Advanced VLSI Design
B.E. Sem. VIII [ETRX]

EVALUATION SYSTEM

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SYLLABUS

- **Objective**: To introduce advance design concepts, develop basic understanding of analog VLSI field and relate to issues occurring at chip level

- **Pre-requisite**: VLSI Design, DSD I and II, BEC

1. **Wire interconnect for circuit simulation**
   Interconnect parameters (Capacitance, Resistance and Inductance) their effect on circuit performance. Electrical wire models (ideal, lumped, lumped rc, distributed rc and transmission line), switching characteristics, transistor sizing, sizing routing conductors, charge sharing and reliability issues. (Numericals on each subtopic expected)

2. **Sequential logic circuits design**
   Clocked systems (Single phase, Two phase and four phase clocking), recommended clocking approaches – clocked CMOS – Dynamic CMOS circuits – solutions for charge sharing - Implementation of general VLSI sequential system components such as Flip Flops, static as well as dynamic latches and Registers. Pipelining concepts

3. **Arithmetic Circuits in CMOS VLSI**
   Dynamic adders, Fast adders, Wide adders: Carry look ahead, Block generate and propagate, carry save, carry skip, carry save

4. **Design of memories & programmable logic**
   CMOS Memory structures – SRAM and DRAM design – Sense amplifier design - Low power design techniques. ROM Arrays and Logic Arrays. EPROM, EEPROM, Flash cell working. Design of basic 6T SRAM Cell with read and write stability criteria

5. **Timing issues & System Level Physical Design**
   Timing classification, Synchronous timing basics, clock skew, propagation delay estimation, clock jitter, combined clock skew and clock jitter estimation, synchronous and asynchronous design timing estimations. Clock generation and distribution

   Crosstalk, Interconnect Scaling, Floor planning & Routing, I/P & O/P Circuit, Power dissipation and consumption, Low power Design considerations.

6. **Introduction to Analog and Mixed signal design**
   Building blocks for CMOS amplifiers, CMOS operational transconductance amplifiers. Frequency compensation schemes. Design of fully differential amplifiers, common mode feedback circuits, switched capacitor circuits. Design of sample and hold and comparator circuits.
Reference Books:
1. Introduction to VLSI Circuits and systems (John P. Uyemura) John Wiley & sons.
6. Introduction to VLSI Design (Fabricius, Eugene D) TMH
Robotics and Automation
B.E. Sem. VIII [ETRX]

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SYLLABUS

• **Objective**
  This course familiarizes students with the concepts and techniques in robot manipulator control and in hardware components for automation like Programmable Logic Controllers and also confident enough to evaluate, choose and incorporate robots and PLC in engineering systems.

• **Pre-requisite**
  1) Matrix Algebra
  2) Fundamentals of Image Processing
  3) Fundamentals of Controllers

1. **Introduction to Robotics**
   Automation and Robots, Classification, Application, Specification, Notations.

2. **Direct Kinematics**
   Dot and cross products, Co-ordinate frames, Rotations, Homogeneous Co-ordinates, Link co-ordinates, Arm equation ((Three axis, Four axis, and Five axis robots)

3. **Inverse Kinematics & Workspace Analysis**
   General properties of solutions, Tool configuration, Inverse Kinematics of Three axis, Four axis and Five axis robots
   Workspace analysis of Four axis and Five axis robots, Work envelope, Workspace fixtures.

4. **Trajectory Planning and Task Planning**
   Trajectory planning, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.
   Task level programming, Uncertainty, Configuration space, Gross motion planning, Grasp planning, Fine-motion Planning, Simulation of Planar motion, Source and goal scenes, Task planner simulation.

5. **Robot Vision**
   Image representation, Template matching, Polyhedral objects, Shape analysis, Segmentation, Iterative processing, Perspective transformation, Structured Illumination.

6. **Programmable Logic Controller**
   Discrete-State Process Control, Relay Controllers background, hardwired control system definition, Ladder Diagram Elements and examples, Relay Sequencers, advantages of Programmable Logic Controller (PLC), Evolutions of PLCs, Block diagram of PLC system – symbols used – relays and PLC Software Functions, logic functions – OR, AND, Comparator, Counters review, PLC Design, PLC Operation, Programming of PLCs – different methods – ladder STL and CSF, ladder programming of simple system like traffic light controller, conveyers, list of various PLCs available.
Reference Books:
1. Fundamentals of Robotics-Analysis and control (Robert Shilling) Prentice Hall of India
2. Robotics (Fu, Gonzales and Lee) McGraw Hill
3. Introduction to Robotics (J.J, Craig) Pearson Education
5. Robotics and AI (Staughard) Prentice Hall of India
7. Robotics and Mechatronics (Walfram Stdder)
8. Introduction to Robotics (Niku) Pearson Education
9. Robot Engineering (Klafter, Chmielewski, Negin) Prentice Hall of India
11. Programmable Controllers (George L Balten Jr.) Tata McGraw Hill publications
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SYLLABUS

1. **Introduction to Embedded Systems**
   Design Metrics, Examples of embedded systems, hardware/software co-design, Embedded micro controller cores (ARM, RISC, CISC, and SOC), embedded memories, sensors and interfacing techniques, Architecture of Embedded Systems.

2. **Introduction to MSP 430 RISC Controllers, parallel I/O, external interrupts.**
   Introduction to ARM 7 instruction set, addressing modes, operating modes with ARM core, ARM7 TDMI modes, ADC, Timers, Interrupt structure.
   Byte ordering (LE, BE), Thumb mode normal mode instructions changes, Pipeline utilization with all register allocations, Floating to fixed point conversion fundamentals.
   System design with ARM as key processor.
   Digital Signal Controllers
   - DSC differences with conventional micro controllers

3. **Serial communications**
   SCI, SPI, Timing generation and measurements. Analog interfacing and data acquisition.
   **Hardware Interrupts:**
   - Various C ISR Declaration syntaxes
   - Interrupt Vectors, Priorities and Nesting
   - Tick Timer Interrupt as heart-beat of embedded system 7-Seg LED, Segment-LCD, Alphanumeric LCD, Graphic LCD displays Communications and Networks
   - RS485 (2 and 3 wire) and Modbus Protocol (Intro only)
   - Ethernet and TCPIP Stack (Features and Usage only)
   - CAN features and protocol

4. **Software Programming in Assembly Language (ALP) and in High Level Language ‘C’, ‘C’ Program Elements:**

5. **Real-time concepts, real-time operating systems, Required RTOS services/capabilities (in contrast with traditional OS).**
   Real-world issues: blocking, unpredictability, interrupts, caching
   Benefits of using RTOS
   - Concepts of Tasks/Threads/Process
   - Multitasking
   - Task Scheduling
− Task management
− Inter-task communication and Synchronization:
− Device Drivers
− How to choose an RTOS

Applications of Embedded Systems : case studies
− Consumer and Home
− Industrial and Automation
− Medical
− Robotics
− Access Control Systems (Smart Cards, RFIDs, FingerScan)

Reference Books :
4. Embedded Microcomputer Systems (Jonathan W. Valvano) Thomson
5. An Embedded Software Primer (David E. Simon) Pearson Education
7. Embedded real time system (Dr. K.V.K.Prasad) Dreamtech Press.
Advanced Networking Technologies
B.E. Sem. VIII [ETRX] (Elective – III)

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SYLLABUS

- **Objective**
  Objective of this course is to make students familiar with data communication technologies and how to use them to: Design, Implement, Operate, Manage enterprise networks.

1. **Networking Fundamentals**

2. **Optical Networking**
   SONET/SDH Standards, devices, DWDM, frame format, DWDM, Performance and design considerations.

3. **LAN Technologies**
   Wireless LANs technology and IEEE 802.11 Standard.

   **WAN Technologies**
   - **Frame**: FR concept, FR specifications, FR design and VoFR and Performance and design considerations

4. **Network Design**
   Network layer design, access layer design, access network capacity, network topology and Hardware and completing the access network design.

5. **Network Security**
   Security threats, safeguards and design for network security
   - **Enterprise Network Security**
     DMZ, NAT, SNAT, DNAT, Port Forwarding, Proxy, Transparent Proxy, Packet Filtering and Layer 7 Filtering.

6. **Network Management and Control**
   Documentation, OAM & P, RMON, Designing a network management solution. Monitoring and control of network activity and network project management.
Reference Books
7. Next Generation wireless LANS (*Eldad Perahita*) Cambridge Publication
DSP Processors and Architectures
B.E. Sem. VIII [ETRX]  (Elective – III)

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SYLLABUS

- **Objective**: The DSP algorithms are better implemented on DSP processors having specially tailored architectures. It is therefore essential for a DSP systems designer to understand these processors and apply them in system design.

- **Pre-requisite**: Fundamentals of Discrete time signal processing

1. **Fundamentals of Programmable DSPs**
   Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory, Multi-ported memory, VLIW architecture, Pipelining, Special Addressing modes in P-DSPs, On chip Peripherals, Computational accuracy in DSP processor

2. **ADSP Processors**
   Architecture of ADSP-21XX and ADSP-210XX series of DSP processors.

3. **TMS320C5X Processor**
   Architecture, Assembly language syntax, Addressing modes Assembly language Instructions, Pipeline structure, Operation Block Diagram of DSP starter kit Application Programs for processing real time signals.

4. **Programmable Digital Signal Processors**
   Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, On-Chip peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors

5. **Advanced Processors**
   Code Composer studio -Architecture of TMS320C6X -architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

6. **Implementation of Basic DSP Algorithms**
   An FFT Algorithm for DFT Computation, Computation of signal spectrum, FIR Filters, IIR Filters, interpolation Filters, Decimation filters, Adaptive Filters
Reference Books:
2. DSP Implementation using DSP microprocessor with Examples from TMS32C54XX (Avtar Singh, S.Srinivasan) Thamson 2004
4. Digital signal processing (Salivahanan. Ganapriya) TMH ,second Edition
6. Digital signal processing (Jonathen Stein) John Wiley 2005
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SYLLABUS

- **Objective**: This course covers basic concepts of artificial neural networks, fuzzy logic systems and their applications. Its focus will be on the introduction of basic theory, algorithm formulation and ways to apply these techniques to solve real world problems.

- **Pre-requisite**: Knowledge of basic probability and statistics with the . Programming skills in one of the following would be desirable: Matlab,, C, C++,Java.

1. **Introduction**
   Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Knowledge representation Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules.

2. **Single Layer Perception**
   Perception convergence theorem, Method steepest descent - least mean square algorithms

3. **Multilayer Perception**
   Derivation of the back-propagation algorithm, Learning Factors.

4. **Radial Basis and Recurrent Neural Networks**

5. **Neuro-dynamics**
   Attractors, Neurodynamical model, Adaptive Resonance theory, Towards the Self Organizing Feature Map. Brain-state-in-a-box model,

6. **Fuzzy logic**
Reference books:
1. Neural Network a - Comprehensive Foundation (Simon Haykin) Pearson Education
2. Introduction to Soft computing tool (Dr. S. N. Sivanandam, Mrs S. N. Deepa) Wiley Publication
4. Introduction to Artificial Neural Systems (Zurada J. M.) Jaico publishers
5. Fuzzy V Logic with Engineering Applications (Thimothy J. Ross) McGraw
6. Introduction to Applied Fuzzy Electronics (Ahmad Ibrahim) PHI
7. Neural Networks, Fuzzy Logic, and Genetic Algorithms (Rajsekan S, Vijaylakshmi Pai) PHI
8. Neural Network Design (Hagan, Demuth, Beale) Thomson Learning
9. Neural Networks For Pattern Recognition (Christopher M Bishop) Oxford Publication
11. Introduction to Neural Network Using Matlab (Dr. S. N. Sivanandam, Dr. S. Sumathi) Tata McGraw-Hill
**Electronic Product Design**  
B.E. Sem. VIII [ETRX]  
(Elective – III)

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### SYLLABUS

- **Objective**: To cover product design & development stages and total coverage of product assessment by introducing the basics of reliability and quality of electronic product and then discusses the various modes and causes of failure.

1. **Product Design and Development**
   - Introduction, An overview of product development & product assessment, Pilot production batch, Concept of availability, Screening test, Environmental effects on reliability, Redundancy, Failsafe system, Ergonomic & aesthetic design considerations, Packaging & storage

2. **PCB Designing**
   - Automation & computers in PCB design, Computer aided design, Design automation. Soldering techniques, Solderability testing. Study of packages for discrete devices & ICs, IC reliability issues. Parasitic elements
   - Calculations of parasitic elements in high speed PCB. High speed PCB design and points to be considered for designing the high speed PCBs
   - Mounting in presence of vibration. SMD assemblies, Board layout check list. Tests for multilayer PCB Cable

3. **Hardware design and testing methods**
   - Logic analyzer, its architecture & operation and Use of logic analyzer
   - Spectrum analyzer
   - Network analyzer, Oscilloscope, DSO trigger modes, Examples using MSO, Signal integrity issues. Use & limitations of different types of analysis, Monte Carlo analysis

4. **Software design and testing methods**
   - Introduction, Phases of software design & Goals of software design, Methods of program flow representation, Structured program construct, Testing & debugging of program, Software design, Finite state machine
   - Decision to use assembly & / or high level language for software development. Assembler, Compilers, Compilers design, Simulators, CPU Simulators, Emulators.
5. **Product testing**

Environmental testing for product. Environmental test chambers & rooms. Tests carried out on the enclosures

Electromagnetic compatibility (EMC) with respect to compliance. Electromagnetic compatibility (EMC) testing. Conducted emission test (time domain methods). Radiated emission test

Basics on standard used. Instrument specifications

6. **Documentation**

PCB documentation- Specifying laminate grade, drilling details, PCB finish- Tin, solder, gold, silver plating, hot air leveling, and bare board testing. Understanding advantages and limitations of each product documentation- bill of materials, Production test specification- a case study for real circuit, Interconnection diagram- A case study., Front and rear panel diagrams for selected product.

Manuals- Instruction or operating manual, Service and Maintenance manual, Fault finding tree

Software documentation practices- For C programmes, Assembly programmes with particular focus on development of programme by several engineers simultaneously.

**Reference Books**

1. Electronic Product Design (R.G.Kaduskar, V.B.Baru) Wiley India
2. Printed Circuit Board design and technology (Walter C Bosshart) Tata McGraw –Hill-CEDT
4. Electronic testing and fault diagnosis (G.C. Loveday) Ah wheeler Publication, India
6. Principles of Reliable Soldering Techniques (Sengupta R.) New Age International
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SYLLABUS

Note: One faculty will not guide more than 3 projects in a semester. For every group allotted to faculty the load is considered as 2 Hour per group per week, be specified in the time table of faculty.

Rationale: Project allows the student to work independently to put the knowledge of Electronics engineering theory into practice.

Detailed description
In continuation to the efforts taken towards building the project in VII semester, during VIII semester, students are expected to complete their project idea and meet the set goals and compile the project report.

Final Project Report
Your guide will give you specific instructions as to the expected content of your final report. The report should cover the progress that has been made, including results obtained, graphical data, design drawings, and a statement of conclusions and recommendations (if applicable). Details of theory, experimental data, computer programs, purchased materials, sources and suppliers etc., must be included. Your report must be sufficiently complete that a student continuing your project would benefit from your report and would not be required to duplicate any of your work.

Project Marking Scheme
A project used to assign marks in three general categories, as explained below. Achievement in each of these areas is critical to a successful project.

Project Goals & Achievements (20%): Guide will evaluate both the difficulty of the goals and whether the goals were achieved. Although projects will differ, it is always extremely important to set goals at the start of a project and work toward these goals. The project goals should be set in collaboration with the guide and an effort should be made to establish a realistic scope for the project. In some cases, it may become apparent as the project progresses that the original goals need to be adjusted and a modified set of goals must be set.

Final Report Quality & Content (40%): This is an evaluation of the quality of the final report based on the report format, the clarity of communication and the analytical content.

Student Organization, Creativity & Effort (40%): This portion of the evaluation reflects the student's performance, with emphasis on effort, organization, creativity and initiative.

Project Report Outline
The hard-bound report will contain following details:
- Title
- Certificate
- Acknowledgement (if any)
- Table of Contents
- List of Figures
- Abstract
- Introduction
- Literature Survey
- Mathematical Modeling/ Analysis and Design
- Implementation
- Result and Discussion
- Conclusion and Future Scope
- Reference
- Appendix (optional)