REGULATIONS - 2013

DEPARTMENT OF
ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABI (FULL TIME)

M.E. – EMBEDDED SYSTEM TECHNOLOGIES
# M.E. (EMBEDDED SYSTEM TECHNOLOGIES)
## REGULATIONS – 2013
### CURRICULUM AND SYLLABUS (FULL TIME)

#### SEMESTER I

<table>
<thead>
<tr>
<th>S.NO.</th>
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**PRACTICAL**

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Total Credits 21

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE - 69**
# LIST OF ELECTIVES FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES

## II SEMESTER ELECTIVE SUBJECTS

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## III SEMESTER ELECTIVE SUBJECTS

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AIM
To gain knowledge on applied mathematics for electrical engineers

OBJECTIVES
- To learn the concepts of matrix theory
- To understand simplex method, two phase method and graphical solution in linear programming.
- To learn moment generating functions and one dimensional random variables.
- To understand queuing models and computation methods in engineering

UNIT I ADVANCED MATRIX THEORY 9
Eigen-values using QR transformations - Generalized eigen vectors - Canonical forms - Singular value decomposition and applications - Pseudo inverse - Least square approximations.

UNIT II LINEAR PROGRAMMING 9
Formulation - Graphical Solution - Simplex Method - Two Phase Method - Transportation and Assignment Problems.

UNIT III ONE DIMENSIONAL RANDOM VARIABLES 9
Random variables - Probability function - moments - moment generating functions and their properties - Binomial, Poisson, Uniform, Exponential, Gamma and Normal distributions.

UNIT IV QUEUEING MODELS 9

UNIT V COMPUTATIONAL METHODS IN ENGINEERING 9
Boundary value problems for ODE - Finite difference methods - Numerical solution of PDE - Solution of Laplace and Poisson equations - Liebmann's iteration process - Solution of heat conduction equation by Schmidt explicit formula and Crank - Nicolson implicit scheme - Solution of wave equation.

L=45; T=15; TOTAL: 60 PERIODS

REFERENCES
AIM

To expose the students to the fundamentals of Real Time Systems, its communication and evaluation techniques

OBJECTIVES

- To introduce real time computing and scheduling algorithms.
- To understand the programming languages and their tools for real time systems.
- To study real time communication concepts and fault tolerant techniques.
- To study the evaluation techniques of Real time systems.

UNIT I

INTRODUCTION


UNIT II

PROGRAMMING LANGUAGES AND TOOLS

Programming Languages and Tools - Desired language characteristics - Data typing - Control structures - Facilitating Hierarchical Decomposition, Packages, Run time (Exception) Error handling - Overloading and Generics - Multitasking - Low level programming - Task Scheduling - Timing Specifications - Programming Environments - Run - time support.

UNIT III

REAL TIME DATABASES

Real time Databases - Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two - phase Approach to improve Predictability - Maintaining Serialization Consistency - Databases for Hard Real Time Systems.

UNIT IV

FAULT TOLERANCE SYSTEMS


UNIT V

EVALUATION TECHNIQUES

Reliability Evaluation Techniques - Obtaining parameter values, Reliability models for Hardware Redundancy - Software error models. Clock Synchronization - Clock, A Nonfault - Tolerant Synchronization Algorithm - Impact of faults - Fault Tolerant Synchronization in Hardware - Fault Tolerant Synchronization in software.

TOTAL: 45 PERIODS

REFERENCES

ESC13 MIXED SIGNAL PROCESSOR L T P C
3 0 0 3

AIM
To impart knowledge on Mixed Signal Processor, its architecture and interfacing.

OBJECTIVES
- To understand the processor classification and its architecture’s.
- To understand the architecture of MSP430 Processor.
- To study the interfacing techniques of the processor.
- To study the on-chip peripheral’s and special features of the processor.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM ARCHITECTURE

UNIT II MSP 430 ARCHITECTURE
Programmers model of MSP 430 CPU, Addressing modes, Instruction set, Resets, Clock System, Interrupt handling mechanism, Low-Power models of operation, Digital I/O port registers

UNIT III ONCHIP LCD CONTROLLER AND TIMERS

UNIT IV MIXED SIGNAL SYSTEM
Methods of Analog to Digital conversion in MSP 430, Architecture and operation of Comparator block, An example of capacitive touch sensing with comparator, Basic operation of ADC block in MSP 430, Low power example with ADC, Triggering the ADC from Timer A - More advanced operation of ADC, DAC block in MSP 430 and its operation.

UNIT V SERIAL COMMUNICATION PERIPHERALS
Overview of communication peripherals in MSP 430, USCI block diagram and its features, Asynchronous serial communication – Asynchronous serial communication with USCI.

TOTAL: 45 PERIODS

REFERENCES
AIM
To learn advanced computer architecture and their processing.

OBJECTIVES
➢ To learn the concepts of parallel computing.
➢ To study the program partitioning, scheduling and performance analysis.
➢ To understand the data path design and memory organization.
➢ To understand parallel processing and architectures.

UNIT I PARALLEL COMPUTING  9
Computing and Computers - Parallel Computer models - the state of computing - Multiprocessors and Multicomputers – Multivectors - and SIMD computers - superscalar and vector processors - PRAM and VLSI models - Program and network properties - Conditions of parallelism.

UNIT II DATA PATH DESIGN  9
Fixed point and floating point arithmetic - Control design - Hardwired and micro programmed control - CPU control unit - memory hierarchy technology - virtual memory technology - cache memory organizations - shared memory organizations.

UNIT III SCHEDULING AND PERFORMANCE ANALYSIS  9
Speed up techniques - Program partitioning and scheduling - Program flow mechanisms - System interconnect architectures - Principles of scalable performance - performance matrices and measures - Parallel processing applications - speedup performance laws - scalability analysis and approaches.

UNIT IV PARALLEL COMPUTER ARCHITECTURES  9
Pipeline design and performance - Instruction pipeline - Pipeline control - Superscalar processing - RISC and CISC processors - Parallel and scalable architectures - Multithreaded data flow architectures.

UNIT V PARALLEL PROCESSING  9
Parallel models - Languages and compilers - Parallel program development and environments - UNIX for parallel computers.

TOTAL: 45 PERIODS

REFERENCES
AIM

To understand the models and schemes of digital system design

OBJECTIVES

➢ To realize Mealy and Moore model networks
➢ To learn the design techniques of fundamental mode asynchronous circuits
➢ To study the various fault models of system design
➢ To impart knowledge on programmable logic devices and HDL.

UNIT I  REALIZATION OF MEALY AND MOORE MODEL NETWORKS  9
Analysis of Clocked Mealy and Moore model Networks, Modelling of Mealy and Moore network
- State Stable Assignment and Reduction - Design of Mealy and Moore model networks - Design of Iterative Circuits - ASM Chart - ASM Realizations using Discrete gates, Multiplexers, PLA, PROMs.

UNIT II  DESIGN OF FUNDAMENTAL MODE ASYNCHRONOUS CIRCUITS  9
Fundamental mode Asynchronous Sequential Circuit analysis –Excitation Table, Transition Table, State Table, Flow Table and its Reduction - Races, Primitive Flow Table - State Assignment Problem - Design of Fundamental mode asynchronous sequential circuits – Timing Hazards - Design of a Microcontroller CPU.

UNIT III  FAULT MODEL AND TESTING SCHEMES  9

UNIT IV  PROGRAMMABLE LOGIC DEVICES  9

UNIT V  HARDWARE DESCRIPTION LANGUAGE  9

TOTAL: 45 PERIODS

REFERENCES

AIM

To learn the methods of designing and interfacing embedded systems.

OBJECTIVES

➢ To learn the basics of embedded system hardware organization.
➢ To understand the basics of real time operating system.
➢ To learn the design methodologies and hardware and software interface.
➢ To study the designing concepts of software for embedded system, basics of exemplary RTOS.

UNIT I EMBEDDED SYSTEM ORGANIZATION

Embedded computing - characteristics of embedded computing applications - embedded system design challenges; Build process of Real time Embedded system -Selection of processor; Memory; I/O devices-Rs-485, MODEM, Bus Communication system using I²C, CAN, USB buses, 8 bit -ISA, EISA bus;

UNIT II REAL-TIME OPERATING SYSTEM

Introduction to RTOS; RTOS- Inter Process communication, Interrupt driven Input and Output – Non maskable interrupt, Software interrupt; Thread - Single, Multithread concept; Multitasking Semaphores.

UNIT III INTERFACE WITH COMMUNICATION PROTOCOL

Design methodologies and tools - design flows - designing hardware and software Interface - system integration; SPI, High speed data acquisition and interface-SPI read/write protocol, RTC interfacing and programming.

UNIT IV DESIGN OF SOFTWARE FOR EMBEDDED CONTROL

Software abstraction using Mealy-Moore FSM controller, Layered software development, Basic concepts of developing device driver - SCI - Software - interfacing & porting using standard C & C++ ; Functional and performance Debugging with benchmarking Real- time system software - Survey on basics of contemporary RTOS – VX Works, UC/OS-II.

UNIT V CASE STUDIES WITH EMBEDDED CONTROLLER

Programmable interface with A/D & D/A interface; Digital voltmeter, control- Robot system; - PWM motor speed controller, serial communication interface.

REFERENCES


TOTAL: 45 PERIODS
AIM
To impart knowledge on different embedded processors, their architectures and programming.

OBJECTIVES
➢ To understand the Architecture of MSP430 chip using Cross Works Development Environment.
➢ To interface MSP chip with interfacing modules to develop single chip solutions on Cross Works Development Environment.
➢ To understand the Architecture of ARM7 Processor using Cross Works Development Environment.
➢ To understand the use of RTOS with ARM7 Processor using Cross Works Development Environment.

LIST OF EXPERIMENTS
PART- I
Write programs to understand the Architecture of MSP430 chip using Cross Works Development Environment.

2. Arithmetic Instructions - Addition/subtraction, multiplication and division,
3. Square, Cube - (16 bits Arithmetic operations - bit addressable).
4. Counters design.
5. Boolean & Logical Instructions (Bit manipulations).
6. Conditional CALL & RETURN.
7. Code conversion: BCD - ASCII; ASCII - Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX.
8. Programs to generate delay, programs using serial port and on-Chip timer / counter.

PART- II
Write programs to interface MSP chip with interfacing modules to develop single chip solutions on Cross Works Development Environment.

9. Write a Program to test the ADC Signal by using 8-LEDs array.
10. Write a program to study on board relay.
11. External ADC and Temperature control interface to MSP
12. Stepper and Bi directional DC motor control interface to MSP
13. Alphanumeric LCD panel and Hex keypad input interface to MSP.
14. Generate different waveforms Sine, Square, Triangular and Ramp using DAC interface to MSP.
15. Simple Calculator Using 6 digit seven segment display and Hex Keyboard
PART- III

Write programs to understand the Architecture of ARM7 Processor using Cross Works Development Environment.

16. Simple Assembly Program for
   a. Addition | Subtraction | Multiplication | Division
17. 8 Bit LED and Switch Interface
18. Buzzer Relay and Stepper Motor Interface
19. Time delay program using built in Timer / Counter feature
20. External Interrupt
21. Displaying a number in 7-Segment Display
22. 4x4 Matrix Keypad Interface
23. Multi digit seven segment display
24. Displaying a message in a 2 line x 16 Characters LCD display
25. ADC and Temperature sensor LM 35 Interface
26. I2C Interface – 7 Segment display
27. I2C Interface – Serial EEPROM
28. Transmission from Kit and reception from PC using Serial Port
29. Generation of PWM Signal

PART- IV

Write programs to understand the use of RTOS with ARM7 Processor using Cross Works Development Environment.

30. Blinking two different LEDs at different timings.
31. Displaying two different messages in LCD display in two lines
32. Sending messages to mailbox by one task and reading the message from mailbox by another task
33. Sending message to PC through serial port by three different tasks on priority Basis
34. Reading temperature from LM35 chip and any other external element at different timings using RTOS.
COURSE OUTCOMES
After completion of the course, the students are able to
- Know the basic processor core of RL78 and their software development tools.
- Use the interrupts and interrupt processing activities of RL78 for external device interfacing.
- Design RL78 based system by utilizing timer and serial communication blocks like I2C and UART.

UNIT I  MICROCONTROLLER CONCEPTS  9

UNIT II  RL78 PROCESSOR CORE  9
RL78 Processor Core basics – Block Diagram - Data flow diagram within core – Instruction set-Addressing Modes- RL78 Pipeline structure – Implementation of C language statements in RL78 Assembly language- - Programming Examples- Software development tools for RL78.

UNIT III  RL78 INTERRUPTS  9
RL78 Interrupt mechanism- Interrupt processing activities: both hardware and software with ISR examples- Interrupt Characteristics- RL78 Interrupt vector table-Concurrent Interrupt - External Interrupt.

UNIT IV  RL78 SERIAL COMMUNICATION  9

UNIT V  TIMER AND ENERGY OPTIMIZATION IN RL78  9

REFERENCES
4. www.renesassingapore.com
COURSE OUTCOMES
After Completion of the course, the students are able to
- Explain the concepts of RTOS based systems
- Summarize the models of distributed operating systems and design strategies.
- Use the real time kernel related functions of µC/OS II.

UNIT I INTRODUCTION TO OPERATING SYSTEM 9

UNIT II RTOS CONCEPTS 9

UNIT III µC/OS II BASICS 9

UNIT IV RTOS INTERPROCESS FUNCTIONS 9
Message Mailbox Management: Creating a Mailbox-Waiting for a Message box-Sending Message to a Mailbox. Message Queue Management: Creating Message Queue-Deleting a Message Queue-Waiting for a Message at a Queue-Sending Message to a Queue-Flushing a Queue- Semaphores in µC/OS II.

UNIT V MEMORY MANAGEMENT AND RTOS APPLICATIONS 9
Memory Management: Memory Control Blocks- Creating Partition- Obtaining a Memory Block function -Returning a Memory Block function - Porting µC/OS II: Development tools- Directories and Files. RTOS for Image Processing - RTOS for Voice Over IP - RTOS for Control Systems.

REFERENCES:

TOTAL: 45 PERIODS
COURSE OUTCOMES
After Completion of the course, the students are able to
- Explain the basics of Ethernet and Embedded communication protocols.
- Design interfacing circuit using USB and CAN bus.
- Discuss the concepts of embedded Ethernet and wireless embedded networking.

UNIT I EMBEDDED COMMUNICATION PROTOCOLS 9

UNIT II USB 2.0 AND CAN BUS 9
USB bus 2.0 - Introduction - Speed Identification on the bus - USB States - USB bus communication: Packets -Data flow types - Enumeration - Descriptors - CAN Bus: Introduction - Frames – Bit stuffing - Types of errors - Nominal Bit Timing - A simple application Program with CAN.

UNIT III ETHERNET BASICS 9
Elements of a network- Inside Ethernet - Building a Network: Hardware options Cables, Connections and network speed - Internet protocol in local and internet communications - Inside the Internet protocol.

UNIT IV EMBEDDED ETHERNET 9

UNIT V WIRELESS EMBEDDED NETWORKING 9

REFERENCES:

TOTAL: 45 PERIODS
COURSE OUTCOMES:
After Completion of the course, the students are able to
- Choose Image transform for particular Image processing task.
- Explain Image enhancement and segmentation algorithms.
- Design Image processing applications using openCV functions.
- Discuss the architecture of OMAP processor.

UNIT I IMAGE FUNDAMENTALS AND IMAGE TRANSFORMS 9
Introduction, Image sampling, Quantization, Resolution, Image file formats, Need for transform, image transforms, 2 D Discrete Fourier transform, Importance of phase, Walsh transform, Hadamard transform, Haar Transform, Slant transform, Discrete cosine transform, KL transform, singular value Decomposition.

UNIT II IMAGE ENHANCEMENTS 9
Introduction to image enhancement, Enhancement in spatial domain, enhancement through point operation, Types of point operation, Histogram manipulation, Linear Gray level transformation, Nonlinear Gray level transformation, Local or neighbourhood operation, Median filter, Image sharpening, Bit plane slicing, Image enhancement in the frequency domain.

UNIT III IMAGE SEGMENTATION 9
Introduction to image segmentation, Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour.

UNIT IV OPENCV 9

UNIT V OMAP 3530 ARCHITECTURE 9

TOTAL: 45 PERIODS
REFERENCES
COURSE OUTCOMES
After Completion of the course, the students are able to

- Develop simple systems which contains both Analog and Digital logic blocks.
- Explain the architecture of RENESAS, OMAP and interfacing external peripherals.

PART I  PSoC
Experiments to understand the architecture and developing simple systems which contains both Analog and Digital logic blocks.

1. LED Blinking : Software Control
2. LED Blinking : Hardware Control
3. LED Blinking : PWM Control
4. Moving Characters Display
5. Interrupt generation using timer
6. ADC-LCD Interface
7. Cap sense – Buttons and Sliders test

PART II  RENESAS
Experiments to understand the architecture and interfacing external peripherals.

1. Measure room temperature and display the same in a LCD with keyboard interaction
2. Design a real time clock using 7-segment displays and create keyboard interaction for the operations.
3. Create a Foreground – background application system using interrupt structure of RL78
4. Design an embedded system to measure the unknown signal frequency using timer/counter of RL78.
5. Program to illustrate the use of PWM Signal to vary the Brightness of LEDs.

PART III  OMAP
1. Experiments to understand the architecture and interfacing external peripherals.
2. Zigbee based wireless communication using Higher end processor
COURSE OUTCOMES
After Completion of the course, the students are able to
- Use encryption techniques and ciphers.
- Practice key management and authentication concepts.
- Summarize the network and system security concepts.

UNIT I SYMMETRIC CIPHERS
Overview - Classical Encryption Techniques - Block Ciphers and the Data Encryption standard

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

UNIT III NETWORK SECURITY APPLICATIONS

UNIT IV SYSTEM SECURITY

UNIT V SECURITY PROTOCOLS FOR ADHOC WIRELESS NETWORK

TOTAL: 45 PERIODS

REFERENCES
COURSE OUTCOMES
After Completion of the course, the students are able to
- Know the concepts of data communication, encoding and congestion control
- Perform hardware and software simulation of I/O communication blocks and virtual instrumentation.
- Analyze Virtual instrument based control unit.

UNIT I NETWORK FUNDAMENTALS 9
Data communication networking - Data transmission concepts – Communication networking - Overview of OSI- TCP/IP layers - IP addressing - DNS - Packet Switching Routing -Fundamental concepts in SMTP, POP, FTP, Telnet, HTML, HTTP, URL, SNMP, ICMP.

UNIT II DATA COMMUNICATION 9
Sensor data acquisition, Sampling, Quantization, Filtering ,Data Storage, Analysis using compression techniques, Data encoding - Data link control - Framing, Flow and Error control, Point to point protocol, Routers, Switches , Bridges - MODEMs, Network layer Congestion control, Transport layer- Congestion control, Connection establishment.

UNIT III VIRTUAL INSTRUMENTATION 9
Block diagram and Architecture - Data flow techniques - Graphical programming using GUI - Real time system - Embedded controller - Instrument drivers - Software and hardware simulation of I/O communication blocks - ADC/DAC - Digital I/O - Counter , Timer, Data communication ports.

UNIT IV MEASUREMENT AND CONTROL THROUGH INTERNET 9
Web enabled measurement and control - data acquisition for Monitoring of plant parameters through Internet - Calibration of measuring instruments through Internet, Web based control - Tuning of controllers through Internet

UNIT V VI BASED MEASUREMENT AND CONTROL 9
Simulation of signal analysis and controller logic modules for Virtual Instrument control Case study of systems using VI for data acquisition, Signal analysis, controller design, Drives control.

TOTAL: 45 PERIODS
REFERENCES
7. Kevin James, "PC Interfacing and Data Acquisition: Techniques for measurement, Instrumentation and control, Newnes, 2000."
COURSE OUTCOMES
After Completion of the course, the students are able to

- Review the hardware and software of embedded systems
- Explain the system modeling and partitioning of hardware and software
- Analyze the hardware software co-synthesis and concurrent design process models
- Discuss the memory types and interfacing peripherals with embedded systems

UNIT I INTRODUCTION TO EMBEDDED HARDWARE AND SOFTWARE 9

UNIT II SYSTEM MODELLING WITH HARDWARE/SOFTWARE PARTITIONING 9

UNIT III HARDWARE/SOFTWARE CO-SYNTHESIS 9
The Co- Synthesis Problem, State- Transition Graph, Refinement and Controller Generation, Distributed System Co-Synthesis.

UNIT IV MEMORY AND INTERFACING 9
Memory: Memory write ability and storage performance - Memory types – composing memory - Advance RAM interfacing communication basic - Microprocessor interfacing I/O addressing - Interrupts - Direct memory access - Arbitration multilevel bus architecture - Serial protocol - Parallel protocols - Wireless protocols - Digital camera example.

UNIT V CONCURRENT PROCESS MODELS AND HARDWARE SOFTWARE CO-DESIGN 9

TOTAL: 45 PERIODS
REFERENCES
7. Giovanni De Micheli, Rolf Ernst Morgon, "Reading in Hardware/Software Co-Design Kaufmann Publishers, 2001."
COURSE OUTCOMES
After Completion of the course, the students are able to

- Know the basis of communication protocols and Network protocols
- Explain the design principles of routing and security protocols
- Categorize Network development platforms and its related tools

UNIT I       COMMUNICATION PROTOCOLS
Physical Layer and Transceiver Design Considerations – Choice of modulation schemes – Comparison of various modulation schemes – MAC protocols for WSN – Address and Name management - Assignment of MAC addresses.

UNIT II      NETWORK PROTOCOLS

UNIT III     ROUTING AND SECURITY PROTOCOLS

UNIT IV      INFRASTRUCTURE ESTABLISHMENT
Topology control – Clustering – Time Synchronization – Localization and Positioning – Sensor Tasking and Control

UNIT V       SENSOR NETWORK PLATFORMS AND TOOLS
Sensor network programming challenges – Node level software platforms – Node level simulators State-centric programming

REFERENCES
ESE2E VLSI ARCHITECTURE AND DESIGN METHODOLOGIES

COURSE OUTCOMES
After Completion of the course, the students are able to
- Discuss the CMOS and Analog VLSI Design.
- Explain the ASIC Concepts.
- Distinguish different FPGA Architectures.
- Write Verilog coding for given circuit.

UNIT I CMOS DESIGN 9
Overview of digital VLSI design methodologies - Logic design with CMOS-transmission gate circuits-
Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- CMOS IC technology - Stick diagram for all basic gates, Layout diagram for Inverter.

UNIT II ANALOG VLSI DESIGN 9
Introduction to analog VLSI- Design of 2 stage and 3 stage Op Amp -High Speed and High frequency Op Amps-Super MOS-Analog primitive cells.

UNIT III PROGRAMMABLE LOGIC DEVICES 9

UNIT IV ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING 9

UNIT V VERILOG HDL 9
Introduction to Verilog HDL, hierarchical modeling concepts, modules and port definitions, gate level modeling, data flow modeling, behavioral modeling, task & functions, Verilog Simulation and synthesis, Verilog coding for Carry Look ahead adder, Multiplier, ALU, Shift Registers using structural modeling – Multiplexer, Sequence detector, Traffic light controller using behavioral modeling.

TOTAL: 45 PERIODS

REFERENCES:
COURSE OUTCOMES
After Completion of the course, the students are able to

- Know the programming concepts of embedded systems
- Explain embedded C programming concepts
- Discuss design and analysis of software development process
- Describe web architectural framework protocols and unified modeling language

UNIT I PROGRAMMING EMBEDDED SYSTEMS
Embedded Program - Role of Infinite loop - Compiling, Linking and locating downloading and debugging - Emulators and simulators - Microcontroller – External peripherals - Types of memory - Memory testing - Flash Memory.

UNIT II C AND ASSEMBLY
Overview of Embedded C - Compilers and Optimization - Programming and Assembly Register usage conventions - typical use of addressing options - instruction sequencing procedure call and return - parameter passing - retrieving parameters - everything in pass by value - temporary variables.

UNIT III EMBEDDED PROGRAM AND SOFTWARE DEVELOPMENT PROCESS

UNIT IV UNIFIED MODELLING LANGUAGE

UNIT V WEB ARCHITECTURAL FRAMEWORK FOR EMBEDDED SYSTEM

TOTAL: 45 PERIODS

REFERENCES
COURSE OUTCOMES
After Completion of the course, the students are able to
- Know the basics of OSI reference model and basics of OS and RTOS
- Explain the concepts of data structure, tables and management devices concepts.
- Demonstrate the multi board communication software design.

UNIT I  INTRODUCTION
Communication Devices - Communication Echo System - Design Consideration – Host Based Communication - Embedded Communication System - OS Vs RTOS.

UNIT II  SOFTWARE PARTITIONING

UNIT III  TABLE AND DATA STRUCTURES
Partitioning of Structures and Tables - Implementation - Speeding Up access - Table Resizing - Table access routines - Buffer and Timer Management - Third Party Protocol Libraries.

UNIT IV  MANAGEMENT SOFTWARE

UNIT V  MULTI BOARD COMMUNICATION SOFTWARE DESIGN

TOTAL: 45 PERIODS

REFERENCES
COURSE OUTCOMES
After completion of the course, the students are able to
- Know the basics of wireless sensor networks
- Discuss about the sensor network components, architecture and environments
- Explain the design principles of WSN and wireless standards
- Design the Smart Sensors and Applications of WSN

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

UNIT II ARCHITECTURES 9

UNIT III NETWORK SCENARIOS AND DESIGN PRINCIPLES FOR WSN 9
Sensor Network Scenarios – Optimization goals and Figure of Merit – Design principles for WSNs – Gateway concepts - Wireless channel.

UNIT IV SMART SENSORS 9

UNIT V APPLICATIONS AND PROTOCOL IMPLEMENTATION ON WSN 9
Home control - Medical Applications - Civil and Environmental Engineering applications – Wildfire monitoring- Habitat monitoring. Embedding LEACH protocol on ARM7 TDM microcontroller using C language- Embedding Caesar cipher encryption and decryption algorithm on ARM 7 TDM microcontroller using C language

TOTAL: 45 PERIODS

REFERENCES
COURSE OUTCOMES

After Completion of the course, the students are able to

- Know the basics of embedded Linux and its concepts
- Know about the bootloader, role of bootloader and universal bootloader concepts.
- Describe power management, interrupt management, timer management and device drivers.

UNIT I            LINUX FUNDAMENTALS            10
Introduction to Linux - Basic Linux commands and concepts - Shells - Advanced shells and shell scripting - Linux File System: concepts, types, representation.

UNIT II           INTRODUCTION TO EMBEDDED LINUX                                                  8

UNIT III         BOOTLOADERS                                                                                                8

UNIT IV          BOARD SUPPORT PACKAGE AND EMBEDDED STORAGE                10
Inclusion of BSP in kernel build procedure - - Memory Map - Interrupt Management Timers - UART - Power Management - Embedded Storage - Flash Map - Memory Technology Device (MTD) –MTD Architecture - MTD Driver for NOR Flash - The Fla Mapping drivers

UNIT V           DEVICE DRIVERS                                                                                           9
Device driver introduction – driver methods-Building and running modules - Communicating with hardware –USB Driver : Basics, USB and Sysfs - USB Urbs-writing a USB device driver.

TOTAL: 45 PERIODS

REFERENCES

COURSE OUTCOMES
After Completion of the course, the students are able to
- Know about the background of ARM family specifically ARM Cortex M3 Processor, Operating Modes, and Instruction set etc.
- Discuss about the memory systems and debugging strategy of Cortex Processor.

UNIT I  ARM CORTEX – M3 PROCESSOR  9

UNIT II  INSTRUCTION SET  9
Cortex-M3 Instruction Set, Mnemonics, Syntax and their Description – Unsupported Instructions – Moving Data Instructions – Pseudo Instructions – Data Processing Instructions – Unconditional Branch Instructions – Decision and Conditional Branch Instructions – Combined Compare and Conditional Branch Instructions – Instruction Barrier and Memory Barrier Instructions Saturation Operations – Useful Instructions – MSR and MRS Instructions – Multiply and Divide Instructions – SDIV and UDIV Instructions – REV, REVH and REVSH Instructions – Reverse Bit – SXTB, SXTH, UXTB and UXTH Instructions – UBFX and SBFX – LDRD and STRD Table Branch Byte and Table Branch Halfword

UNIT III  MEMORY SYSTEMS  9

UNIT IV  DEBUGGING ARCHITECTURE  9
Debugging Features – Coresight Overview – Debug Modes – Debugging Events – Accessing Register Content in Debug – Trace System – Trace Components – DWT, ITM, ETM and TPIU Flash Patch and Breakpoint Unit – Advanced High-Performance Bus Access Port – ROM Table.

UNIT V  CORTEX - M3 PROGRAMMING  9
Overview- A typical Development Flow - Simple programs using C - CMSIS : Background, areas of standardization, Organization, Benefits – Assembly language programs for Cortex-M3-Bit band for Semaphores-Working with bit field extract and table branch.

TOTAL: 45 PERIODS
REFERENCES