M. Tech in Embedded System Design Syllabus
(2020-22)

Department of Electronics and Communication Engineering, Sambalpur University Institute of Information Technology, Burla, Odisha,

Pin: 768019

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Semester-I

Code	Subject	Credits
ESD611	Embedded system Design	4
ESD612	Digital VLSI Design	4
	Program Elective-I	4
	Program Elective-II	4
	Program Elective-III	4
	Elective Lab-I	2
ESD613	VLSI Lab	2
	TOTAL	**24**

Semester-II

Code	Subject	Credits	
ESD621	Embedded OS and Real Time OS	4	
ESD622	FPGA based system design	4	
	Program Elective-IV	4	
	Program Elective-V	4	
	Program Elective-VI	4	
ESD623	Embedded Systems Lab	2	
	Elective Lab-II	2	
	TOTAL	24	

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Semester-III

Code	Subject	Credits	
ESD631	Masters Research Project (Phase-I)	20	
	TOTAL	20	

Semester-IV

Code	Subject	Credits
ESD641	Masters Research Project (Phase-II)	20
ESD642	Comprehensive Viva	4
	TOTAL	24

I	II	III	IV	Total
24	24	20	24	92

List of Electives

1. Electronic circuit and system design (ESD6E01)
2.Microcontroller Systems Design(ESD6E02)
3.Embedded C & C++ Programming Languages(ESD6E03)
4.Analog VLSI Design (ESD6E04)
5.Advance Digital Signal Processing(ESD6E05)
6.Algorithm and Model based design(ESD6E06)
7.Wire and wireless communication (ESD6E07)
8.Access technologies and smart card(ESD6E08)
9.Automotive embedded systems(ESD6E09)
10.Mobile computing using Embedded System(ESD6E10)
11.DSP on FPGA(ESD6E11)
12.VLSI Signal Processing **(**ESD6E12**)**
13.Wireless sensor networks (ESD6E13)
14.Internet of Things(ESD6E14)

15. Artificial Intelligence(ESD6E15)

Elective Labs

1. Embedded Lab(ESDEL01)
2. Microcontroller lab(ESDEL02)
3.Advance DSP lab(ESDEL03)
4. Internet of things lab(ESDEL04)
5. VLSI lab-I(ESDEL05)
6. VLSI lab-II(ESDEL06)
7.Simulation techniques for wireless communication lab(ESDEL07)
8. Wireless channel modelling lab(ESDEL08)
9. Industrial Applications of control systems(DCS,PLC based control system(ESDEL09)

N.B-

- **A student will be eligible to get M. Tech. degree only if he/she completes the course work including the MOOCs courses recommended by the department.**
- **The students can register for these courses through SWAYAM (Govt. of India) directly as per the courses offering in Odd/Even Semesters by them.**
- **SWAYAM will charges minimal fee per course and awards a certificate of completion. Students need to register for the course on payment of their own and submit the certificate to the institute.**
- **For registration to MOOCs, the students shall abide by the norms and policies proposed by SWAYAM.**
- For Masters Research Project, students shall choose a topic from the latest technological developments / research in Embedded System Design or in allied fields in consultation with the faculty. They shall submit a thesis for the presentation in an approved format on the day of presentation.
- Project work and Comprehensive Viva-Voce shall be as per Academic & Examination Guidelines of SUIIT.

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Programme Outcome

PO1	**Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions**
PO2	**Effective Communication: Will be able to speak, read, write and listen clearly in person and through electronic media in English and in one Indian language**
PO3	**Social Interaction (Interpersonal Relation): Elicit views of others, mediate disagreements and prepared to work in team.**
PO4	**Entrepreneurship capability: Demonstrate qualities to be prepared to become an entrepreneurship**
PO5	**Ethics: Recognize different value systems including your own, understand the moral dimension, and accept responsibility for them.**
PO6	**Environment and Sustainability: Understand the issues of environmental contexts and sustainable development**
PO7	**Life Long Learning: Acquire the ability to engage in independent and life long learning in the context of socio technological changes**

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Embedded System Design

Prerequisite: Microprocessor, Microcontroller, Computer Architecture
Objective: To study basics of Embedded System Design.

CO-1	Remember and understand the basic concepts/ Principles of Embedded System Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I

UNIT-I

INTRODUCTION AND EXAMPLES OF EMBEDDED SYSTEMS

Concept Of Embedded System Design: Design challenge, Processor technology, IC technology, Design technology, Trade-offs. **CUSTOM SINGLE PURPOSE PROCESSOR HARDWARE, GENERALPURPOSE PROCESSOR** introduction, basic architecture, operation, super-scalar and VLIW architecture, application specific instruction set processors (ASIPS), microcontrollers, digital signal processors, selecting a microprocessor. **MEMORY** Introduction, Memory writes ability, Storage performance, Tradeoff s, Common memory types Memory hierarchy and cache

UNIT-II

ARM MICROCONTROLLER Architecture and Programming in assembly and C. Interfacing Analog and digital blocks: Analog-to-Digital Converters (ADCs), Digital to-Analog, Converters (DACs).

Module-II

UNIT-III

Communication basics and basic protocol concepts, Microprocessor interfacing: I/O addressing, Port and Bus based, I/O, Memory mapped I/O, Standard I/O interrupts, Direct memory access, Advanced communication principles parallel, serial and wireless, Serial protocols I2C, Parallel protocols PCI bus, Wireless protocol IrDA, blue tooth.

UNIT-IV DIFFERENT PERIPHERAL DEVICES Buffers and latches, Crystal, Reset circuit, Chip select logic circuit, timers and counters and watch dog timers, Universal asynchronous receiver, transmitter (UART), Pulse width modulators, LCD controllers, Keypad controllers. Design tradeoffs due to thermal considerations and Effects of EMI/ES etc.

Module-III

UNIT-V

SOFTWARE ASPECT OF EMBEDDED SYSTEMS Challenges and issues in embedded software development, Co-design.

UNIT-VI EMBEDDED SOFTWARE DEVELOPMENT ENVIRONMENTS Real time operating systems, Kernel architecture: Hardware, Task/process control subsystem, Device drivers, File subsystem, system calls, Embedded operating systems, Task scheduling in embedded systems: task scheduler, first in first out, shortest job first, round robin, priority based scheduling, Context switch: Task synchronization: mutex, semaphore, Timers, Types of embedded operating systems, Programming languages: assembly languages, high level language.

Module-IV

UNIT-VI DEVELOPMENT FOR EMBEDDED SYSTEMS Embedded system development process, Determine the requirements, Design the system architecture, Choose the operating system, Choose the processor, Choose the development platform, Choose the programming language, Coding issues, Code optimization, Efficient input/output, Testing and debugging, Verify the software on the host system, Verify the software on the embedded system.

Text BOOKS

- Frankvahid/Tony Givargis, “Embedded System Design- A unified Hardware/software Introduction”.

Reference Books

- David E Simon, " An embedded software primer ", Pearson education Asia, 2001.
- Dreamteach Software team,” Programming for Embedded Systems” AVR 8515 manual
- J.W. Valvano, "Embedded Microcomputor System: Real Time Interfacing"
- Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.

Analog VLSI Design

Prerequisite: VLSI Engineering, Analog Electronics Circuits, Semiconductor devices.
Objective: To Study basics of Analog VLSI Design

CO-1	Remember and understand the basic concepts/ Principles of Analog VLSI Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE-I (12 hours)

MOS Device and Modeling: The MOS Transistor, Passive Components- Capacitors and Resistors, Integrated Circuit Layout, CMOS Device Modeling- Simple MOS Large Signal Model, Other MOS

Large Signal Model Parameters, Small Signal Model of the MOS Transistor, Computer Simulator Models, Subthreshold MOS Model.

MODULE-II (12 hours)

Analog CMOS Sub Circuits: MOS Switch, MOS Diode/Active Resistor, MOS Current Sinks and Sources, Current Mirrors- Current Mirror with Beta Helper, Cascode Current Mirror and Wilson Current Mirror, Voltage and Current References, Bandgap Reference, CMOS Amplifiers: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers.

MODULE-III (10 hours)

CMOS Operational Amplifiers: Design of Op-Amps, Compensation of OP-Amps, Design of a Two-Stage OP-Amp, Power Supply Rejection Ratio of Two Stage Op-Amp.

MODULE-IV 10 hours

Comparators: Characterization of a Comparator, Two Stage Open Loop Comparators, Discrete Time Comparators. Other Open Loop Comparators, Improving the Performance of Open Loop Comparators.

Text Books

1. Philip.E. Allen and Douglas.R. Holberg, CMOS Analog Circuit Design, Oxford University Press, Indian3rd Edition, 2012.
2. Paul.R. Gray, Paul.J. Hurst, S.H. Lewis and R.G.Meyer, Analysis and Design of Analog Integrated Circuits, Wiley India, Fifth Edition, 2010

Reference Books

1. R.J. Baker, H. W. Li, D. E. Boyce, CMOS Circuit Design, Layout, and Simulation, PHI, 2002
2. D.A. Johns and K. Martin, Analog Integrated Circuit Design; Wiley Student Edition, 2013
3. B. Razavi; Design of Analog CMOS Integrated Circuits, Tata McGraw-Hill, 2002

Digital VLSI Design

Prerequisites: Digital Circuit and System, VLSI Engineering.
Objective: To study the basics of Digital VLSI Design.

CO-1	Remember and understand the basic concepts/ Principles of Digital VLSI Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE –I 10 hours

Introduction to MOSFETs: MOS Inverter, Static and Switching Characteristics, Voltage Transfer characteristics, Noise Margin, Regenerative Property, Power and Energy Consumption, Stick/Layout Diagrams; Issues of Scaling.

MODULE –II 10 hours

Combinational MOS Logic Circuits: Pass Transistors, Transmission Gates, Primitive Logic Gates; Complex Logic Circuits, Sequential MOS Logic Circuits: Latches and Flip-flops, Dynamic Logic Circuits; Clocking Issues, Rules for Clocking, Performance Analysis, Logical effort.

MODULE –III 10 hours

CMOS Subsystem Design; Data Path and Array Subsystems: Addition, Subtraction, Comparators, Counters, Coding, Multiplication and Division.

MODULE –IV 10 hours

SRAM, DRAM, ROM, Serial Access Memory, Content Addressable Memory, Field Programmable Gate Array.

Text Books

1. Rabey J.M, A. Chandrakasan, and B.Nicolic, Digital Integrated Circuits: A design Perspective, Second Edition, Pearson/PH, 2003 (Cheap Edition).
2.Hodges, David A, Analysis and Design Of Digital Integrated Circuits, In Deep Submicron Technology , Tata McGraw-Hill Education, 2005.

Reference Books

1. Kang, Sung-Mo, and Yusuf Leblebici. CMOS Digital Integrated Circuits, Tata McGraw-Hill Education, 2003.
2. J.P Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2001 3. R. L. Geiger, P.E. Allen and N.R. Strader, VLSI Techniques for Analog and Digital Circuits, McGraw-Hill, 1990
3. DebaprasadDas , VLSI Design, Oxford Publication.

ELECTRONIC CIRCUIT AND SYSTEM DESIGN

Prerequisite: Analog Electronics Circuit, Digital Circuits, Electronic Measurement and Instrumentation.

Objective: To study basics of Electronic Circuit and System Design

CO-1	Remember and understand the basic concepts/ Principles of Electronic Circuit and System Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT – I:ANALOG AND DIGITAL ELECTRONICS

Relationship between Voltage, Current & resistance, Theorems, Capacitors and ac circuits, Inductor and transformer applications, diodes and diode circuits, applications of electromagnetic devices, indicators and variable components. Transistor and transistor circuits, Amplifier circuits, FET circuits , FET switches, transistor applications. Feedback and OPAM circuit applications. Basic regulator circuits, Heat and power Design, Unregulated power supply, voltage references. Three & four terminal regulators, special purpose power supply circuits like high voltage, low noise, low drift, micro power, constant current, commercial modulesBasic Logic concepts, TTL and CMOS, combinational and sequential logic, system design using digital IC's.. CMOS & TTL logic interfacing, Digital signals and long wires, Analog/Digital conversion, A/D examples, PLL, F/B shift register sequence, circuit ideas. PAL, PLA, ROM, RAM, CPLD, FPGA architecture. PLD Based system design implementation.

UNIT – II: ADVANCE ELECTRONICS AND ELECTRONIC MEASUREMENTS

High Frequency Techniques: HF amplifiers, RF circuits, High speed switching, switching speed examples, advanced modulation methods.Low power Design: Low power applications, power sources, power switching and micro power regulators, linear micro design techniques, micro power digital design, circuit ideas on low power design Study of different instruments like DMM, Oscilloscope, Function Generator, Logic Analyzer

UNIT – III: ELECTRONIC CONSTRUCTION TECHNIQUES

Prototyping methods like breadboards, PC prototyping, wire wrap panels, Printed circuit board – tips for schematic, padstack and footprint design. Printed circuit board- tips for layout design, design rules, DFM, DFT, DFA, Signal

Integrity issues. Instrument construction– Housing circuit boards, cabinets, construction hints, cooling, electrical hints, component purchasing.

UNIT – IV: SYSTEM DESIGN AND APPLICATIONS

System design characteristics, roadmap, steps, trends, areas, issues, applications, system design tools. Power electronic application : Three phase converters, inverters, UPS, SMPS, Three Phase Induction Motor Control, DC motor, stepper motor drive. Agricultural Applications: Applications of electronic instrumentation in agriculture like Green house instrumentation, Data logger, Dairy electronics, Soil science, Watermanagement and irrigation. Need, Scope and applications. of electronics in field of agriculture,Basic physical principles of electronic measuring instruments used in agriculture, Factorsinfluencing the growth of plants,Robotics/Automotive Applications: Automation and robotics, classification of robots basedon coordinate system, robot specifications, Components of robot-Manipulator, controller,power conversion units etc., Motion conversion Rotary to rotary , Rotary to linear,Transformation and Kinematics, Robot actuators, Robot sensors, Robot motion planning,Robot programming. Any other applications of interests, Renewable power sources: solar cell technology & its applications.

TEXT AND REFERENCE BOOKS:

1. The art of electronics by Paul Horowitz
2. Circuit Designer's Companion by Tim Williams
3. High Speed Digital Design by Howard Johnson
4. Printed Circuit Boards Design and technology By Walter J Bosshart

Microcontroller Systems Design

Prerequisite: Computer organization and architecture, Microprocessor
Objective: To study basics of Microcontroller System Design

CO-1	Remember and understand the basic concepts/ Principles of Microcontroller Systems Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I:

Computer Architecture: Comparison of Microprocessors and Micro controllers, Harvard architecture/Van Neumann Architecture, CISC/RISC Architecture, MIPS architecture

UNIT II:

Microcontroller Architecture: MCS-51 Microcontroller: Internal architecture/Pin description/Port structure, Timer operations, Serial communication, Interrupts,

UNIT III:

MCS-51 Microcontroller Instruction set, Addressing modes, Assembly Language Programming,

UNIT IV:

Real world interface design: LED, SWITCH, keyboard, LCD, ADC, DAC, UART, RTC,
PWM, Watch Dog Timer, DC Motor, Stepper Motor, Industrial control applications like PLC , DCS etc.

TEXT BOOK:

1. Mazidi and Mazidi, The 8051 Micro controller and Embedded Systems, Pearson Education. 2ND Edition

Embedded C & C++ Programming Languages

Prerequisites: Programming Knowledge, C, C++
Objective: To study basics of Embedded C & C++ Programming Languages.

CO-1	Remember and understand the basic concepts/ Principles of Embedded C & C++ Programming Languages
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I: BASIC C

C and embedded C comparison, Keywords, constant, variable, data types , c instruction,
console I/O function, operator their hierarchy and Associativity, Decision control structure ,case control structure ,ternary operator, loop control structure(for,while,do-while),Function(call by value ,call by reference ,recursion) and pointers

UNIT II: ADVANCE C

Arrays(1D, 2D,3D) , Structures and Union, C Preprocessors (macro versus
function,#undef,#if,#elif,#pragma), File input/ output, Bitwise operator and operation on
bits, Enumerated data type, renaming data type , type casting, linklist, stack, queue, circular buffer, pipe.

UNIT III: ADVANCE FEATURES IN C++

What and why C++, Concept of OOP, Graduating to C++ functions ,classes in C++ and
different Issues on class, Data structure through C++, Inheritance ,templates and Exception handling, File input/output in C++, Advance features and virtual functions

UNIT IV: EMBEDDED C & DEVICE DRIVER

Introduction to DD: Basic device Driver functions and program structure, Type of Device Drivers, Basics I/O Ports and Memory Architecture of Microcontroller,
I/O and interrupt handling: Parallel port access techniques, Interrupt Handler IRQ Number and its role, Concept of Interrupt Sharing and Interrupt Nesting , Interrupt driven I/O and Race Conditions and Priority
Development tools: DevC++, Keil Compiler, Linker, Debugger, C Library.

TEXT BOOK:

1 Let Us C: Yeswant Kanetkar; BPB Publishers
2 Let Us C++: Yeswant Kanetkar; BPB Publishers
3Embedded C, Michael J. Pont, An imprint of Pearson Education
4.The 8051 Microcontroller & Embedded Systems: Muhammad Ali Mazidi

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Embedded Operating Systems & Real time OS

Prerequisites: Basics of operating Systems, Embedded Systems, Real Time Systems
Objectives: To study basics of Embedded OS and RTOS

CO-1	Remember and understand the basic concepts/ Principles of Embedded Operating Systems & Real Time OS
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I: EMBEDDED SOFTWARE
Basics of Embedded Systems Design and Development, Important components of typical embedded systems, Embedded System Initialization, General features of embedded software, Software environment for Embedded Applications development.

UNIT II: INTRODUCTION TO OS and REAL TIME OPERATING SYSTEM
OS fundamentals, Operating System Internal and its services, Introduction to Embedded Operating system, Characteristics/Features of RTOS, Examples hard real time, soft real time and firm real time systems Services provided by OS: Process /task management, Resource management, Memory management, Input/output management, Power management,Modularizing an application for concurrency, providing services to the application, Providing user interface to the application, Common Design Problems. Operating System Internals:Process, Signal, Thread, Tasks, Task scheduling, Context switching, Inter-process Communication & synchronization. Kernel objects :Task, Task scheduler, Exceptions &Interrupt service routine, Semaphore, Mutex, Message queue, FIFO, Signal, Timer and Timer Services

UNIT III: SCHEDULING
Scheduling process, scheduling criteria, scheduling policies & Schedulability analysis, Analyzing hard real time system, Clock driven, event-driven, hybrid scheduler.

UNIT IV: COMMERCIAL RTS, CASE STUDY: STUDY OF RTOS
uC-OS II Microcontroller OS introduction, development environment, architecture, devicedriver, programming concept, Other available commercial RTOS, Standard OS conversion to Real time OS. Multiprocessor and Distributed RTS

TEXT BOOK:
1 Embedded Systems : Architecture, Programming and Design – Dr. Rajkamal
2 Embedded/Real-Time Systems: Concepts, Design and Programming- DR. KVKK Prasad
3 Real Time System: Dr. Rajiv Mall
4 MicroC/OS-II The Real Time Kernel – Jean J. Labrosse

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FPGA Based Systems Design

Prerequisites: VHDL, Digital Circuits and Systems
Objective: To study basics of FPGA Based Systems Design

CO-1	Remember and understand the basic concepts/ Principles of FPGA Based Systems Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I:
Overview & Architecture of Programmable Logic Design Devices: PROM, PLA, PAL,
CPLD and FPGA Introduction:What is VHDL, History, Capabilities, and Hardware
Abstraction. Top-down design and Bottom Up design. Basic Language Terminology: Design Entities, Code Structure Data Types And Data Objects, Expressions. Operators & Operands:Overloaded Operator, Logical Operators, Relational Operators, Shift Operators, Arithmetic Operators equality & inequality Operator and Miscellaneous Operator. Literals and Identifier, type conversion operands.

UNIT II:
Design/Modeling: Different style of modeling in VHDL. Behavioral Modeling, Data Flow & Structural modeling, Modeling Combinational Logic Circuits: Logical/Arithmetic Equation s, Logical Structure Control, Multiplexer. Encoders, Priority Encoders, Decoder Comparators, ALU.

UNIT III:
Modeling Synchronous Logic Circuits: Modeling Latch Circuits, Tristate buffers. Flip Flops: D-Type etc, Shift Registers, and Counters. Modeling of Finite State Machine, State Table & State Diagram's, Mealy or Moore type outputs. Sequential Next state logic.

UNIT IV:
Modeling of Memories (VHDL), Understanding basic RAM Architecture and its modeling (using HDL), Understanding basic ROM Architecture and its modeling (using HDL). Packages And Libraries in VHDL: Introduction to packages, Package declaration, package body. Design Library.

TEXT BOOK:
1. VHDL – Douglas Perry
2. Fundamentals of Digital Logic with VHDL Design- Brown/Vranesic
3. VHDL Synthesis Primer –Jayaram Bhaskar.
4. Verilog HDL - Sameer Palnitkar.

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Embedded Design Cycle

Prerequisites: Basics of Embedded Systems
Objective: To study basics of Embedded Design Cycle

CO-1	Remember and understand the basic concepts/ Principles of Embedded Design Cycle
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT-I: TRADITIONAL EMBEDDED DESIGN CYCLE
Introduction: Product specification, Hardware/software partitioning, Iteration and implementation, Hardware/software design, Hardware/software integration, Product testing and release, Maintaining and upgrading existing product. Hardware development: Introduction, Hardware/software duality, Hardware trends, Selection of hardware platform,peripherals, I/Os, Power supply requirement. Software development: Selection of software tool chain, RTOS

UNIT-II:
Introduction to SDLC (Software Development Life Cycle), SDLC models study. Development environment: Introduction, Execution environment, Memory organization, System startup. Testing: Introduction, Test case preparation and selection,Testing types.

UNIT-III:
Requirement management : Introduction, Requirement capture, Making of requirement document and study of some standard templates. Making of design document: Introduction Discussion on design issues, Making of design documents and study of some standard design templates

UNIT-IV:
Model based design approach: Introduction to MBD: What is it?,Detailed discussion on MBD, Comparison between traditional and MB design.UML and its role in Embedded Systems Design: Introduction: Introduction to modeling language, Introduction to different types of diagrams, Making of object and class diagram, Making of use case diagram, Making of state transition and sequence diagram, Making of component and deployment diagram. Case Study: Traditional design approach, Model design using UML.

TEXTBOOKS:
1. Embedded Systems Design – An introduction to Processes, Tools & Techniques,
Arnold S. Berger, CMP books.
2. Real- Time Systems – Design Principles for Distributed Embedded Applications,
Hermann Kopetz, Kluwer Academic Publication
3. UML for real – Design of Embedded Real-Time Systems, Luciano Lavagno, Grant
Martin, Bran Selic, Kluwer Academic Publishers

REFERENCE BOOKS:
1. Embedded Systems Design, Bruno Bouyssounouse, Joseph Sifakis, Springer.

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ADVANCE DIGITAL SIGNAL PROCESSING

Prerequisites: Digital Signal Processing, Signal and Systems
Objective : To study advance concepts in DSP.

CO-1	Remember and understand the basic concepts/ Principles of Advance Digital Signal Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module 1 (13 hours)
Review of sampling theory. Sampling rate conversion by integer and rational factors. Efficient realization and applications of sampling rate conversion. Wiener filtering. Optimum linear prediction. Levinson- Durbin algorithm. Prediction error filters.
Module 2 (14 hours)
Adaptive filters. FIR adaptive LMS algorithm. Convergence of adaptive algorithms. Fast Algorithms. Applications; Noise canceller, echo canceller and equalizer.
Module 3 (13 hours)
Recursive least–squares algorithms. Matrix inversion lemma. Convergence analysis of the RLS algorithm. Adaptive beam forming. Kalman filtering.
Module 4 (14 hours)
Spectrum estimation. Estimation of autocorrelation. Periodogram method. Nonparametric methods. Parametric methods.
Text Books:
1. J.G.Proakis et al, Advanced Digital Signal Processing, McGraw –Hill, 1992 2. S.Haykin, Adaptive Filter Theory (3/e), Prentice- Hall, 1996
Reference Books:
1. D.G.Manolakis et al, Statistical and Adaptive Signal Processing, McGraw-Hill, 2005
2. Marple, Spectral Analysis, 3. M.H.Hays, Statistical Digital Signal Processing and Modelling, John-Wiley.

Algorithm and Model based design

Prerequisites: Embedded System, Software engineering
Objective: Basics of Algorithm and Model based system design

CO-1	Remember and understand the basic concepts/ Principles of Algorithm and Model Based Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I:

Model Based Design for Embedded Application Development, Adoption of MBD, Procedure for MBD, (Verification, Validation and Testing)(Software In Loop, Hardware In Loop, Processer In Loop)

UNIT II:

Matlab/Simulink: Introduction, Use of different commands to develop programs in Matab. ,Introduction to simulink, study of different block sets, Commonly used block sets, simple model development, graphs, waveforms , complex system model study and development(Based on Examples,Projects).

UNIT III:

LABVIEW: Introduction to Graphical System Design(GSD), Inroduction to LabVIEW, ModularProgramming,Loops, Arrays,Clustrers,Plotting Data(Graphs and Charts),Instrument Control, Data Acquisition(Signal Conditioning, DAQ Hardware study by NI DAQ, LabVIEW tool and GSD Applications

UNIT IV: scilab based model study: single board heater control system

TEXT BOOK:

1Getting started with MATLAB . A quick introduction for Scientists and Engineers, Rudra Pratap, Oxford University Press.

REFERENCE BOOK:

1.Thomas Stahl, Markus Voelter. Model-Driven Software Development Technology, Engineering, Management. John Wiley & Sons, 2006. ISBN 0-470-02570-0

2. Steven Kelly, Juha-Pekka Tolvanen. Domain-Specific Modeling: Enabling Full Code Generation. John Wiley & Sons, 2008. ISBN 978-0-470-03666-2

WIRE AND WIRELESS COMMUNICATION

Prerequisites: Wireless communication

Objective: Basics of Wire and Wireless Communication

CO-1	Remember and understand the basic concepts/ Principles of Wire and Wireless Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I:

Introduction to exclusive growth of Telecommunication: Wired Telephone system, PSTN,Cellular telephony and Techniques: GSM, GPRS, GPS, 3G&4G, CDMA, TDMA, FDMA, OFDM.

UNIT II:

Local Area Network, IEEE LAN Standards, Wireless LAN, world wide web and related technology, Zigbee , Blue tooth, Digital Subscriber line and ISDN Television system: Standard for TV and CATV system, Digital TV, HDTV transmission

UNIT III

Satellite Communication System: Digital and analog Television transmission, Data and telephone signal multiple access, Satellite phone system.Fiber optics system: introduction to high speed data transmission using fiber cables, structure of optical and electronics linking, Data transmission techniques, ATM, SONET

UNIT IV

Link Budget Analysis: Signal power, noise characterization, Link budget evaluation, E b /N 0 link budget for Digital system. Path loss for wireless environment. Effective transmission using noise reduction techniques.

TEXT BOOKS:

1. Digital and Analog Communication system by Leon.W.Couch II, Pearson Publication.

REFERENCE BOOK:

1. Computer Networking. By Keneth C. Mafield and etal.

2. Communication by Taub and Schilling.
3. Optical Fiber communication by G.Keiser.

ACCESS TECHNOLOGIES AND SMART CARD

Prerequisites: Embedded Systems
Objective: To study technology related to smart cards.

CO-1	Remember and understand the basic concepts/ Principles of Access Technologies and Smart Card
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I:
Introduction to the smart card: History, Types of cards, Applications of smart card.
UNIT II:
Basic Standards & Physical properties: Needs of standards , Different ISO/IEC smart card standards, ISO 7810 standard, ISO 7811 standard, ISO 7816 standard, ISO 7816 – 2 standard. Electrical Properties of smart card: Introduction to electrical properties, Electrical properties with reference to ISO/IEC 7816-3, Supplementary standards, Supply voltage, Processor clock, Supply current, Activation & deactivation sequence.
UNIT III:
Smart Card Controller & memory types: Comparison between smart card controllers and general microcontrollers, Smart card controllers – 8,16 and 32 bits, Memory types: Introduction to memory, Usage of ROM, RAM and EEPROM. Additional hardware requirement: Hardware based data transmission, Internal clock multiplication and generation, Timers and watchdog timers, DMA, Hardware based memory management and firewalls, CRC calculation units, Random number generator, Coprocessor for symmetric and asymmetric cryptography.Contact less Cards , Smart card Manufacturing, Smart card & information management, SDL notation, State machine, Cryptography.
UNIT IV:
Smart Card Operating Systems , Atomic operation, Smart card transmission, Message structure: APDUs, Smart Card Commands, smart card applications.
TEXT BOOK:
1.Smart Card Handbook – by Dr. Rankle, CMP publication.

AUTOMOTIVE EMBEDDED SYSTEMS

Prerequisites: Embedded Systems, Sensors, Transducers, Control Systems
Objective: To study basics of automotive embedded systems

CO-1	Remember and understand the basic concepts/ Principles of Automotive Embedded Systems
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT-I
Current trends in Automobiles, open loop and closed loop systems - components for electronic engine management system. Electro - magnetic interference suppression. Electromagnetic compatibility, Electronic dashboard instruments, onboard diagnostic system, security and warming system. Electronic management of chassis systems. Vehicle motion control.

UNIT II

Sensors and actuators, and their interfacing. Basic sensor arrangement, types of sensors such as- oxygen sensors, crank angle position sensors- Fuel metering/ vehicle speed sensors and destination sensors, Attitude sensor, Flow sensor, exhaust temperature, air mass flow sensors. Throttle position sensor, solenoids, stepper motors, relays. Electronic- ignition systems. Types of solid state ignition systems and their principle of operation.

UNIT-III

Digital engine control system. Open loop and closed loop control system, Engine cranking and warm up control. Acceleration enrichment. Deceleration learning and ideal speed control, Distributor less ignition – Integrated engine control system, Exhaust emission control engineering.

UNIT-IV

Automotive Embedded systems. PIC, Freescale microcontroller based system. Recent advances like GLS, GPSS, GMS. Multiprocessor communication using CAN bus. Case study- cruise control of car. Artificial Intelligence and engine management. Digital bus communication protocol for industrial control systems.

TEXT BOOK:

1. William B. Riddens, "Understanding Automotive Electronics", 5th Edition, Butterworth Hennimann Woburn, 1998.
2. Young A.P. & Griffiths, " Automotive Electrical Equipment" , ELBS & New Press-
1999.
3. Tom Weather Jr. & Cland c. Ilunter, " Automotive computers and control system"
Prentice Hall Inc., New Jersey.
4. Crouse W.H., " Automobile Electrical Equipment" , Mc Graw Hill Co. Inc., New
York ,1995.
5. Bechhold, " Understanding Automotive Electronic", SAE,1998.
6. Robert Bosch," Automotive Hand Book", SAE (5TH Edition), 2000.

Mobile computing using Embedded System

Prerequisites: Mobile computing, Wireless communication, sensors, transducers
Objective: To study basics of Mobile Computing using Embedded System

CO-1	Remember and understand the basic concepts/ Principles of Mobile Computing using Embedded System
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT I: INTRODUCTION TO MOBILE COMPUTING

Motivations, concepts, and challenges of mobile computing, Types of mobile networks, Mobile network architectures, Cellular telephony, Mobile Ad-hoc networks, Routing and mobile IP, relationship with distributed computing, Internet computing, ubiquitous / pervasive computing.

UNIT II: ARCHITECTURE

Wireless communication concepts, modulation and multiplexing techniques (spread spectrum, multi-access methods), medium access control, classification of wireless networks: WPAN, WLAN, WMAN, WWAN; IRDA, Bluetooth, Wi-Fi, WiMAX, Mesh networks, evolution of cellar communication systems (1G, 2G, 3G, 4G).Extended client-server model; peer-to-peer model; mobile agent model; wireless Internet; smart client; messaging; mobile data management;. Bus and memory architectures, I/O architectures , System On Chip (SOC) designs . ARM and Thumb instruction set architectures.software : Principles of disconnected operation: caching, hoarding, etc. Software adaptation and OSsupport. Resource sharing. OS for embedded devices: PalmOS, WindowsCE, embedded Linux, WAP/WML, J2ME, Windows Mobile and .Net Framework, BREW. Mobile agents, Resource and service discovery, Mobile Java, Mobile Grid and collaborative processing with Jini.

UNIT III: SENSOR AND ACTUATOR

Sensor and actuator networks: Platforms and capabilities, Programming sensor networks,Sensor database: in-network query processing and storage management. Routing and MAClayer algorithms. Localization and synchronization techniques. Introduction to development with TinyOS.

UNIT IV: ISSUES & APPLICATIONS

Concepts and applications: mobile positioning techniques, GIS, LBS architecture and protocols.Mobility management: Handoff and location management concepts: mobility management in PLMN, mobility management in mobile Internet, mobility management in mobile agent. Mobile Ad hoc Networks (MANETs) and applications: Concepts and applications, routing protocols,clustering, mobile P2P systems. Mobile computing middleware: Functionalities of mobile computing middleware, tuple-space middleware, context-aware middleware, reflective middleware, publication/subscription middleware, service discovery; disconnected operations.

TEXT BOOK:

1. Reza B'Far, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge University Press, 2005.
2. J. Schiller, Mobile Communications, 2nd edition, Pearson Education, 2003.
3. Evaggelia Pitoura and George Samaras, Data Management for Mobile Computing, Kluwer Academic Publishers, 1998.
4. R. Riggs, A. Taivalsaari, M. VandenBrink, Programming Wireless Devices with Java2 Platform, Micro Edition, Addison-Wesley, 2001.
5. H.M. Deitel, P.J. Deitel, T.R. Nieto, and K. Steinbuhler, Wireless Internet & Mobile Business– How to Program, Prentice Hall, 2002.
6. Programming Wireless Devices with Java2 Platform, Micro Edition, R. Riggs, A. Taivalsaari, M. VandenBrink, ISBN: 0-201-74627-1, Addison-Wesley, 2001.
7. Wireless Internet, Applications and Architecture, Mark Beaulieu, ISBN: 0-201-73354-4, Addison-Wesley, 2002.

DSP on FPGA

Prerequisites: Digital Signal Processing, MATLAB

Objective To study implementation of DSP concepts using FPGA

CO-1	Remember and understand the basic concepts/ Principles of DSP on FPGA
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT-I

Introduction to fpga technology ,introduction to digital signal processing technology, real time digital signal processing, different types of hardware platforms, introduction to MATLAB.

UNIT-II

FPGA based DSP design flow, DSP IP CORE/ Algorithms,FPGA design of audio processing,Audio CODEC interface, Filters IIR, FIR,FPGA design of video processing, Video ADC/DAC interface, Filter Mean, Median,FPGA design of computer vision, Image processing.

UNIT-III

Signal Processing using FPGA: Audio test Signal generation – Matlab Sinewave, QPSK, QAM. Audio Processing: Programming Audio ADC/DAC with I2C, FPGA to microphone interface through ADC and speaker interface through DAC. Design of audio filters FIR,IIR.

UNIT-IV

Video Processing : Programming Video ADC/DAC with I2C, FPGA to Camera interface through ADC, FPGA to display monitor interface through DAC, Video test signal Generation, Camera video processing modules on FPGA, Design of video filters MEAN, MEDIAN

TEXT BOOK:

1.Digital Signal Processing with Field Programmable Gate Arrays, Uwe-Meyer Baese, Springer-Verlag, Germany, 2001.
2.VLSI DIGITAL Signal Processing Systems: Design and Implementation. Keshab K. Parhi, Wiley-India edition.
3. Digital Image Processing, Rafael C. Gonzalez (Author), Richard E. Woods (Author), Prentice Hall.
4. Peter Pirsch: Architectures for DSP

REFERENCE BOOK:

1 IEEE Papers and articles, Articles from Techonline, Xilinx and Altera Websites, Digital library.

VLSI Signal Processing

Prerequisites: VLSI Engineering, Digital Signal Processing
Objective To study basics of VLSI Signal Processing

CO-1	Remember and understand the basic concepts/ Principles of VLSI Signal Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE-I (12 hours)

Pipelining and Parallel Processing: Introduction, Pipelining of FIR Digital Filters, Parallel Processing. Pipelining and Parallel Processing for Low Power. Retiming: Introduction, Definition and Properties, Solving System of Inequalities, Retiming Techniques.

MODULE-II (12 hours)

Unfolding: Introduction an Algorithms for Unfolding, Properties of Unfolding, Critical Path, Unfolding and Retiming Application of Unfolding. Folding: Introduction to Folding Transformation, Register Minimization Techniques, Register Minimization in Folded Architectures, Folding in Multirate Systems.

MODULE-III (12 hours)

Systolic Architecture Design: Introduction, Systolic Array Design Methodology, FIR Systolic Arrays, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design, Systolic Design for Space Representations Containing Delays.

MODULE-IV (12 hours)

Fast Convolution: Introduction, Cook, Toom Algorithm, Winograd Algorithm, Iterated Convolution, Cyclic Convolution, Design of Fast Convolution Algorithm by Inspection.

Text Books

1. Keshab K. Parhi. VLSI Digital Signal Processing Systems, Wiley-Inter Sciences, 1999
2. Mohammed Ismail, Terri, Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1994
. 3. Kung. S.Y., H.J. While house T.Kailath, VLSI and Modern singal processing, Prentice Hall, 1985.
4. Jose E. France, YannisTsividls, Design of Analog Digital VLSI Circuits for Telecommunications and Signal Processing' Prentice Hall, 1994.

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WIRELESS SENSOR NETWORKS

Prerequisites: Wireless Communications, Data Communications and Networking
Objective : To study concepts in Wireless Sensor Networks

CO-1	Remember and understand the basic concepts/ Principles of Wireless Sensor Networks
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

UNIT – I:
Networked wireless sensor devices, Applications, Key design challenges.Network deployment: Structured versus randomized deployment, Network topology,Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

UNIT – II:
Localization: issues & approaches, Coarse-grained & Fine-grained node localization,Network-wide localization, Theoretical analysis of localization techniques.Synchronization: Issues & Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

UNIT – III:
Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference. Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols. Sleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage

UNIT – IV:
Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime- maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks. Data-centric networking: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks. Introduction to Tiny OS, NesC, Sensor Simulator,

REFERENCE BOOKS:
1. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli, TaiebZnati , Wiley Inter Science.
2. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
3. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati , Springer.
4. Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press
5. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and MilindTambe , Kluwer Publications.
6. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004

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Internet of Things

Prerequisites: Embedded Systems, Sensors, Networking concepts
Objective : To study basics of Internet of Things

CO-1	Remember and understand the basic concepts/ Principles of Internet of Things
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I
IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision,IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Module-II
M2M to IoT –A Basic Perspective–Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.M2M to IoT-An Architectural Overview–Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Module-III

IoT Architecture-State of the Art –Introduction, State of the art,Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Module-IV
Internet of Things Privacy, Security and Governance,Introduction, Overview of Governance, Privacy and Security Issues, Contribution from
FP7 Projects,Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform,Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

Reference Books:
1.Vijay Madisetti and Arshdeep Bahga,"Internet of Things (A Hands-on-Approach)",1stEdition, VPT, 2014
2.Francis daCosta,"Rethinking the Internet of Things: A ScalableApproach to Connecting Everything",1st Edition, Apress Publications, 2013
3.Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

Elective Labs:

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Embedded Lab

Objective: Students will be familiarized with interfacing concepts with microcontrollers.

CO-1	Remember and understand the basic concepts/ Principles of Embedded Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1.Bread boarding of 8051 Microcontroller
2.Installation and study of Kiel Compiler
3.Testing Switch and LEDs
4.Testing of Unknown pulse
5.Interfacing KEYPAD
6.Interfacing LCD
7.Interfacing DAC
8.Interfacing ADC
9.Interfacing Serial communication
10.Interfacing RTC
11.Interfacing DC Motor
12.Interfacing STEPPER Motor
13.Project 1 - Build simple calculator Interfacing KEYPAD & LCD
14.Project 2 - Build Fire Alarm System Interfacing Temp sensor and ADC and Buzzer
15.Project 3 – Build Access Control System Interfacing RFID serial communication
16.Project 4 – Build waveform generation sine, triangular, square wave interfacing DAC
17.Project 5 - Build heartbeat sensor and display on LCD
18.Project 6 – Simple DC Motor Speed Control.
19. Project 7 – Renewable energy sources like operation of water pump using solar cell.

VLSI Lab-I

COURSE OBJECTIVE:

1. Students will be familiar withdigital VLSI circuits using software.
2. They can also analyze various types of VLSI modelling techniques.

CO-1	Remember and understand the basic concepts/ Principles of VLSI Lab-I
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

(The Following Experiments Need to be Carried out Using HDL Simulation Tools)

1. Design a full adder using dataflow modelling.
2. Design a full adder using half-adder.
3. Design a half adder.
4. Design a 4-bit adder -cum-sub tractor using: 4:1 MUX using the following: (a) Dataflow (b) Using when else (c) Structural modelling using 2:1 MUX (d) Behavioural modelling using (i) Case statement (ii) If else statement (e) Mixed style of modelling (use structural, behavioural, dataflow)

5. Design a decoder (3: 8) and Encoder (Gray to Binary).
6. Design a BCD to 7-Segment Decoder.
7. Interface the 2-bit adder with 7-segment display.
8. Design 4-bit Even/Odd parity checker & generator.
9. Design of Flip-Flops: (a) S-R Flip Flop (b) J-K Flip Flop (c) D Flip Flop (d) T Flip Flop
10. (a) Design of counters: (i) 4-bit up counter (use asynchronous reset) (ii) 4-bit down counter (use synchronous reset) (iii) 4-bit up/down counters (iv) Decade Counter (b) Design of Shift Registers: (i) Serial-in serial-out (ii) Serial-in parallel-out (c) Design the following using Generics (i) Generic Decoder (ii) Generic Parity (iii)Detector Generic parity generator
11. Design of a simple Microprocessor Data Path and Control Path using VHDL modelling

VLSI LAB-II LAB

CO-1	Remember and understand the basic concepts/ Principles of VLSI Lab-II Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Lab-1-2 Xilinx's WebPACK ISE Software overview, Demonstration of the Synthesistool, Constraints Editor, Reports, and ISE Simulation tool Behavioral andTiming simulation, Demonstration for down loading the logic in to the kit.
Lab-3 -4 Implementation and its simulation of Logic gates e.g. Simple combinationalblocks, Multiplexers, Decoder, Encoder, Adder, priority Encoder, Checksum generator
Lab 5-6 Assignments on data types and operators from lab manual.(modeling of simple arithmetic blocks)
Lab 7-8 Assignments on different styles of modeling from lab manual(structural, dataflow,behavioral)
Lab 9-10Modeling of flip-flops, counters and shift registers and all possible variations
Lab 11-12Modeling a sequence detector using FSM modeling.
Modeling of RAM, ROM and all possible variations.
Lab 13-14 REAL WORLD INTERFACE DESIGN
Lab 15-16 LED, SWITCH,7 SEGMENT DISPLAY,LCD Display,ADC,DAC - Waveform Generation,PWM,UART

MICROCONTROLLER LAB

CO-1	Remember and understand the basic concepts/ Principles of Microcontroller Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Suggested Microcontroller Platform : Texas InstIntroduction to VHDL, Behavioral modeling, sequential processing, Data types, IEEE std logic, VHDL operators, arrays, Modules, packages, libraries. VHDL description of combinational logic circuits, VHDL description of sequential logic circuits. Modeling of flip-flops, registers, and counters using VHDL. VHDL code for serial adder, and binary multiplier.ruments MSP430, ARM 9,68HC12, 8051.
1. Architecture, Instruction Set.
2. Demonstration of software development.

Create a new project
Configuration of a new project
Create a new source file
Write an assembly/C script
Compilation and debugging of the code
Download binary image to the hardware platform
Real time debugging
Verification and validation of the code
3. Assembly language programming(10 programs)
4. C language programming (10 programs)
5. ADC/DAC Programming
6. PWM programming7. UART programming-polling and interrupt mode
8. SPI programming-polling and interrupt mode.
9. I 2 C programming-polling and interrupt mode.
10. GPIO programming

ADVANCE DIGITAL SIGNAL PROCESSING LABORATORY

CO-1	Remember and understand the basic concepts/ Principles of Advance Digital Signal Processing Laboratory
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1. Basic Operations on Signals, Generation of Various Signals and finding its FFT.
2. Program to verify Decimation and Interpolation of a given Sequences.
3. Program to Convert CD data into DVD data
4. Generation of Dual Tone Multiple Frequency (DTMF) Signals
5. Plot the Periodogram of a Noisy Signal and estimate PSD using Periodogram and Modified Periodogram methods
6. Estimation of Power Spectrum using Bartlett and Welch methods
7. Verification of Autocorrelation Theorem
8. Parametric methods (Yule-Walker and Burg) of Power Spectrum Estimation
9. Estimation of data series using Nth order Forward Predictor and comparing to the Original Signal 10. Design of LPC filter using Levinson-Durbin Algorithm
11. Computation of Reflection Coefficients using Schur Algorithm
12. To study Finite Length Effects using Simulink
13. Design and verification of Matched filter
14. Adaptive Noise Cancellation using Simulink
15. Design and Simulation of Notch Filter to remove 60Hz Hum/any unwanted frequency Component of given Signal (Speech/ECG
16. Familiarity with Digital Signal Processing Kits (DSK) - TMS 320C3x and TMS320C67x, generation of different types of signals - sine, square and noise using the DSK, study of aliasing effects.

IOT LAB

CO-1	Remember and understand the basic concepts/ Principles of IOT Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

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1.Define and Explain Eclipse IoT Project
2.List and summarize few Eclipse IoT Projects.
3.Sketch the architecture of IoT Toolkit and explain each entity in brief.
4.Demonstrate a smart object API gateway service reference implementation in IoT toolkit.
5.Write and explain working of an HTTP-to-CoAP semantic mapping proxy in IoT toolkit.
6.Describe gateway-as-a-service deployment in IoT toolkit.
7.Explain application framework and embedded software agents for IoT toolkit.
8.Explain working of Raspberry Pi.
9.Connect Raspberry Pi with your existing system components.
10.Give overview of Zetta. Design based Problems (DP)/Open Ended Problem:

Major Equipment:
Raspberry pi, Arduino

Simulation techniques for wireless communication lab

CO-1	Remember and understand the basic concepts/ Principles of Simulation Techniques for Wireless Communication Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1. Wireless Path loss Computations - Study of Propagation Path loss Models : Indoor & Outdoor
2.Free Space Propagation – Path Loss Model
3.Link Budget Equation for Satellite Communication
4.Carrier to Noise Ratio in Satellite Communication
5.Outdoor Propagation – Okumura Model
6. Outdoor Propagation – Hata Model

Wireless channel modelling lab

CO-1	Remember and understand the basic concepts/ Principles of Wireless Channel Modelling Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Experiment 1:
Free space Propagation – Path Loss model to determine the free space loss and the power received using Matlab program.
Experiment 2:
Introduction to the IEEE80211.a WLAN PHY Communication Toolbox in MATLAB a. What is IEEE 802.11a WLAN PHY? Briefly explain the functions of each blue block in the model diagram. b. What type of shadowing is IEEE802.11 WLAN based on.
Experiment 3:
Investigation on WLAN Multipath Channel c. Plot BER-SNR and Bit Rate-SNR graphs for different types of fading channel i. No Fading ii. Flat Fading iii. Dispersive Fading
Experiment 4:

Introduction to Simulink a. Familiarize with the block components of Simulink in MATLAB b. Setup a basic integrator for a square wave input and note the parameters like amplitude, frequency etc

Experiment 5: Implement a Direct Sequence Spread Spectrum with Matlab Simulink