RF filters.

TEXT BOOKS

1. B. Razavi, “RF Microelectronics” PHI1998
2. R. Jacob Baker, H.W. Li, D.E. Boyce “CMOS Circuit Design, layout and Simulation”,PHI

REFERENCE BOOKS

1. Thomas H. Lee “Design of CMOS RF Integrated Circuits” Cambridge University press1998.
2. Y.P. Tsividis, “Mixed Analog and Digital Devices and Technology”, TMH1996

CMOS RF CIRCUIT DESIGN

Model Question Paper

Answer anyFIVEquestions Max.Marks: 100

1. a) Explain the design bottleneck of RF system and with neat block diagram. Explain the Generic analogRFsystem. (10 M)

b) Define sensitivity and dynamic range and illustrate their importance with an example. (10 M)

2. a) With a neat block diagram, explain the implementation of the π/4 QPSK transmitter. (10 M)

b) Explain the operation of Direct-Conversion transmitter with the help of neat sketches.(10 M)

3. a) Explain the concept of image reject receivers. (10 M)

b) Illustrate the operation of Digital IF receivers with neat sketches. (10 M)

4. a) Explain MOSFET behavior at RF frequencies. (10 M)

b) Explain the behavior of integrated parasitic elements at high frequencies. (10 M)

5. a) With neat sketches, explain the phase noise mechanism in oscillation. (10M)

b) Explain the mechanism involved in the design of mixers at GHz range with an example.(10 M)

6. a) Derive an expression for the power gain in bipolar mixers. (10 M)

b) Explain the basics of multiple access techniques. (10 M)

7. Write short notes on:

a) Noise in PLL's (10 M)

b) Power efficiency of modulation schemes. (10 M)

8. a) Compare the BJT and MOSFET in terms of noise performance and the limitations. (10 M)

b) Discuss the design issues involved in integrated RF filters. (10 M)

Code: 15 EC215

ASIC DESIGN FLOW

SYLLABUS

Types of ASICs – Design flow – Economics of ASICs – ASIC cell libraries – CMOS logic cell data path logic cells – I/O cells – cell compilers.

ASIC Library design: Transistors as resistors – parasitic capacitance – logical effort programmable ASIC design software: Design system – logic synthesis – half gate ASIC.

Low level design entry: Schematic entry – low level design languages – PLA tools – EDIF – An overview of VHDL and Verilog. Logic synthesis in Verilog and & VHDL simulation.

CMOS System case studies: Dynamic warp processor: Introduction, the problem, the algorithm, a functional overview, detailed functional specification, structural floor plan, physical design, fabrication, pixels-planes graphic engine: introduction, raster scan graphic fundamental, pixels-planes system overview, chip electrical design, chip organization and layout, clock distribution.

Hierarchical layout and design of single chip 32 bit CPU: Introduction, design methodology, technology updatability and layout verification.

Floor planning & placement: Floor Planning Goals and Objectives, Measurement of Delay in floor planning, Floor planning tools ,I/O and Power planning, Clock planning ,Placement Algorithms.

Routing: Global routing, Detailed routing ,Special routing.

TEXT BOOKS

1. Application specific Integrated Circuits", J.S. Smith, AddisonWesley.
2. Principles of CMOS VLSI Design : A System Perspective, N. Westle& K. Eshraghian ,Addison – WesleyPub.Co.1985.

REFERENCES

1. Basic VLSI Design :Systems and Circuits, Douglas A. Pucknell& Kamran Eshraghian, Prentice Hall of India Private Ltd. , New Delhi ,1989.
2. Introduction to VLSI System,C. Mead & L. Canway, Addison WesleyPub
3. Introduction to NMOS & VLSI System Design, A. Mukharjee, PrenticeHall,
4. The Design & Analysis of VLSI Circuits, L. A. Glassey & D. W. Dobbepahl, Addison Wesley Pub Co.1985.
5. Digital Integrated Circuits: A Design Perspective, Jan A. Rabey, Prentice Hall of India PvtLtd

ASIC DESIGN FLOW

MODEL QUESTION PAPERS

Answer anyFIVEquestions Max Marks:100

1.a) Define ASIC and describe the various types of ASICs.

b)Explain the design approach of standard cells and cell based ASIC Design with an examples.

2.a) Compare the performance of Xilinx XC LCA families.

b)Explain in detail about PLA and PAL devices.

3. a) Briefly describe about Boundary Scan Test with suitable example.

b)Explain the various design tools available in ASIC Design.

4.a) Explain about standard cells in ASIC Design. b)Give an overview of mixed mode and analogue ASICs.

5.a) Explain the design flow methodology used in ASIC Design.

b)Discuss in detail ASIC design approach using Xilinx based FPGA design tool.

6.a) Define simulation and synthesis. Explain in detail about various simulation techniques used in FPGA design.

b)Write in detail about automatic test pattern generation.

7.a) Explain about goals and objectives of floor planning.

b)What are the various placement algorithms in FPGA design? Explain in brief any one of them.

8.a) Explain in detail about global routing mechanism.

b)List the various partitioning methods in FPGA design. Explain in detail about Kernighan-Lin algorithm.

Code: 15 EC312

ADVANCED ANALOG IC DESIGN

SYLLABUS

Small Signal & large signal Models of MOS & BJT transistor. Analog MOS Process

Passive & Active Current Mirrors: Basic current mirrors, Cascode current mirror, Active loads, voltage and current references;

Frequency response of integrated circuits: Single Stage (CS,CG,CD) amplifiers, Cascade Stage; frequency response(miller effect) of CG, CS, CD, Operation of Basic Differential Pair, differential pair with MOS loads, Frequency response of Cascade & DifferentialPair;

Operational Amplifiers with single ended outputs: Applications of operational amplifiers, basic two stage MOS operational amplifiers, Deviations from ideality in real operational amplifiers, Basic two-stage MOS operational amplifier, MOS Folded –cascode operational amplifiers,

Feedback: Ideal feedback equation, gain sensitivity, feedback configurations, practical configuration and effect of loading

Nonlinear Analog circuits & other applications: Precision rectification ,phased locked loops, Sampling Switches, switched capacitor integrator, oscillators, ADC, DAC.

TEXT BOOKS

1. Gray & Meyer, Analysis & Design of Analog Integrated Circuits, 4th edition,Wiley, 2001.
2. Behzad Razavi, “Design Of Analog CMOS Integrated Circuits”, Tata Mcgraw Hill,2005.

REFERENCE

1. Jacob Baker,“CMOS Mixed Signal Circuit Design”, JohnWiley.
2. Gray, Wooley, Brodersen, " Analog MOS Integrated Circuits ", IEEE Press,1989.
3. Kenneth R. Laker, Willy M.C. Sansen, William M.C.Sansen, “Design of Analog Integrated Circuits and Systems ", McGrawHill.

ADVANCED ANALOG IC DESIGN

Answer any FIVE of the following questions **5X** 20=100M

1. a)Explain large scale signal modeling of single stage BJT amplifier with neatsketch
b) Explain the common source amplifier with current mirror load

2. a)Explain the effect of negative feedback on the frequency response ofop-AMP

b) Explain about cascade on CE-CB operational amplifier and obtain AC analysis of it

3. a)Draw the circuit of CMOS current mirror and explain its workingprinciple

b) Explain why source/emitter follower circuits exhibits large amount of over shoot and regians

4. a)Briefly explain about various performances parameters of sample and holdcircuit
b) Draw the circuit of switched capacitor circuit and explain its principle

5. a)Explain the principle of operation of dual slope A/Dconverter

b) Explain briefly a 3 bit flash A/D converter state. Sailent issues in designing flash A/D converter

6. a)Give the significance of CMFBcircuits

b) Give an account of charge injection errors in connection with comparators and suggest a method to minimite the same

7. a)What is quantization noise? Explain indetails

b) Explain the operation of D/A converters using Hybrid converter

8. a)Discuss the stability and linearity issues associated with delta sigma convertersb) Discuss in details and design PLLCircuits

Code: 15 EC311

TESTING OF VLSI CIRCUITS

SYLLABUS

Basics of Testing and Fault Modeling Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

Test Generation for Combinational and Sequential Circuits Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequentialcircuits.

Design for Testability Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design – System level DFTapproaches.

Self-Test and Test Algorithms Built-In Self-Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs. Fault Diagnosis Logic Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

TEXT BOOKS

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico PublishingHouse.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer AcademicPublishers.

REFERENCE BOOKS

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press,2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice HallInternational.

TESTING OF VLSI CIRCUITS

Answer any FIVE of the following questions 2X 20=100M

1. Evaluate the types of Modeling of faultswith examples. [20]
2. Evaluate the Gate-Level EventDrivensimulation. [20]

3. (a) Differentiate between structural and functionalmodels.
   (b) Analyze the typesofsimulations. [10+10]
4. Discuss the testable logic design for combinational and sequential circuits with example. [20]

5. (a) Analyze the generic scan baseddesigns.
   (b) Propose the operation ofAd-hocdesigns. [10+10]

6. (a) Discuss about the STUMPS andLOCST.
   (b) Analyze the operation of MemoryTestArchitecture. [10+10]
7. (a) Propose the operation of diagnosis by UUTreduction.
   (b) Evaluate the operation of EffectCauseAnalysis. [10+10]
8. Analyze the Totally self checking m/ncode checkers. [20]

Code: 15 EC306

EMI AND EMC

Syllabus

UNIT – I

EMI Environment: Sources of EMI, Conducted and Radiated EMI, Transient EMI, EMI – EMC Definitions and Units of Parameters.

EMI Specifications/Standards/Limits: Units of specifications, Civilian Standards and Military Standards

UNIT – II

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

UNIT – III

EMC Design Guidelines: Typical Sub systems in Electronic Equipment, Transmitters, Receivers, Antenna
Systems, Power Supplies, Motors, Control Devices, Digital Circuits, Digital Computers.

UNIT – IV

Choice of Passive Components for EMC: Capacitors, Inductors, Transformers, Resistors, Conductors,
Ferrite Beads, Coaxial Connectors, Conductive Gaskets.

UNIT – V

EMI Measurements: EMI Test Instrument / Systems, EMI Test, EMI Shielded Chamber, Open Area Test
Site, TEM cell Antennas

TEXT BOOKS:

1. V P Kodali, Engineering EMC Principles, Measurements and Technologies, IEEE press,1996.
2. Bernard Kieser, Principles of Electromagnetic Compatibility, Artech House 3rd Edition, 1986

EMI/EMC

Time : 3 hours Max Marks : 100

MODEL QUESTION PAPER

Answer any five questions from the following.

1 a) Define EMI and EMC. List out Different Sources of EMI. (10M)

b) With practical examples distinguish conducted, radiated and transient EMI (10M)

2. (a) Define EMC and ESD 4M

(b) List the various man-made resources of EMI and Explain. 8M

(c) What are the basic differences between conducted and radiated Emission.8M

3. (a) Discuss the methods for eliminating EMI. 10M

(b) Explain MIL – STD 461 / 462 10M

4. (a) Explain discuss various types of grounding and shielding techniques to reduce EMI/EMC(10M)

(b) How EMI is suppressed using EMI suppression cables. (10M)

5. (a) Explain the designing of power line filter for both common modeand differential mode noises. 10M

(b) Discuss about Isolation transformers. 10M

6. (a) How do you meet EMC requirements of communication and Radar antennas. 10M

(b) Explain the factors affecting the choice of components for highfrequency applications. 10M

7. (a) Describe different categories of EMI testing. 10M

(b) Mention the probable errors that can arise at the time of performing EMC measurements and explain how they can be overcome.(10M)

8. Write short notes on

(a) Anechoic chamber 8M

(b) Electrical Bonding 8M

(c) Errors in EMI Testing 4M

Code: 15 EC314

MULTIRATE SIGNAL PROCESSING

SYLLABUS

Fundamentals of Multirate Theory: The sampling theorem - sampling at sub-Nyquist rate - Basic Formulations and schemes - Basic Multirate operations- Decimation and Interpolation- Digital Filter Banks- DFT Filter Bank- Identities- Polyphase representation - Maximally decimated filter banks: Polyphase. representation - Errors in the QMF bank- Perfect Reconstruction (PR) QMF Bank - Design of an alias free QMF Bank M-channel perfect reconstruction filter banks: Uniform band and non uniform filter bank - tree structured filter bank- Errors created by filter bank system- Polyphase representation- perfect reconstruction systems Perfect reconstruction (PR) filter banks: Para-unitary PR Filter Banks- Filter Bank Properties induced by paraunitarity- Two channel FIR paraunitary QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property-Quantization Effects:

-Types of quantization effects in filter banks. - coefficient sensitivity effects, dynamic range and scaling. Cosine Modulated filter banks: Cosine Modulated pseudo QMF Bank- Alas cancellation- phase - Phase distortion- Closed form expression- Polyphase structure- PR Systems.

TEXT BOOKS

1. P.P. Vaidyanathan. “Multirate systems and filter banks.” Prentice Hall.PTR.
2. N.J. Fliege. “Multirate digital signal processing .” JohnWiley.
3. Sanjit K. Mitra. “ Digital Signal Processing: A computer basedapproach.”

REFERENCES

1. R.E. Crochiere. L. R. “Multirate Digital Signal Processing”, Prentice Hall.Inc.
2. J.G. Proakis. D.G. Manolakis. “Digital Signal Processing: Principles. Algorithms and Applications”, 3rd Edn. Prentice Hall India

MULTIRATE SIGNAL PROCESSING

Model Paper

Answer any five of the following questions:-
5X20=100

1 . (a) From the fundamentals of Multirate Signal Processing, develop a Digital Filter Bank with all necessary expressions for Filter Response.

(b) Represent Noble Identities in detail with an example.

2. (a) Design a QMF Bank and also analyze the errors present in QMFBank.

(b) Illustrate with the required expressions how Reconstruction of the signal takes place in QMFBank.

3. (a) Compose the two popular Interconnections of Decimator and Interpolator, Justify your answer with an example.

(b) Interpret the purpose of using a Decimator and an Interpolator in an Audio System?

4. (a) State and prove sampling theorem. Discuss about Nyquist rate and Aliasing phenomena Indetail.

(b) Compare and Contrast Uniform and Non uniform filter banks with neat block diagrams.

5. (a) Perform Poly phase Analysis for Multirate SignalProcessing.

(b) Illustrate Perfect Reconstruction in QMF Bank with neat blockdiagram.

6. (a) Discuss about Linear Phase PR Filter Banks indetail.

(b) Discuss about Quantization effect, and types of quantization effects in filter banks.

7. (a) Analyze Cosine modulated QMF bank Systems with neat blockdiagram.

(b) Discuss about Alias Cancellation in Cosine modulated QMF Banks.

8. Discuss about coefficient sensitivity effects, dynamic range and scaling in

Perfect Reconstruction FilterBanks.

Code: 15 EC206

WAVELET THEORY AND APPLICATIONS

SYLLABUS

Introduction Stationary and non-stationary signals, Signal representation using basis and frames, Brief introduction to Fourier transform and Short time Fourier transform, Time-frequency analysis, Bases of time frequency: orthogonal, Filter banks, Multi resolution formulation: Wavelets from filters, Classes of wavelets: Haar, Daubechies, bi-orthogonal.

Continuous Wavelet Transform Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transformdomain.

Discrete Wavelet Transform AndFilterbanksOrthogonal and bi-orthogonal two-channel filter banks, Design of two-channel filter banks, Tree-structured filter banks, Discrete wavelet transform, Non-linear approximation in the Wavelet domain, multi resolution analysis, Construction and Computation of the discrete wavelet transform, the redundant discrete wavelet transform.

Multi Resolution Analysis Multirate discrete time systems, Parameterization of discrete wavelets, Bi-orthogonal wavelet bases, Two dimensional, wavelet transforms and Extensions to higher dimensions, wave packets

Applications Signal and Image compression, Detection of signal changes, analysis and classification of audio signals using CWT, Wavelet based signal de-noising and energy compaction, Wavelets in adaptive filtering, Adaptive wavelet techniques in signal acquisition, coding and lossy transmission, Digital Communication and Multicarrier Modulation, Trans multiplexers , Image fusion, Edge Detection and object isolation.

TEXT BOOKS

1. A Wavelet Tour of Signal Processing, 2nd edition, S. Mallat, Academic Press,1999.
2. Wavelets and Sub band Coding, M. Vetterli and J. Kovacevic, Prentice Hall,1995.
3. Wavelet transforms: Introduction, Theory and applications, Raghuveer rao and AjitS.Bopardikar, Pearson Education Asia,2000.

REFERENCES

1. Fundamentals of Wavelets: Theory, Algorithms, and Applications, J.C. Goswamiand A.K. Chan, 2nd ed., Wiley, 2011.
2. Wavelets and their Applications, Michel Misiti, Yves Misiti, Georges Oppenheim, Jean-Michel Poggi, John Wiley & Sons, 2010.
3. A premier on Wavelets and their scientific applications, J S Walker, CRC press,2002.
4. Wavelets and signal processing: An application based introduction, Stark, Springer, 2005.
5. A friendly guide to Wavelets, Gerald keiser, Springer,2011.
6. Multirate Systems and Filter Banks, P. P. Vaidyanathan, Pearson Education,2004.
7. Wavelets : from math too practice, Desanka.P.Radunovik, springer, 2009.
8. Insight into wavelets from theory to practice, K P Soman and KL Ramachandran, PHI,2008.

WAVELET THEORY AND APPLICATIONS

Time:3Hrs Max. Marks: 100

Answer any five of the Following Questions 5x20=50M

1) (a) How can you reconstruct a periodic signal from orthogonal bases? Explain with a suitableexample. 10M

(b) Write a brief note on the significance of frames insignal analysis. 10M

2) (a) Filter bank analysis is analogous to multi resolutionformulation.Justify. 10M

(b) State and prove the properties of Continuouswavelettransform. 10M

3) (a) Comment on two channel filter banks, by emphasizing orthogonal and bi- orthogonal filterbanks. 10M

(b) What is redundancy of Continuouswavelet transform? 10M

4) Write a note on multirate discretetimesystems. 20M

5) (a) What is a nonlinear approximation inWaveletdomain? 10M

(b) How can you use discrete wavelet transform forimage processing? 10M

6) (a) What isatransmultiplexer? 10M

(b) How can you ensure perfect reconstruction usingdirectcharacterization? 10M

7) Comment on the applications of wavelet transform in Audio signal processing20M

8) Distinguish classesof wavelets 20M

Code: 15 EC205

MATHEMATICS FOR SIGNAL PROCESSING

SYLLABUS

Mathematical Models and Vector Space Concepts: Mathematical models for linear systems and signals, Vector spaces and linear algebra: norms, Hilbert and branch spaces, linear transformations, projections and orthogonalization ofvectors.

Least Square and Minimum Mean Square Filtering and Estimation: Approximation problem in Hilbert space, Orthogonality principle, Matrix representation of least square problems, Minimum error in Hilbert-space approximations, Least squares filtering, Minimum mean square estimation, MMSE filtering, Comparison of least squares and minimum mean squares, Frequency-domain optimal filtering, Minimum-norm solution of underdetermined equations, Iterative reweighted LS for LP optimization.

Linear Operators and Matrix Inverses: Linear operators, Operative norms, Adjoint operators and transposes, Geometry of linear equations, Four fundamental sub spaces of a linear operator, Pseudo inverses, Inverse of a block matrix.

Eigen values and Eigen vectors: Eigen values and linear systems, Linear dependence of eigenvectors, Diagonalization of a matrix, Geometry of invariant subspaces, Geometry of quadratic forms subject to linear constraints, Karhunen-Loève approximations, Eigen filters, Signal subspace techniques.

Singular Value Decomposition: Theory of SVD, Matrix structure from the SVD, Pseudo inverses, Numerically sensitive problems, Rank-reducing approximations. Applications of the SVD: System Identification, Total least square problems, Partial total least squares, Rotation of subspaces, Computation of SVD.

TEXT BOOKS

1. Todd K. Moon, Wynn C. Stirling, ‘Mathematical Methods and Algorithms for signal processing’, Pearsoneducation.
2. Statistical Signal Processing of Complex-Valued Data, Peter J. Schreier and Louis L. Scharf, Cambridge UniversityPress

REFERENCE TEXT BOOKS

1. Steven M. Kay, Intuitive Probability and Random Processes using Matlab, Springer, 2006.
2. Richard E. Blahut, Fast Algorithms for Signal Processing Cambridge UniversityPress
3. The Edinburgh Building, Cambridge CB28RU

MATHEMATICS FOR SIGNAL PROCESSING

PRE Ph.D EXAMINATION

Model Question Paper

Time: 3hrs. Max. Marks: 100

Question No. 1 is compulsory. Answer any five questions from the remaining.

1 .(a) Explain Least Squares problem in Hilbert Space. 10M

(b) Inner product defined as Euclidian inner product $X^T Y$ for the following functions.

(i) $X = [1, 2, -3, 4]$, $Y = [2,3, 4,1]$ (ii) $X = [2,3]$, $Y = [1, -2]^T$ 10M

.2 (a) Explain about the Cauchy-Schwarz inequality. 10M

(b) For Given vector , compute the l_p metric $d_p(X,0)$ for p =1,2,4,10,100,∞ . Comment onwhy$d_p(X,0) \rightarrow \max(X_i)asp \rightarrow \infty$. 10M

3 – (a) Explain Orthoganality Principle using necessary equations. 10M

(b) Consider the set of data x= (2, 2.5, 3.5, 9} y=(-4.2 ,-5 .2, 1, 24.3} 10M

(a) Make a plot of thedata.

(b) Determine the best least-squares line that fits this data and plot theline.

(c) Assuming that the first and last points are believed to be the most accurate, formulate a weighting matrix and compute a weighted least-squares line that fits the data. Plot thisline.

4 (a) A linear operator A: $X \rightarrow Y$ is bounded if and only if it is continuous. 10M

(b) Show that if A has both a left inverse and a right inverse, they must be same. 10M

5 (a) If λ is an eigen value of a nonsingular matrix A , showthat $\frac{|A|}{\lambda}$ is an eigen value of $adjA$. 10M

(b) Find the eigen values of the followingmatrices 10M

(i) A diagonalmatrix

(ii) A triangularmatrix

6 Write short notes on applications of SVD. 20M

7 Show that the functions defined by $p_k[t] = \frac{1}{\sqrt{N}} e^{j 2\pi kt / N}$ are orthonormal with respect to the inner product $= \sum_{t=0}^{N-1} x[t]\, y[t]$ 20M

8 (a) Show that if A has both a left inverse and a right inverse, they must be same. 10M

(b) Explain Minimum Mean Square Error Filtering. 10M

Code: 15 EC211

DETECTION AND ESTIMATION OF SIGNALS

SYLLABUS

Introduction to Discrete-time signals: Fourier Transform of a discrete time signal, Amplitude and phase spectrum, Frequency content and sampling rates, Transfer function, Frequency response.

Random - Discrete-time signals: Review of probability, Random data, Generation of Pseudo-random noise, Filtered signals, Autocorrelation and power spectral density, Sampling band-Limited random.

Detection of Signals in Noise:- Minimum probability of Error Criterion, Neyman-Person criterion for Radar detection of constant and variable amplitude signals, Matched filters, Optimum formulation, Detection of Random signals, Simple problems thereon with multi sample cases.

Estimation of Signals in Noise: Linear mean squared estimation, Non linear estimates, MAP and ML estimates, Maximum likelihood estimate of parameters of linear system, Simple problems thereon.

Recursive linear mean squared Estimation: Estimation of a signal parameter, Estimation of time-varying signals, Kalman filtering, Filtering signals in noise, Treatment restricted to two variable case only, Simpleproblems.

TEXT BOOKS

1. Signal processing: Discrete Spectral analysis, Detection and Estimation, Mischa Schwartz and Leonard Shaw, Mc-Graw Hill Book Company, 1975.
2. Signal Detection and Estimation, 2nd edition, Mourad Barkat, Artech House Inc, Norwood, MA 02062,2005,
3. Fundamentals of Statistical Signal Processing: Estimation Theory, Steven M. Kay, Prentice Hall New Jersey,1993,

REFERENCE TEXT BOOK

1. "Probability, Random Variables and Random Signal Principles", *Peyton Z.Peebles*Jr, 4th Edition, Tata Mc GrawHill.
2. Jerry M. Mendel, Lessons in Estimation Theory for Signal Processing, Communication and Control, Prentice Hall Inc., 1995.
3. Shanmugam and Breipohl, 'Detection of signals in noise and estimation', John Wiley & Sons, New York,1985.
4. Srinath, Rajasekaran& Viswanathan, Introduction to statistical Signal processing with Applications, Prentice Hall of India, New Delhi, 110001,1989.
5. Steven M. Kay, Intuitive Probability and Random Processes using Matlab, Springer, 2006.

SIMULATION TEXT BOOKS

1. Statistical Digital Signal Processing and Modeling by Monson Hayes, John Wiley & Sons,Inc.,
2. Statistical Signal Processing Modelling and ESTIMATION BY Chonavel, T., Springer2001

DETECTION AND ESTIMATION OF SIGNALS

Per Ph.D EXAMINATION
Model Question Paper
Time: 3 hrs. Max. Marks: 100

1. (a) How would you explain optimum detection algorithms with respect to minimum probability of error. (10M)
(b)Prove that the detection procedure for minimizing the probability of error whenm independent data samples are available for processing. (10M)
2. What facilitates the use of maximum likelihood estimators for estimating the signal parameters and their consistencies? (20M)
3. Can you see a possible solution for Kalman filter equations for filtering noise? (20M)

4. (a) What assumptions are to be made while formulating a fourier transform. (10M)
(b) Compute and compare Fourier transform for differentiation and integration properties for a random variable. (10M)
5. (a) What is the function of minimum mean squared estimation in signal estimation problems. (10M)
(b) Can you see a possible solution to maximum likelihood parameter estimation?(10M)
6. How would you explain the linear mean squared estimation and its connection withlinear filtering? (20M)
7. (a) What do you understand by transfer function. Express mathematically withnecessary expressions. (10M)
(b) Give an example for converting time domain signal to frequency domain signal. (10M)

8. (a) Outline the process to detect random noise in signals. (10M)
(b) What motive is there behind the design of matched filters? (10M)

EMBEDDED NETWORKING

SYLLABUS:

UNIT-I

EMBEDDED COMMUNICATION PROTOCOLS: Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard –RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming -ISA/PCI Bus protocols –Firewire.

UNIT-II

USB Bus: Introduction – Speed Identification on the bus – USB States – USB bus flow communication: Packets –Data types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface

UNIT-III

CAN Bus: Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN.

UNIT-IV

EMBEDDED ETHERNET: Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.

UNIT-V

WIRELESS EMBEDDED NETWORKING: Wireless sensor networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing

TEXT BOOKS

1. Frank Vahid, Givargis ‘Embedded Systems Design: A UnifiedHardware/Software
2. Introduction’, WileyPublications
3. Jan Axelson, ‘Parallel Port Complete’, Penrampublications
4. Dogan Ibrahim, ‘Advanced PIC microcontroller projects in C’, Elsevier2008
5. Jan Axelson ‘Embedded Ethernet and Internet Complete’, Penrampublications
6. Bhaskar Krishnamachari, ‘Networking wireless sensors’, Cambridge press2005

EMBEDDED NETWORKING

Answer any Five of the following

Time:3:00Hours Max. Marks:100

1. a).Describe Serial Peripheral Interface (SPI) Bus? b) Differentiate between:
   i. ISA and PCIbus
   ii. I2C and Firewire?

2. a) Explain parallel communication protocol with oneexample?
   b) Explain RS232 and RS485 standards?

3. a) Discuss different types of descriptors in USB?
   b) Discuss different types of data transfers in USB Bus?

4. a) Describe the message format in the CANBus?
   b) Draw the interfacing diagram of PIC microcontroller with CAN Bus and explain about it?

5. a)How do you serve the WebPages with a dynamicdata?
   b) Explain how to email for Embedded Systems using FTP in Embedded Ethernet?

6. a) Define Embedded Ethernet? How do you keep devices in Embedded Ethernet?
   b) Explain network secure in EmbeddedEthernet?

7. Explain thefollowing:
   1. Energy efficientand
   2. Robust routing

8. Describe the concept of Data CentricRouting?

Code: 15 EC208

MICRO ELECTRO MECHANICAL SYSTEMS

Syllabus

Overview of MEMS and Micro Systems: Introduction, miniaturization, Reliability, Advantages of MEMS, working principles of chemical sensors, optical, pressure and thermal sensors, micro actuation: actuation using thermal forces, actuation using piezo electric crystals, actuation using electrostatic forces; micro accelerometers, micro fluidics, MEMS switches, phase shifters, varactors, tunable oscillators

Basics of MEMS technology: Molecular theory of matter and intermolecular forces, doping of semi-conductors, the diffusion process, scaling laws in miniaturization, Engineering mechanics: static bending of thin plates, mechanical vibrations, thermo mechanics, fluid flow in nano scale.

Micro system Design: Introduction, design considerations, process design, mechanical design, micro system packaging, essential packaging technologies, 3D packaging, assembly, selection of materials, Finite Element Analysis (FEA).

Fabrication methods: Lithography: Introduction, wafers, masks, spinning resist and soft baking, exposure and post exposure treatment, resolution, mathematical expression of resist profiles, image reversal, interface effects, radiation and resist profiles, ion implantation, diffusion, oxidation, RIE , Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD), deposition by epitaxy, comparison of bulk and surface micromachining, comparison of wet and dry etching, LIGA process. system level packaging, single and multichip packaging.

Case Study: MEMS capacitive switch, MEMS capacitive accelerometer, MEMS pressure sensor, quartz rate gyroscope, cantilever based micro cantilevers for mass measurement.

References:

1. Microsystem Design by *Stephen D.Senturia*, Springer InternationalEdition,2010
2. RF MEMS Theory, Design and Technology by *Gabriel M.Rebeiz*, Wiley India Pvt Ltd.
3. MEMS and Microsystems: Design and Manufacture by *Tai-Ran Hsu*, Tata McGraw
4. Hill,2002
5. The MEMS Handbook, *Mohamed Gad-el-Hak*, CRC Press, 2002.
6. Foundations of MEMS by *Chang Liu*, Second Edition, PearsonPublication

MICRO ELECTRO MECHANICAL SYSTEMS

Model Question Paper

ANSWER ANY FIVES QUESTIONS

1) a) Explain clearly the advantages of MEMS devices 10M

b) Discuss various applications of MEMS 10M

2) a) Explain doping and diffusion process in semiconductors 10M

b) Discuss the fluid flow in micro channels 10M

3) a) Discuss the static bending theory applied to Microsystems 10M

b) Explain about factors influence the packaging of MEMS devices 10M

4) a) Explain various diffusion techniques used in MEMS industry 10M

b) Differentiate between bulk micromachining and surface micromachining 10M

5) a) Explain about Physical Vapor Deposition technique with suitable application 10M

b) Explain about Chemical Vapor Deposition technique with suitable application 10M

6) a) Compare bulk and surface micromachining with examples 10M

b) Compare wet and dry etching with suitable example 10M

7) a) Explain the design considerations of MEMS accelerometer 7M

b) With details explain about the mass measurement using MEMS cantilevers 7M

c) A mechanical resonator (fixed-fixed, or double clamped) has been demonstrated using SiC thin film material. The length (L), width (W) and thickness (T) of the resonator are 1.1microns, 120 nanometers, 75nanometers respectively. Knowing the resonant frequency found experimentally was 1.014 GHz and assuming a Young's modulus of 700 GPa, findthe density of the SiC material used for the resonator. 6M

8) Explain in short about

a) MEMS tunable oscillator 7M

b) actuation using electrostatic forces 7M

c)Scaling laws in miniaturization 6M

Code: 15 EC307

MEMS MEASUREMENT TECHNIQUES

Syllabus

Introduction: Macro-Meso, Micro and Nanostructure of Materials, Fundamentals of crystallography and

Crystal structures Optical Microscopy: Geometry of Optics, Resolution, and Construction of a Microscope, Image Contrast, and Phase Contrast. Electron Microscopy: SEM: Electron Optics - Interaction of Electrons and Matter - Elastic and Inelastic Scattering, Backscattered Electrons, SecondaryElectrons,

Materials For MEMS - Substrate and wafer, silicon as a substrate material, silicon compound, silicon Piezo-resistors, Gallium Arsenide, quartz, Piezoelectric crystals, polymers:Polymide,SU-8,Liquid Crystal Polymers, PDMS, PMMA, mechanical properties of polymers and packaging Materials

Microscopy – Image Formation, magnification, and depth of field, distortion, detectors, Contrast, and Resolution. TEM: Electron diffraction, different electron Diffraction techniques, Atomic Force Microscopy(AFM): Construction and principle, Surface & optical profilometry, Semiconductor Material Impurity Characterization: Spectroscopic Ellipsometry (SE), X-ray Reflectivity (XRR), X-ray Fluorescence (XRF), X-ray Diffraction (XRD), Secondary Ion Mass Spectrometry (SIMS), Auger Electron Spectrometry(AES), Rutherford Backscattering Spectrometry,FTIR.

Electrical Characterization- Four-probe technique, Hall Effect, sheet resistance C-V measurements, Carrier lifetime, impurity profiling, I-V measurements

Case Study- Optical characterization of MEMS cantilever, piezoelectric, capacitive, Magneto-motive, piezo-resistive, dielectric gradient, Electro thermal actuation schemes for cantileversensors.

ReferenceBooks:

1. Fundamentals of Micro Fabrication by *MarcMadou*
2. Microsystem Design by *Stephen D.Senturia*, Springer InternationalEdition,2010
3. RF MEMS Theory, Design and Technology by *Gabriel M.Rebeiz*, Wiley India Pvt Ltd.
4. MEMS and Microsystems: Design and Manufacture by *Tai-Ran Hsu*, Tata McGraw Hill,2002
5. The MEMS Handbook, *Mohamed Gad-el-Hak*, CRC Press, 2002.
6. Foundations of MEMS by *Chang Liu*, PearsonPublications

MEMS MEASUREMENT TECHNIQUES

Model Question Paper

1. a) Estimate the number of atoms per cubic millimeter and cubic micrometer ofpure silicon 10M

b) Determine the angle between the orientation <100> to the <111> plane in asingle silicon crystal cell 10M

2. a) Explain the construction and working of electron microscope 10M

b) Explain clearly the concept of back scattering of electrons with suitable diagram 10M

3. a)Explaindifferentelectrondiffractiontechniquesusedin MEMSapplications 10M

b) List out the mechanical properties of polymer material 10M

4. a) Why Silicon is used as a substrate in MEMS 10M

c) Explain about Atomic Force Microscopy with neat diagram 10M

5. a) Explain about X-ray Difraction Spectroscopy and its uses. 10M

b) Explain about Fourier Transform Infrared Spectroscopy and its applications 10M

6. What is the importance of four point technique in electrical measurements 20M

7. a) Explain the dielectric gradient actuation scheme 10M

b) Optical actuation scheme 10M

8. a) Briefly explain the characteristics of SU-8 10M

b) With clear diagram explain the process of preparation of a wafer used f MEMS10M

ADAPTIVE SIGNAL PROCESSING

SYLLABUS

Complex-Valued Adaptive Signal Processing: Optimization in the Complex Domain, Widely Linear Adaptive Filtering, Nonlinear Adaptive Filtering with Multilayer Perceptrons, Complex Independent Component Analysis,

Robust Estimation Techniques for Complex-Valued Random Vectors: Statistical Characterization of Complex Random Vectors, Complex Elliptically Symmetric (CES) Distributions, Tools to Compare Estimators, Scatter and Pseudo-Scatter Matrices Array Processing Examples, MVDR Beamformers Based on M-Estimators,

Turbo Equalization: Communication Chain, Turbo Decoder: Overview, Forward-Backward Algorithm, Simplified Algorithm: Interference Canceler, Capacity Analysis, Blind Turbo Equalization, Convergence, Multichannel and Multiuser Settings,

Subspace Tracking for Signal Processing: Linear Algebra Review, Observation Model and Problem Statement, Preliminary Example: Oja's Neuron, Subspace Tracking,, Eigenvectors Tracking, Convergence and Performance Analysis Issues,

Particle Filtering: The Basic Idea, The Choice of Proposal Distribution and Resampling, Some Particle Filtering Methods, Handling Constant Parameters, Rao–Blackwellization, Prediction, Smoothing,

TEXT BOOKS

1. Tu¨layAdalı ,SimonHaykin," Adaptive Signal Processing", John Wiley &Sons

ADAPTIVE SIGNAL PROCESSING

Pre PhD Model Question Paper

Time: 3Hrs
Max.Marks:100

Answer any five questions from the remaining

1. (a) Discuss about statistics of complex valued random variables and randomprocesses.(10M)
   (b) Discuss about Non-linear adaptive filtering with multilayer Perceptrons. (10M)
2. (a) Why we need to define an Influence Function? Explain its significance.(6M)
   (b) Perform Statistical Analysis on influence function. (6M)
   (c) Derive expression for Influence function of a covariance matrix(8M)
3. (a) When a random variable is said to be circular symmetric distribution?(5M)
   (b) Deduce the relation between Circular quotient and Pseudo variance.(5M)
   (c) Test the Circularity of a complex random variable.(5M)
   (d) Write a short note on Scatter and Pseudo Scatter matrices(5M)
4. (a) Explain about Communication Chain Concept.(10M)
   (b) Analyze Turbo equalization using a linear interference canceller with neat block diagram(10M)
5. (a) what are the key motivators for particle filter design(5M)
   (b) Give your comment on the choice of proposal distribution and Re-sampling. (15M)
6. Discuss about different particle filtering methods involved in sampling and Re-sampling(20M)
7. Discuss about standard subspace iterative computational techniques involved in subspace tracking. Deduce principle subspace of a covariance matrix from the mean square error(20M)
8. a) Discuss the Bartlett procedure of spectral estimation. Show that in this method the variance of the spectrum is inversely proportional to number of periodgrams averaged.(10M)

b) Compare and contrast Non Parametric methods of power spectral density. (10M)

Code: 15 EC201

GLOBAL POSITIONING SYSTEMS

SYLLABUS

GPS fundamentals: INS, Trilaiteration, Hyperbolic navigation, Transit, GPS principle of operation, architecture, operating frequencies, orbits, Keplerian elements. Solar and Siderial days, GPS and UTC Time

GPS Signals:, Signal structure, C/A and P-Code, ECEF and ECI coordinate systems and WGS 84 and Indian datums, Important components of receiver and specifications, link budget.

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna Phase center variation, multipath; estimation of Total Electron Content (TEC) using dual frequency measurements, Various DOPs, UERE. Spoofing and Anti-spoofing. : Future GPS satellites, new signals and their benefits GPS integration – GPS/GIS, GPS/INS, GPS/pseudolite, GPS/cellular.

GPS data processing, DGPS and Applications: RINEX Navigation and Observation formats, Code and carrier phase observables, linear combination and derived observables, Ambiguity resolution, cycle slips, Position estimation. principle of operation of DGPS, architecture and errors.

Other Constellations and Augmentation systems Other satellite navigation constellations GLONASS and Galileo IRNS System. : Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Reference Books:

1. B.HofmannWollenhof, H.Lichtenegger, and J.Collins, “GPS Theory and Practice”, Springer Wien, new York,2000.
2. Pratap Misra and Per Enge, “Global Positioning System Signals, Measurements, and Performance,” Ganga-Jamuna Press, Massachusetts,2001.
3. Ahmed El-Rabbany, “Introduction to GPS,” Artech House, Boston, 2002. WITH EFFECT FROM THE ACADEMIC YEAR2010-2011
4. Bradford W. Parkinson and James J. Spilker, “Global Positioning System: Theory and Applications,” Volume II, American Institute of Aeronautics and Astronautics, Inc., Washington,1996.

GLOBAL POSITIONING SYSTEM

Model Paper

Time:3Hours Max.Marks: 100

Answer any 5 from the following

1. (a) Explain the principle of operation and architecture of GPS with the help of aneat diagram.(10)

(b) Discuss the various sources of errors affecting the position accuracy of GPS user. (10)

2. (a) With the help of a neat block diagram, discuss the function of important components of a GPS receiver.(10)

(b) What is meant by a datum? Mention the salient features of WGS-84?(10)

3. (a) Define TEC. With relevant equations, explain how TECand ionospheric delay can be estimated using dual frequency measurements.(10)

(b) The error budgets from various sources for a C/A code L1 user without SA are as follows: (10)

(i) Space /control segment /reference station: 3 m, (ii) Ionosphere: 8 m,
(iii) Troposphere: 1.5 m, (iv) Multipath: 2.5 m,
(v) Receiver noise and resolution: 1.5 m,
(vi) Others: 0.5 m. Calculate the system UERE. Determine the horizontal position error (2drms), if HDOP is 1.6

4. (a) Explain the principle of operation of DGPS with the help of a neat diagram.(10)

(b) Discuss important steps in GPS data processing for position fixing.(10)

5. (a) Explain the architecture of GAGAN with the help of a neat block diagram.(10)

(b) Compare the salient features of GPS, GALILEO and GLONASS satellite constellations. (10)

6. Write short notes on the following(10)

(a) RINEX dataformat

(b) VariousDOPs

(c) GPS and UTC time (10)

7.a) Explain the salient features of ECFF and ECI Coordinate system with neat diagram (10)

b) Given semi-major axis (a)= 6378137m, square if eccentricity (e^2) = 0.00669437998. If the geographic coordinates of a point on the earth are longitude = 78.5°, latitude = 17.5° And height is 500m, determine the correspondingECEF(X,Y,Z)Coordinates (10)

8)a) Explain significance of various DoP's using relevant expression for calculating them (10)

b) If the pseudorandom measurements on the GPS frequencies f_1=1575.45MHz, f_2=1227.60MHz and ρ_1= 23525863.60400m and ρ_2= 23525871.73040m respectively, determine the ionospheric group delay on L1 frequency. (10)