EI- 701 – VLSI Design

Unit-I

Introduction to CMOS circuit, Circuit & System representation Behavioral representation, structural representation. Physical representation MOS transistor theory. NMOS and PMOS enhancement transistor. Threshold voltage, body effect. MOS device design equation. Basic DC equation, second order effects, MOS models.

Unit-II

The complementary CMOS inverter-DC character, Static load MOS inverters. The differential inverter. Tristate inverter. Bipolar devices, diodes, transistors, BICMOS inverters.

Unit-III

Review of silicon semiconductor technology and basic CMOS technology-n-well and p-well process. Interconnect and circuit Twin-tub process layout design rules and latch-up, latch-up triggering and prevention.

Unit-IV

Circuit characterization and performance estimation resistance and capacitance estimation, Switching characteristics, CMOS gate transistor sizing, power dissipation. Basic physical design of simple logic gates. CMOS logic structure.

Unit-V

CMOS design methods. Design strategies. Programmable logic, programmable logic structure, reprogrammbale gate arrays. Exiling programmable gate array. Algotonix, concurrent logic, sea of gate and gate array design VHDL as a tool.

References:

1. Neil, H.E. Wasdte, Kamran Eshraghian, Principles of CMOS VLSI design, Pearson Education.
2. Wyne Wolf, Modern VLSI Design-system on silicon, PHI.
3. Phillip E. Allen and Douglas R holding, CMOS Analog Circuit Design, 2nd edition, Oxford University press.

List of Experiments

1. Introduction to Tanner Tool 13.0 and its various domains.
2. Design CMOS Inverter using S-edit and getting its transient response.
3. Design Universal gates and all other gates using S-edit and getting its transient esponse.
4. Obtain the DC- characteristics of CMOS Inverter using DC-analysis.
5. Design Symbol of CMOS Inverter and using instances of its getting transient response.
6. Design Symbol of Universal gates and using instances of them getting transient esponse.
7. Design a Half Adder and Full adder using instances.
8. Design a Transmission gate using PMOS & NMOS by instance calling.
9. Introduction to Tanner L-edit.
10. Design the Layout of NMOS and PMOS transistor.
11. Design the Layout of CMOS Inverter.
12. Design the Layout of Universal gates.
13. Introduction to Hardware Description Language (HDLs).
14. Design all universal gates and flip-flops using different coding styles of VHDL.
15. Design a serial to parallel shift register using VHDL and download on FPGA kit.

EI- 702 – Process Control

Unit-I

Introduction: Historical Perspective, incentives of process control, synthesis of control system. Classification and definition of process variables.

Mathematical modeling: Need and application of mathematical modeling, Lumped and distributed parameters, Analogies, thermal, Electrical, and chemical systems, Modeling of CSTR, Modeling of heat exchanger, Interactive and non-interactive type of system, Dead time elements, Developing continuous time and discrete time models from process data.

Unit-II

Control Modes: Definition, Characteristics and comparison of on-off, proportional, Integral, Differential, PI,PD,PID, Dynamic behavior of feedback controlled processes for different control modes, Control system quality, IAE, ISE, IATE criterion, Tuning of controllers Ziegler-Nichols, Cohen-Coon Methods, controller trouble shooting.

Unit-III

Realization of Control Modes: Realization of different control modes like P, I, D in Electric, Pneumatic, Hydraulic controllers.

Unit-IV

Actuators: Hydraulic, Pneumatic actuators, Solenoid, E-P converters, control valves, Types, Functions, Quick opening, Linear and equal percentage valve, Ball valves, Butterfly valves, Globe valves, Pinch valves, valve application and selection, Cavitations and flashing, Dampers and variable speed Drives.

Unit-V

Advanced Controls: Introduction to advanced control system like Cascade , Feed forward, Ratio, Selective, Override, Split range and Auctioneering control, Plant wide control.

PI Diagrams: Symbols, Terminology, Case studies.

References:

- Dale Patrick, Stephen Fardo, “Industrial Process Control System”.
- Shinskey F.G., “Process Control System”, III Ed., McGraw Hill.
- Smith C.A. & A.B. Corripio, “Principle & Practiced Automatic Process Control”, J. Willey.
- Rao M & S.Qiv, “Process Control Engg.”, Gorden & Breach.
- GeorgeStephanopoulos “ Chemical Process Control” PHI, Delhi
- C.D. Johnson “Process control instrumentation technology’ PHI
- Harriott- Process Control 1st ed., TMH
- Patranabis- Principles of Process Control 2nd ed., TMH

List of Experiments

1. Designing of continuous electronics controllers, (P, I, D, PI, PD, PI D)
2. Study of Electro - Pneumatic Trainer kit and Pneumatic control valves.
3. Controlling of Temperature of water by continuous controllers (P, I, D, PI, PD, PI D).
4. Study of P to I converter and it's Interfacing to electro-pneumatic kit.
5. Study of I to P converter and it's Interfacing to electro-pneumatic kit.
6. Study of PLC and ladder diagram programming.
7. Controlling of flow meter through PLC.
8. Controlling of Bottling plant through PLC.
9. Controlling of Water level through PLC.
10. Implementation of traffic light control through PLC.
11. Controlling of stepper motor through PLC.
12. Study of rotary encoder and its controlling through PLC.

EI-703-New (Introduction to Microcontrollers for Embedded systems)

UNIT-I: Introduction to Embedded systems

Embedded system overview and applications, features and architecture considerations-ROM, RAM, timers, data and address bus, Memory and I/O interfacing concepts, memory mapped I/O. CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture, instruction set, instruction formats, and various addressing modes of 32-bit. Fixed point and floating point arithmetic operations.

Introduction ARM architecture and Cortex – M series, Introduction to the Tiva family viz. TM4C123x & TM4C129x and its targeted applications, Tiva block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT-II: Microcontroller Fundamentals for Basic Programming

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on Tiva, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming.

Case Study: Tiva based embedded system application bringing up the salient features of GPIO, Watchdog timer, etc.

UNIT- IIITimers, PWM and Mixed Signals Processing

Timer, Basic Timer, Real Time Clock (RTC), Timing generation and measurements, Analog interfacing and data acquisition: ADC, Analog Comparators, DMA, Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

Case Study: Tiva based embedded system application using ADC & PWM.

UNIT-IV Communication protocols and Interfacing with external devices Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, I2C protocol, SPI protocol & UART protocol. Implementing and programming I2C, SPI & UART interface using Tiva. CAN & USB interfaces on Tiva platform. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices “Sensor Hub BoosterPack”

UNIT V Embedded networking and Internet of Things

Embedded Networking fundamentals, Ethernet, TCP/IP introduction IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless protocols and its applications: NFC, ZigBee , Bluetooth, Bluetooth Low Energy, Wi-Fi. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API: connecting sensor devices using Tivaware sensor library.

Case Study: Tiva based Embedded Networking Application: “Smart Plug with Remote Disconnect and Wi- Fi Connectivity”

Lab

1.Interfacing and programming GPIO ports in C using Tiva (blinking LEDs , push buttons)
2.Interrupt programming examples through GPIOs
3.Use Hibernation mode and wake on RTC interrupt
4.PWM generation using PWM Module on Tiva

5.Interfacing potentiometer with Tiva GPIO
6.PWM based Speed Control of Motor controlled by potentiometer connected to Tiva GPIO
7.Connect the Tiva to terminal on PC and echo back the data using UART
8.Interfacing an accelerometer with Tiva using I2C
9.Experiment on USB (Sending data back and forth across a bulk transfer-mode USB connection.)
10.Using IQmath Library for implementing Low pass FIR filter
11.Review of User APIs for TI CC3100 & Initialization and Setting of IP addresses
12.A basic Wi-Fi application – Communication between two Tiva based sensor nodes using TIVA sensor library in TivaWare
13.Setting up the CC3100 as a HTTP server

TEXT Books:

1. John Davies, “MSP430 Microcontroller Basics”, Newnes, 1st Edition
2. Ajit Pal, “Microcontrollers Principles and applications”, PHI
3. B. Kanta Rao, “Embedded Systems”, PHI
4. Rajkamal, “Embedded Systems Architecture Programming and design”, McGraw Hill,

EI 704 Elective – I (EI7101 – Safety and Reliability Engineering)

Unit-I

Reliability and safety definitions, Risk factor, Classification of failures and protective measures. Safety measurement, Preliminary hazard analysis, Subsystem fault hazard analysis, Common mode failures, codes and standards for safety.

Unit-II

Reliability improvement

Redundancy element, Unit, and stand by optimization-cost trade off- Fault tree analysis-Constructions of Fault tree-Calculations of reliability from fault tree-reliability allocation-evaluation of reliability-test- O.C. curve specifying reliability acceptance test.

Unit-III

Definition of Quality-Quality control design-Product development cycle-Quality planning of manufacturing process-Process selection and control-Inspection and testing-Quality audit-Organizing for quality-Quality function-Quality engineering and quality control-Typical organization for quality : Small scale, Medium scale and Large scale organization.

Unit-IV

Distribution, Markov modeling, Stress-strength approach to reliability design, Relationship between MTBF, hazard rate, failure rate, reliability.

Unit-V

Redundancy techniques, examples from Electrical, Nuclear, Chemical and Process Engineering, Elementary Analysis and Estimation techniques.

References:

- Jurian J.M., “Quality V Control Handbook”, McGraw Hill.
- Grant E.L., & Levenworth, “Statistical Quality Control”, McGraw Hill.
- Geedenko B.V., “Mathematical Methods of Reliability Theory”, Academic.
- Mann, Schafer R.E., & Singapurvala N.D., “Mehods for Statistical Analysis of Reliability and Life Date”
- Reigenbaum V., “Total Quality Control”, McGraw Hill.
- Trylot J.R., “Quality Control Systems-Procedures for Planning Quality Programs”.

EI 704 Elective – I (EI7102 – Data Acquisition Systems)

Unit-I

Display System: Seven segment Dot matrix, Multiplexed, Code converter, LCD(construction, working and Programming Hitachi controller), Plasma and vapor displays.

Unit-II

Recorders: Galvanometric type, Null type, Potentiometer type, Strip Chart and circular chart type ,Magnetic tape recorder-principle & operation, Digital tape recorders.

Unit-III

General Telemetric Systems: land line & RF telemetry, voltage, current and Position telemetry with feedback mechanism, RF telemetry, Amplitude modulation , Frequency modulation , Pulse modulationpulse amplitude modulation, pulse code modulation, wire ine and radio channels, Microwave channels, Radio ink, Transmitting and receiving antenna, telemetry with time and frequency division multiplexing, telemetry hardware, band width and Noise reduction(interference, Grounding, shielding, Guarding).

Unit-IV

Data transfer techniques: DMA controller and data transfer in DMA mode, Serial data transmission method and standards, 4-20 mA current loop, RS-232C: specifications connection and timing , RS- 422,RS-423, GPIB/IEEE-488 standard digital interface, parallel communication, Centronix port, communication protocols, Local Area networks, Firewire, Universal serial bus, HART protocol, Foundation – Fieldbus, ModBus, TCP/IP, Data compression, Encryption, Error detection & correction techniques, Optical disk storage.

Unit-V

Data Acquisition System(DAS): single channel and multi channel, data conversion, Super Visory control and data acquisition system(SCADA), data acquisition system around microprocessor, micro controller & PC.

References:

1. Mathivanan N “Microprocessor PC Hardware and interfacing”, PHI, New delhi
2. H S Kalsi “ Electronic Instrumentation” TMH, New delhi
3. Patranabis- Principles of Industrial Instrumentation 3rd Ed., TMH
4. Singh- Industrial Instrumentation & Control 3rd ed., TMH

EI 704 Elective – I (EI7103 – Management Information System (MIS)

Unit-I

The meaning and role of MIS

What is MIS, Decision support systems, systems approach, The systems view of business, MIS organization within the Company. Management organizational theory and the systems approach: Development of organizational theory, Management and organizational behavior, Management information and the systems approach.

Unit-II

Information systems for decision-making:

Evolution of an information system, Basic information systems, Decision making and MIS, MIS as echnique for making programmed decisions, design assisting information systems. Strategic and project planning for MIS General business planning, appropriate MIS response, MIS planning-general, MIS planning-details.

Unit-III

Conceptual System Design

Define the problems, Systems objectives, Establish system constraints, Determine information needs, Determine information sources, Develop alternative conceptual designs and select one, Document the system concept, Prepare the conceptual design report.

Detailed System Design

Information and involve the organization, arm of detailed design, Project management of MIS detailed design. Identify dominant and trade off criteria define the subsystems, Sketch the detailed operating MIS systems and information flows, Determine the degree of automation of each operation, inform and involve the organization again, Inputs, Outputs and processing, early system testing, Software, Hardware and tools, propose an organization to operate the system, Document the detailed design., Revisit the manager user.

Unit-IV

Implementation, Evaluation and Maintenance of the MIS

Plan the implementation, Acquire floor space and plan space layouts organized for implementation, Develop procedures for implementation, Train the operating personnel, Computer related acquisitions, Develop forms for data collection and information dissemination, Develop the files, Test the system, Cut over, Document the system, Evaluate the MIS, Control and maintain the system.

Unit-V

Pitfalls in MIS Development

Fundamental weaknesses, Soft spots in planning, Design problem, Implementation the TAR PITF.

References:

- Murdick R.G., Russ J.B., Clagget J.R., Information Systems for modern management.
- Effy OZ, Management Information Systems, 3rd edition, Thomson.
- Jawadekar W.S., Management Information System.
- Brien J.A.O., Irwin, Management Information Systems, McGraw Hill.
- Dour's G.B., Olson M.H., Management Information Systems, 2nd edition, McGraw Hill.
- Thireramp R.J., Decision Support Systems for Effective Planning and Control, PHI.
- Sadagopan S., Management Information Systems, 4th edition, Prentice-Hall of India

EI 704 Elective – I (EI 7104 – Advanced DSP)

1. Fundamentals of multirate systems, decimation, interpolation, aliasing, imaging, single stage and multistage implementation, polyphase representation, anti-alias and anti-image filters.

2. Filterbanks: Introduction, analysis and synthesis filter abnks, two-channel QMF, M-channel filterbanks, Tree structured filterbanks, polyphase representation.
3. Cosine modulated filter banks, near perfect and perfect reconstruction, pseudo QMF bank, polyphase structure.

4. Design of cosine modulated filterbanks, paraunitary filterbanks.

5. Quantization effects: Types of quantization effects, standard techniques, noise in filterbanks, coding gain, sub-band coding.

References:

☐ Multirate systems and filterbanks, P.P. Vaidyanathan, Preason Edu.

☐ Digital signal processing: A computer based approach, S.K. Mitra, TMH.

☐ Multirate digital signal processing, N.J. Fliege., John Wiley.

☐ Multirate Digital Signal Processing, Crochiere and Rabiner., PHI.

EI 705 Elective – II (EI 7201 – Artificial Intelligence & Expert Systems)

Unit-I

Basic Problem solving methods: Production systems-state space search, control strategies, Heuristic search, forward and backward reasoning, Hill climbing techniques, Breadth first search, Depth first search, Best search, staged search.

Unit-II

Knowledge Representation: Predicate logic, Resolution question Answering, Nonmonotonic Reasoning, statistical and probabilistic reasoning, Semantic Nets, Conceptual Dependency, frames and scripts.

Unit-III

AI languages: Important characteristics of AI languages - PROLOG, LISP.

Unit -IV

Introduction to Expert Systems: Structure of an Expert system interaction with an expert, Design of an Expert system.

Unit-V

Fundamentals of Artificial Neural Network (ANN), perceptrons, Back propagation, Cohenon self organizing network, Hop field networks

References:

- Rich E and Knight K, Artificial Intelligence, TMH New Delhi.
- Nelsson N.J., Principles of Artificial Intelligence, Springer Verlag, Berlin.
- Barr A, Fergenbaub E.A. and Cohen PR. Artificial Intelligence, Addison Wesley, Reading
- Waterman D.A., A guide to Expertsystem, Adision - Wesley, Reading
- Artificial Intelligence Hand book, Vol. 1-2, ISA, Research Triangle Park.
- Kos Ko B, Neural Networks and Fuzzy system –PHI.
- Haykin S, Artificial Neural Networks-Comprehensive Foundation, Asea, Pearson.

EI 705 Elective – II (EI 7202 – Environmental Instrumentation)

Unit-I
Characterization of waste and sources of pollution. Effects of pollution-ecological balance, Quality Standards and legislation.

Unit-II
Air pollution: Emission intensity and dispersion measurement and analysis techniques Photometric, Gas chromatography, and Mass Spectroscopic analysis. Dust Collectors, Colorimetry and radioactivity detectors. Trace element detectors, Continuous pollution monitoring. Control of Air Pollution and control instrumentation.

Unit-III
Water Pollution: Effluents and their characterization, Concentration and Separation methods of measurement and analysis. Waste treatment by Biological, Physical and Chemical (Aeration, Sedimentation, Flotation Coagulation, Ion-exchange, Aerobic and Anaerobic digestion) process control and Instrumentation. Colorimetry and Spectroscopic remote sensing techniques and instrumentation.

Unit-IV
Land Pollution: Instrumentation in sludge handling radioactive waste disposal and safety instrumentation. Soil Characteristic and fertility conservation. Instrumentation for Noise and Thermal Pollution monitoring.

Unit-V
Control Instrumentation of Specific Industrial pollution in Steels, Paper, Cement, Power and Petrochemical Plants.

References:

- Bond. R.G., C.P. Straub, Handbook of Environmental Control, Volume II.
- Jones Instrumentations series.

EI 705 Elective – II (EI 7203 – Bio Medical digital Signal Processing)

Unit-I

Introduction: Origin of Bio electric signals and their characteristics. Noise coupling, powerline and other interfering sources, Artifacts, Analysis of concurrent, coupled and correlated processes.

Unit-II

Filtering techniques for removal of noise, artifacts and interferences. Design of Time domain and frequency domain filter. Optimal and Adaptive filtering techniques.

Unit-III

Detection of events in Bioelectric signals like ECG, EEG, PCG, etc. Detection of waves, correlation & coherence analysis, Few case studies.

Unit-IV

Wave shape & envelope extraction analysis. Processing of event related potentials. DSP techniques for Bio medical signals.

Unit-V

Frequency domain characterization, The Fourier spectrum, Estimation of the power spectral density function, Measures derived from PSD's. The short time Fourier transform and wavelet basics with application to Bio signals.

Reference:

1. Reddy- Biomedical Signal Processing: Principles and Techniques 1st ed., TMH

EI 705 Elective – II (EI 7204 – Total Quality Management)

Unit-I

Quality Concepts And Management

Evolution of quality control, Quality journey : Inspection to TQM, Quality of design, conformance, performance, functions, Global scenario, concept of Quality costs.

Unit-II

Standardization and Quality Assurance

Quality assurance: Concept, need; ISO 9000 systems, ISO 14000; Quality audit, documentation.

Unit-III

Statistical Quality Control

Basic statistical concepts, Probability distribution-Binomial, Poisson and Normal, control chars for variables and attributes, CUSUM charts, Multivariate charts, Process capability, Tolerances and selective assembly, Acceptance sampling.

Unit-IV

Diagnosis and Prevention of Defects

Defect study, Identification and analysis of defects, Corrective measure, Factors affecting reliability, MTBF, MTTR, Calculation of reliability, Building reliability in the product, Evaluation of reliability, Interpretation of test results, Reliability control, Maintainability, FMEA, Guarantee, Warrantee and claims.

Unit-V

Quality Awards

Break through in quality management, Quality gurus: Deming, Crosby, Ishikawa, Juran etc., Seven quality tools, Quality circle, Kaizen, Concepts of poka yoke, 5 S campaign, Six sigma, Qquality function deployment, Benchmarking, National quality award model; Malcom Balbridge, National Quality Awards , Quality in service sector, Administration etc., Case Studies.

References:

- Lt. Gen. H. Lal, “Total Quality Management”, Wiley Eastern Limited.
- Greg Bounds, : Beyond Total Quality Management”, McGraw Hill.
- Besterfield, Total Quality Management, Pearson Education, Asia.
- Menon, H.G., “TQM in New Product Manufacturing”, McGraw Hill.
- Mitra, Total Quality Control, Pearson Publication.
- Quality assurance and TQM by K.C. Jain and A.K. Chitale.