ERROR CONTROL AND CODING

Introduction to Algebra: Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF (2^m) and its basic properties, Computation using Galois Field GF (2^m) Arithmetic, Vector spaces and Matrices.

Linear Block Codes: Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes, Reed – Muller codes, The (24, 12) Golay code, Product codes and Interleaved codes.

Cyclic Codes: Introduction, Generator and Parity check Polynomials, Encoding using Multiplication circuits, Systematic Cyclic codes – Encoding using Feed back shift register circuits, Generator matrix for Cyclic codes, Syndrome computation and Error detection, Meggitt decoder, Error trapping decoding, Cyclic Hamming codes, The (23, 12) Golay code, Shortened cyclic codes.

BCH Codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non – binary BCH codes: q – ary Linear Block Codes, Primitive BCH codes over GF (q), Reed – Solomon Codes, Decoding of Non – Binary BCH and RS codes: The Berlekamp - Massey Algorithm.

Majority Logic Decodable Codes: One – step Majority logic decoding, one – step Majority logic decodable Codes, Two – step Majority logic decoding, Multiple – step Majority logic decoding.

Convolutional Codes: Encoding of Convolutional codes, Structural properties, Distance properties, Viterbi Decoding Algorithm for decoding, Soft – output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding
**Concatenated Codes & Turbo Codes:** Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes.

**Burst – Error – Correcting Codes:** Burst and Random error correcting codes, Concept of Inter – leaving, cyclic codes for Burst Error correction – Fire codes, Convolutional codes for Burst Error correction.

**Reference Books:**


**ELECTIVE – III**

**ASIC DESIGN**

<table>
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<th>Subject Code</th>
<th>IA Marks</th>
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| Total no. of Lecture Hours | 52         |

Note All Designs Will Be Based On VHDL

**Introduction:** Full Custom with ASIC, Semi custom ASICS, Standard Cell based ASIC, Gate array based ASIC, Channeled gate array, Channel less gate array, structured get array, Programmable logic device, FPGA design flow, ASIC cell libraries

**Data Logic Cells:** Data Path Elements, Adders, Multiplier, Arithmetic Operator, I/O cell, Cell Compilers

**ASIC Library Design:** Logical effort: practicing delay, logical area and logical efficiency logical paths, multi stage cells, optimum delay, optimum no. of stages, library cell design.

**Low-Level Design Entry:** Schematic Entry: Hierarchical design. The cell library, Names, Schematic, Icons & Symbols, Nets, schematic entry for ASIC’S, connections, vectored instances and buses, Edit in place attributes, Netlist, screener, Back annotation

**Programmable ASIC:** programmable ASIC logic cell, ASIC I/O cell

**A Brief Introduction to Low Level Design Language:** an introduction to EDIF, PLA Tools, an introduction to CFI designs representation. Half gate ASIC. Introduction to Synthesis and Simulation;

**ASIC Construction Floor Planning and Placement And Routing:** Physical Design, CAD Tools, System Partitioning, Estimating ASIC size, partitioning methods. Floor planning tools, I/O and power planning, clock planning, placement algorithms, iterative placement improvement, Time driven placement methods. Physical Design flow global Routing, Local Routing, Detail Routing, Special Routing, Circuit Extraction and DRC.

**Reference Books:**

MULTIMEDIA COMMUNICATION

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**Multimedia Communications**: multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS.

**Information Representation**: text, images, audio and video. Text and image compression, compression principles, text compression, image compression. Audio and video compression, audio compression, video compression, video compression principles, video compression standards: H.261, H.263, P1.323, MPEG 1, MPEG 2. Other coding formats for text, speech, image and video.

**Detailed Study of MPEG 4**: coding of audiovisual objects, MPEG 4 systems, MPEG 4 audio and video, profiles and levels. MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework. Significant features of JPEG 2000, MPEG 4 transport across the Internet.

**Synchronization**: Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.

**Multimedia Communication Across Networks**: Layered video coding, error resilient video coding techniques, multimedia transport across IP networks and relevant protocols such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia in broadcast networks.

Assignments / Practicals can be given on writing the programs to encode and decode the various kinds of data by using the algorithms. Students can collect several papers from journals/conferences/Internet on a specific area of multimedia communications and write a review paper and make a presentation.

**Reference Books**:

1. Fred Halsall, “**Multimedia Communications**”, Pearson education, 2001

RF AND MICROWAVE CIRCUIT DESIGN

<table>
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**Wave Propagation in Networks**: Introduction to RF/Microwave Concepts and applications; RF Electronics Concepts; Fundamental Concepts in Wave Propagation; Circuit Representations of two port RF/MW networks

**Passive Circuit Design**: The Smith Chart, Application of the Smith Chart in Distributed and lumped element circuit applications, Design of Matching networks.

**Basic Considerations in Active Networks**: Stability Consideration in Active networks, Gain Considerations in Amplifiers, Noise Considerations in Active Networks.

Reference Books:


ELECTIVE IV
Advanced Embedded Systems

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Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components

Characteristics and Quality Attributes of Embedded Systems:


Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages.

Real-Time Operating System (RTOS) based Embedded System Design:
Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS

The Embedded System Development Environment:
The Integrated Development Environment (IDE), Types of Files Generated on Cross-compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan

Trends in the Embedded Industry:
Processor Trends in Embedded System, Embedded OS Trends, Development Language Trends, Open Standards, Frameworks and Alliances, Bottlenecks

Reference Books:


Broadband wireless networks

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Wimax genesis and framework: 802.16 std., wimax forum, other 802.16 stds. Protocol layer topologies: layers of wimax, CS, MAC CPS, security layer, phy layer, reference model, topology.

Frequency utilization and system profiles: cellularar concept, licensed and unlicensed frequencies, fixed wimax system profiles, mobile wimax profiles.

Wimax physical layer: OFDM transmission, SOFDMA, subcarrier permutation, 802.16 transmission chains, channel coding, turbo coding, burst profile.

Wimax MAC and QOS: CS layer, MAC function and frames, multiple access and burst profile, uplink bandwidth allocation and request mechanisms, network entry and QoS magmt.

Reference Books:

RF MEMS

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<th>Subject Code</th>
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Review – Introduction to MEMS. Fabrication for MEMS, MEMS transducers and Actuators. Microsensing for MEMS, Materials for MEMS. MEMS materials and fabrication techniques – Metals, Semiconductors, thin films, Materials for Polymer MEMS, Bulk Machining for silicon based MEMS, Surface machining for Silicon based MEMS, Micro Stereo Lithography for Polymer MEMS.

RF MEMS Switches and micro – relays. Switch Parameters, Basics of Switching, Switches for RF and microwave Applications, Actuation mechanisms, micro relays and micro actuators, Dynamics of Switch operation, MEMS Switch Design and design considerations. MEMS Inductors and capacitors.

Micromachined RF Filters and Phase shifters.
RF Filters, Modeling of Mechanical Filters, Micromachanical Filters, SAW filters – Basics, Design considerations. Bulk Acoustic Wave Filters, Micromachined Filters for Millimeter Wave frequencies. Micromachined Phase Shifters, Types and Limitations, MEMS and Ferroelectric Phase shifters, Applications.

Micromachined transmission lines and components.
Micromachined Transmission Lines – Losses in Transmission lines, coplanar lines, Microshield and membrane supported lines, Microshield components, Micromachined waveguides, directional couplers and mixers, Resonators and Filters.


Reference Books:
2. RF MEMS Circuit Design J De Los Santos, Artech House, 2002