

**CURRICULUM AND SYLLABUS
REGULATION – 2011**

**M.Tech. EMBEDDED SYSTEM TECHNOLOGIES
(4 Semesters)**



**KALASALINGAM UNIVERSITY
FACULTY OF ELECTRICAL ENGINEERING
KRISHNANKOIL – 626 190**

M.Tech	EMBEDDED SYSTEM TECHNOLOGIES	REGULATION 2011
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KALASALINGAM UNIVERSITY
ANAND NAGAR, KRISHNAN KOIL
M.Tech - EMBEDDED SYSTEM TECHNOLOGIES
CURRICULUM

Semester I

Code No.	Subject	L	T	P	C
MAT5101	Applied Mathematics	3	0	0	3
EEE5101	Embedded Hardware	3	0	0	3
EEE5102	Advanced Digital System Design	3	0	0	3
EEE5103	Embedded Processors	3	0	0	3
EEE5104	Object Oriented Programming	3	0	0	3
EEE****	Elective I	3	0	0	3
EEE5181	Embedded System Laboratory I	0	0	3	2
	Total	18	0	3	20

Semester II

Code No.	Subject	L	T	P	C
EEE5105	Embedded System Design	3	0	0	3
EEE5106	Multiprocessor System on Chip	3	0	0	3
EEE5107	Real Time Operating System	3	0	0	3
EEE5108	Embedded Networks and Protocols	3	0	0	3
EEE5109	Embedded Communication Software Design	3	0	0	3
EEE****	Elective II	3	0	0	3
EEE5182	Embedded System Laboratory II	0	0	3	2
	Total	18	0	3	20

Semester III

Code No.	Subject	L	T	P	C
EEE****	Elective III	3	0	0	3
EEE****	Elective IV	3	0	0	3
EEE****	Elective V	3	0	0	3
EEE6198	Project Work Phase I	0	0	18	6
	Total	9	0	18	15

Semester IV

Code No.	Subject	L	T	P	C
EEE6199	Project Work Phase II	0	0	36	12

TOTAL CREDITS – 67

ELECTIVES

Code No.	Subject	L	T	P	C
I Year					
EEE5013	Digital Signal Processing	3	0	0	3
EEE5111	Data Communication and Networks	3	0	0	3
EEE5112	Robotics & Automation	3	0	0	3
EEE5113	Data Compression Techniques	3	0	0	3
EEE5114	Wireless & Mobile Communication	3	0	0	3
EEE5115	Multimedia Systems	3	0	0	3
EEE5116	Computer Architecture	3	0	0	3
EEE5117	Soft Computing	3	0	0	3
EEE5118	Distributed Embedded Computing	3	0	0	3
EEE5119	Real Time Systems	3	0	0	3
II Year					
EEE6110	Embedded control of Electrical Drives	3	0	0	3
EEE6111	Application Specific Integrated Circuits	3	0	0	3
EEE6112	Mixed Signal Embedded systems	3	0	0	3
EEE6113	Hardware Software co-Design	3	0	0	3
EEE6114	Network Processors	3	0	0	3
EEE6115	Network Security	3	0	0	3
EEE6116	Digital Image Processing	3	0	0	3
EEE6117	VHDL & Programmable Devices	3	0	0	3s
EEE6118	Advanced Embedded Systems	1	1	1	1
EEE6119	Embedded Linux				

MAT5101	APPLIED MATHEMATICS	L	T	P	C
		3	0	0	3

CLASSICAL OPTIMIZATION TECHNIQUES

Statement of optimization problem – classification – optimization technique - Unconstrained Optimization – Equality constraints – Inequality constraints – Lagrange Multiplier method – Kuhn-Tucker Condition - Indirect search methods – Gradient of a function – Steepest descent method – Conjugate gradient method – Newton’s method.

LINEAR PROGRAMMING

Standard form of Linear programming problem – definitions and theorems – Solution of linear simultaneous equations – Simplex algorithm – graphical method – Dual simplex method – Transportation problem - Applications.

MATRIX THEORY

Matrix Norms - Jordan Canonical form Generalized Eigen vectors - Singular Value Decomposition - Pseudo Inverse - Least square Approximations – QR Algorithm.

PROBABILITY AND RANDOM PROCESS

Probability - Random Process variables - Binomial, Poisson, Geometric, Uniform Normal, Exponential Distributions - Moment generating functions and their properties - Functions of random variables.

QUEUING THEORY

Single and multiple server Markovian queuing models - Customer impatience- Queuing applications.

TEXT BOOK:

1. Singiresu S.Rao ,Engineering Optimization , New Age International (P) Ltd , 2001
2. Gupta S.C. and Kapoor V.K. Fundamentals of Mathematical Statistics, sultan Chand and sons , Newdelhi,2001
3. Lewis.D.W. Matrix Thoery, Allied Publishers, Chennai 1995

REFERENCES :

1. S.D.Sharma, Operations Research, Kedar Nath Ram Nath & co,20
2. M.K. Ochi., Applied Probability and Stochastic processes, John Wiley & sons 1992.
3. Bronson.R. Matrix operations , Schaums outline series , Tata Mcgraw Hill, Newyork.

EEE5101	EMBEDDED HARDWARE	L	T	P	C
		3	0	0	3

EMBEDDED HARDWARE

Concept – Memory, DMA, Block diagram of embedded computer, Register, Stack, Firmware, Schematic – component with net – Power sources – Regulator – LM78xx Regulator, Max602/603 Regulator, Max1615 Regulator, Max724 Regulator - battery, low power design.

BUILDING HARDWARE

Tools – Development kit – measurement tools – Construction tools – Soldering – soldering surface mount component using rework station – quick construction – Bread boarding - wire wrapping - PCB – JTAG.

ADDING PERIPHERALS AND SERIAL PORT

Adding peripherals using SPI, Serial peripheral interface - adding peripherals using I2C – overview of I2C - adding real time clock with I2C – adding small display with I2C – Serial port – UART – RS232 – RS422 – RS485 – IrDA – USB – device classes – device packet – physical interface – Implementing USB interface.

ANALOG AND DIGITAL CONVERSION

Amplifier – ADC – Interfacing an external ADC – Temperature sensor – Light sensor – Accelerometer – Pressure sensor – Magnetic field sensor – DAC – PWM – Motor control – Switching big loads – MC33298.

EMBEDDED APPLICATIONS

Motor control with PIC – PIC based environment data logger – AVR based data logger – simple 68HC11 based computer – MAXQ overview – Simple 68000 based computer – DSP 56805 based computer.

TEXT BOOKS

1. John Catsoulis, Designing Embedded Hardware, O'Reilly Publisher, 2nd Edition, 2005.
2. Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C, CMP Books, 2005.

REFERENCES

1. Ball S. R, Embedded microprocessor Systems – Real World Design, Prentice Hall, 2001.
2. Daniel W. Lewis, Fundamentals of Embedded Software where C and Assembly meet, PHI, 2002.

EEE5102	ADVANCED DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	0	3

SEQUENTIAL CIRCUIT DESIGN

Overview of IC technology - Digital hardware components - Design process of digital hardware - Analysis of Clocked Synchronous Sequential Networks (CSSN), Modeling of CSSN – State Stable Assignment and Reduction - Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – State Assignment, Problem and the Transition Table – Design of ASC.

HARDWARE DESCRIPTION LANGUAGES

Introduction to VHDL - Types of modeling - Behavioral Modeling - Transport vs. Inertial Delay - Simulation Deltas - Sequential Processing - Process Statement - Signal Assignment vs. Variable Assignment - Sequential Statements - Data Types - Subprograms and Packages - Predefined Attributes - Configurations - Subprogram Overloading - VHDL synthesis - Design Examples.

VHDL CODE

Design and testing BCD Adders, multiplexer, Demultiplexer, Encoder, Decoder, ALU, RAM, flip flops, registers, Latches Counters circuits using VHDL - Synchronous versus Asynchronous Circuits design - Implement state machines using VHDL codes - Design of a Simple Microprocessor.

PROGRAMMABLE DEVICES

EPROM to Realize a Sequential Circuit – Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a PAL – EPROM – Realization State machine using PLD - Complex Programmable Logic Devices and Field Programmable Gate Arrays - Altera Series FPGAs and Xilinx Series FPGAs.

TESTING OF LOGICAL CIRCUITS

Fault model - Hazards - Fault diagnosis and testability algorithms, Fault Table Method – Path Sensitization Method – Boolean Difference Method - Kohavi Algorithm - Tolerance Techniques - Test Generation – Masking Cycle - DFT Schemes - Built-in Self Test.

TEXT BOOKS:

1. Dueck, [“Digital Design with CPLD Application and VHDL”](#)
2. Stephen Brown and Zvonk Vranesic, [“Fundamentals of digital logic with VHDL Design”](#) Tata McGraw Hill, 2005
3. Brain Holdsworth, Clive Woods, [“Digital logic Design”](#) Newnws Fourth Edition 2004

REFERENCE BOOKS:

1. John M Yarbrough, “Digital Logic applications and Design” Thomson Learning, 2001.
2. Nripendra N Biswas, “Logic Design Theory” Prentice Hall of India, 2001.
3. Parag K Lala, “Digital System design using PLD” BS Publications, 2003.
4. Charles H. Roth , “Fundamentals of Logic design” Thomson Learning, 2004.

EEE5103	EMBEDDED PROCESSORS	L	T	P	C
		3	0	0	3

8086 MICROPROCESSOR

Intel 8086 microprocessor - Architecture - Instruction set and assembler directives - Addressing modes - Assembly language programming - Procedures - Macros - Interrupts and interrupt service routines - 8086 signals and timing - MIN/MAX mode of operation - Addressing memory and I/O - Multiprocessor configurations - System design using 8086 – virtual 8086 model – processor flags – application programming.

8051 MICROCONTROLLER

Architecture of 8051 - Signals - Operational features - Memory and I/O addressing - Interrupts - Instruction set – Applications - The software model – functional description – central processing unit pin descriptions – reduced instruction set computer concepts – bus operations – super scalar architecture – pipelining – branch prediction – the instruction and caches – floating point unit – protected mode operation – segmentation – paging, protection, multitasking, exception and interrupts, input/output .

MOTOROLA MICROCONTROLLER

Instructions and addressing modes of 68HC11 – operating modes – hardware reset, interrupt system – parallel I/O ports – flats – real time clock – programmable timer – pulse accumulator – serial communication interface – analog to digital converter – hardware expansion – basic assembly language programming.

PIC MICROCONTROLLER

Central processing unit architecture – instruction set – interrupts – timers – memory – I/O port expansion – inter integrated circuit bus for peripheral chip access – A/D converter – universal asynchronous receiver transmitter – advanced risc machine architecture – advanced risc machine organization and implementation, advanced risc machine instruction set, thumb instruction set, basic advanced risc machine Assembly language program, advanced risc machine central processing unit cores.

ARM CONTROLLER

Architecture – Memory Organization – Pipeline and cache concepts – ARM (32 bit) Architecture - Instruction set and Assembly Language Programming - ARM instruction set and THUMB instruction set - Switching between ARM and THUMB instructions.

TEXT BOOKS

1. John B. Peatman, Design with PIC Micro controller, Pearson Education, 2003.
2. ARM processor data book.
3. 8051 Microcontroller & Embedded systems By Madizi M.A.

REFERENCES

1. David Calcutt, Fred Cowan, and Hassan Parchizadeh, 8051 Microcontrollers: An imprint of Elsevier, 2006.
2. Barry B. Breg, The Intel Microprocessors Architecture, Programming and Interfacing, PHI, 2002.
3. Steave Furber, ARM system – on – chip architecture, Addison Wesley, 2000.

EEE5104	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

PROGRAMMING IN C

Introduction to C - Data types – Structures – Functions – Arrays – Pointers – strings - Hello world program - Super Loop architecture - delay function - Controlling the port pins - Reading switches - Basic techniques for reading and writing the port pins - Dealing with switch bounce - Adding structure to your code.

EMBEDDED C

Selection of processors - programming language - operating system - Object-oriented programming with C - The Project Header (MAIN.H) – The Port Header (PORT.H) Meeting real-time constraints - Creating ‘hardware delays’ using Timer - need for ‘timeout’ mechanisms - Creating loop timeouts - Testing loop timeouts - Creating hardware timeout - Testing a hardware timeout.

MULTI-STATE SYSTEMS AND FUNCTION SEQUENCES IN C

Introduction-Implementing a Multi-State (Timed) system - Traffic light sequencing - Implementing a Multi-State (Input/Timed) system - Controller for a washing machine Using the serial interface - Basic RS-232 protocol - Asynchronous data transmission and baud rates - Flow control - The software architecture - Using the on-chip UART for RS-232 communications - Memory requirements - Displaying elapsed time on a PC 225 - The Serial-Menu architecture 237- Data acquisition.

PROGRAMMING IN C++

C++ Initiation - The main() Function-C++ Comments-C++ Preprocessor - iostream File - Header Filenames - C++ Output – Statements – Functions - User-Defined Functions - Dealing with Data, Simple Variables -Floating-Point Numbers - C++ Arithmetic Operators- Pointers, Arrays, and Pointer Arithmetic .- Loops and Relational Expressions-Function Overloading - Objects and Classes - Working with Classes - Classes and Dynamic Memory Allocation - Class Inheritance.

EMBEDDED C++

Introduction-conceptual and physically realizable objects - Real objects - Object classes-Encapsulation - Abstract classes - Dynamic Memory Allocation - Class hierarchies-Inheritance - Multiple inheritance - Polymorphism - An example object hierarchy - Naming convention - Developing an object class - Parallel port class – stage I, stage II & III - Advantages and disadvantages.

TEXT BOOKS:

1. Michael J. Pont, “Embedded C” Addison Wesley, Pearson Education Limited 2002.
2. Dr. Jayantha Katupitiya, Mr. Kim Bentley “Interfacing with C++ -Programming Real-World Applications” Pringer Verlag Berlin Heidelberg 2006

REFERENCE BOOKS:

1. Matthew Wilson, “Imperfect C++ Practical Solutions for Real-Life programming” Addison Wesley Professional 2004.
2. Stephen Prata, “C++ Primer Plus” Sams Publishing, 2005.
3. Michael Barr, “Programming Embedded Systems in C and C++ Publisher: O'Reilly 1999.
4. Jean Labrosse , Jack Ganssle, Tammy Noergaard , Robert Oshana, Colin Walls, Keith Curtis, Jason Andrews, David J. Katz, Rick Gentile, Kamal Hyder, Bob Perrin, “Embedded Software” Elsevier 2008.
5. Alan Holub, “Compiler Construction In C” Prentice Hall, 2005.

EEE5181	EMBEDDED SYSTEM LABORATORY I	L	T	P	C
		0	0	3	2

1. Micro controller 8051/8031 based application programs with kit
 - a) Conversion programs
 - b) Interface program using parallel port
 - c) Interface program using serial port
 - d) Application programs with 8051 kit
2. Controller program using keil software
 - a) ALU design
 - b) RAM / ROM
 - c) Flash
3. Testing real time operating system environment and system programming
 - a) RTxTiny
 - b) Real time operating system solutions
4. Signal application programming
 - a) ADC
 - b) DAC
 - c) Cryptographic algorithm implementation
5. Modelsim programming with hardware description languages
 - a) Using vhdl
 - b) Using verilog

6. Third party design tools using
 - a) Mentor graphics
 - b) Cadence

EEE5105	EMBEDDED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

INTRODUCTION

Embedded design life cycle – product specification – hardware / software partitioning, detailed hardware and software design, integration, product testing.

SELECTION PROCESS AND PARTIONING DECISION

Selection processes– Performance – Measuring tools - Meaningful bench marking, RTOS availability, tool chain availability, other issues in selection processes partitioning decision – hardware / software duality, coding hardware – application specific integrated circuit revolution – managing the risk, co-verification.

DEVELOPMENT ENVIRONMENTS

Execution environment, memory organization, system startup – hardware manipulation – memory, mapped access, speed and code density Software techniques - Interrupt service routines – watch dog timers – flash memory basic toolset – host and debugging – remote debugging – read only memory emulators, logic analyzer.

INCIRCUIT EMULATORS

BDM, JTAG, and Nexus – Background debug mode – ICE - Bullet proof run control – real time trace, hardware break points – timing constraints – triggers setting.

TESTING

Testing, bug tracking, reduction of risks and costs – performance – unit testing, regression testing, choosing test cases – functional tests, coverage tests, testing embedded software.

TEXT BOOK

1. Arnold S. Berger, Embedded System Design CMP books, USA 2002.

REFERENCES

1. Wayne Wolf, Computers as Components: Principles of Embedded Computer Systems Design, Morgan Kaufman Publishers, 2004.
2. Jean J. Labrosse Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C, CMP Books, 2005.
3. David E. Simon, An Embedded Software Primer, Perason education, 2003.

EEE5106	MULTIPROCESSOR SYSTEMS-ON-CHIPS	L	T	P	C
		3	0	0	3

FUNDAMENTALS OF MPSoC

Introduction to SoC - MPSoCs - Challenges - Design Methodologies - Hardware Architectures - Software - Energy-Aware Processor Design - Energy-Aware Memory System Design - Energy-Aware On-Chip Communication System Design - Energy-Aware Software.

NETWORKS ON CHIP

Technology Trends - Signal Transmission on Chip - Micro network Architecture and Control - Software Layers - Architecture of Embedded Microprocessors - Embedded Versus High-Performance Processors A Common Foundation - Pipelining Techniques - Survey of General-purpose 32-bit Embedded Microprocessors - Virtual Simple Architecture (VISA): Integrating Non-Determinism Without Undermining Safety.

PERFORMANCE MODELING AND ANALYSIS FOR MPSoC DESIGN

The Limitations of Traditional ASIC Design - Extensible Processors as an Alternative to RTL - Toward Multiple - Processor SoCs - Processors and Disruptive Technology - Complex Heterogeneous Architectures - Design Challenges - State of the Practice - Chapter Objectives - Structuring Performance Analysis - Architecture Component Performance Modeling and Analysis - Process Execution Modeling - Modeling Shared Resources - Global Performance Analysis.

ARCHITECTURES AND RTOS FOR MPSoC

On-Chip Communication Architectures - System-Level Analysis for Designing Communication Architectures - Design Space Exploration for Customizing Communication Architectures - Adaptive Communication Architectures - Communication Architectures for Energy/Battery-Efficient Systems - Platform Architecture - Tasks - Basics of Scheduling - Basic System Model - Uniprocessor Systems - Multiprocessor Systems.

APPLICATIONS BASED DESIGN FOR MPSoC

ASIC to System and Network on Chip - Basics for MPSoC Design Models for Component Abstraction Component - Based Design Environment Memory Wrapper Generation - Component-Based Design of a VDSL Application.

TEXT BOOK

1. Wayne Wolf, "Multiprocessor Systems-on-Chips", Morgan Kaufmann Publishers, 2005.

REFERENCE

1. Joseph A. Fisher, Paolo Faraboschi and Cliff Young, "Embedded Computing" Morgan Kaufmann Publishers, 2005.

EEE5107	REAL TIME OPERATING SYSTEM	L	T	P	C
		3	0	0	3

REAL-TIME KERNEL CONCEPT

Foreground/background systems - Non-preemptive kernel, Preemptive kernel - Critical sections: resources – multitasking - context switching – scheduling - reentrancy - task priorities - mutual exclusion - semaphores - Deadlock - Synchronization - Event Flags - inter task communications - interrupts -Clock Tick -Memory Requirements.

μC/OS-II KERNEL STRUCTURE

Tasks - task states - task control blocks - ready list - Task Scheduling - idle task - CPU usage- μC/OS-II features - Interrupts under μC/OS-II-Task Management - create a task delete a task - check the size of a task's stack - change a task's priority -suspend and resume a task - Time Management.

μC/OS-II'S SERVICES

Inter task Communication and Synchronization – semaphores - message mailboxes and message queues - Memory Management - Porting μC/OS –II.

LINUX KERNEL

Sources and Installation - Installing the Kernel Source-lilo and Boot-up Sequence- Configuring and installing the Kernel-Threads - Multi-threading under Linux- Modules-Exporting Symbols using Non-exported Symbols and System Calls From Modules-Debugging Techniques - Error-Interrupt Handling.

EMBEDDED LINUX

Real Time Operating System - System Architecture - selection of platform, booting Linux, debugging Interfacing - Asynchronous serial communication interfacing- parallel port interfacing, USB interfacing, Memory interfacing, Synchronous serial communication interfacing - System Integration - Building root file system - Kernel Compilation for ARM.

TEXT BOOKS:

1. Jean J. Labrosse “[μC/OS, The Real-Time Kernel](#)”, the publisher, Paul Temme, 2002
2. Linux Device Drivers (Nutshell Handbook) O'Reilly Publishers 2000
3. Craig Hollabaugh , “[Embedded Linux: Hardware, Software, and Interfacing](#)”, Addison Wesley 2002

REFERENCE BOOKS:

1. Sreekrishnan Venkateswaran ,”Essential Linux Device Drivers” Prentice Hall 2008
2. Christopher Hallinan, “Embedded Linux Primer: A Practical, Real-World Approach” Prentice Hall, 2006
3. μC/OS-II User Manual

EEE5108	EMBEDDED NETWORKS AND PROTOCOLS	L	T	P	C
		3	0	0	3

INTRODUCTION TO CAN

The CAN bus - General - Concepts of bus access and arbitration - Error processing and management - From concept to reality - Patents, licenses and certification - CAN protocol: 'ISO 11898-1'-Content of the different ISO/OSI layers of the CAN bus- Compatibility of CAN 2.0A and CAN 2.0B.

ETHERNET BASICS

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components – Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.

EMBEDDED ETHERNET

Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.

INDUSTRIAL NETWORKING PROTOCOL

LIN – Local Interconnect Network - Basic concept of the LIN 2.0 protocol - Fail-safe SBC – Gateways - Managing the application layers - Safe-by-Wire - Safe-by-Wire Plus - Audio-video buses - I2C Bus - D2B (Domestic digital) bus - MOST (Media oriented systems transport) bus - IEEE 1394 bus or 'FireWire'- profi bus.

RF COMMUNICATION

Radio-frequency communication: internal and external - Remote control of opening parts - PKE (passive keyless entry) and passive go- TPMS (tyre pressure monitoring systems) - Wireless networks- GSM-Bluetooth - IEEE 802.11x - NFC (near-field communication).

TEXT BOOKS:

1. Dominique Paret , “Multiplexed Networks for Embedded Systems- CAN, LIN, Flexray, Safe-by-Wire...” John Wiley & Sons Ltd- 2007.
2. Jan Axelson ‘Embedded Ethernet and Internet Complete’, Penram publications

REFERENCE BOOKS:

1. Glaf P.Feiffer, Andrew Ayre and Christian Keyold, “Embedded networking with CAN and CAN open”. Embedded System Academy 2005.
2. Gregory J. Pottie, William J. Kaiser “Principles of Embedded Networked Systems Design”, Cambridge University Press, Second Edition, 2005.

EEE5109	<u>EMBEDDED COMMUNICATION SOFTWARE DESIGN</u>	L	T	P	C
		3	0	0	3

COMMUNICATION

Open system interconnect reference model – communication devices – communication echo system – design consideration – host based communication – embedded communication system – operating system vs real time operating system.

SOFTWARE PARTITIONING

Limitation of strict layering – tasks and modules – modules and task decomposition – layer2 switch – layer3 switch / routers – protocol implementation – management types – debugging protocols.

TABLES 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.

MANAGEMENT SOFTWARE

Device management – management schemes – router management – management of sub system architecture – device to manage configuration – system start up and configuration.

MULTI BOARD COMMUNICATION SOFTWARE DESIGN

Multi board architecture – single control card and multiple lines card architecture – interface for multi board software – failures and fault – tolerance in multi board systems – hardware independent development – using a COTS board – development environment – test tools .

TEXT BOOK

1. Sridhar T, Designing Embedded Communication Software, CMP Books, 2004.

REFERENCE

1. Greg Utas, Robust Communication Software John, Wiley and Sons, 2005.

EEE5182	EMBEDDED SYSTEM LABORATORY II	L	T	P	C
		0	0	3	2

1. Real time operating system solution and tools
 - a) MCOS
 - b) RTxTiny
2. Very large scale integration designing with various tools and design methodologies
 - a) AT40K field programmable gate array series-synthesis-design-simulation of application programs
 - b) Xilinx electron design automation design tools-device programs – programmable read only memory programming
 - c) ALTERA and mentor graphics – integrated circuit design tools
3. Embedded digital signal processing based system designing.
 - a) Code compressor studio (CCS) for embedded digital signal processing using Texas tool kit
 - b) Analog digital signal processing tool kit
4. IPCORE usage in voice over internet protocol through SoC2 tools.
 - a) Cypress PsoC designing tools
 - b) SoPC designing tools
5. FPSLIC synthesis, designing and testing and BLUE TOOTH wireless communication designing.
 - a) ATMEL FPSLIC tools
 - b) CYPRESS BLUE TOOTH tools.
6. Cell based application specific integrated circuit - sample programs for risk and security plans.

ELECTIVES

EEE5013	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

DIGITAL SIGNAL PROCESSING

Digital signal processing - sampling of analog signals, selection of sample frequency, signal-processing systems, frequency response, transfer functions, signal flow graphs, filter structures, adaptive digital signal processing algorithms, discrete fourier transform - the discrete fourier transform, fast fourier transform - fast fourier transform algorithm, image coding, discrete cosine transforms.

DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS

Finite impulse response filters – finite impulse response filter structures, finite impulse response chips, infinite impulse response filters, specifications of infinite impulse response filters, mapping of analog transfer functions, mapping of analog filter structures.

MULTIRATE DSP

Decimation by a factor D, interpolation by a factor i, filter design and implementation for sampling rate conversion, multistage implementation of sampling rate conversion – sampling rate conversion by an arbitrary factor – applications of multirate signal processing – digital filter banks – quadrature mirror filter bank.

DSP PROCESSORS AND DSP APPLICATIONS

General purpose Digital Signal Processors: Texas Instruments TMS320 family – Motorola DSP 56333 family – analog devices ADSP 2100 family – Instruction set of TMS320C50 – simple programs. FFT Spectrum Analyser – musical sound processing. Power System Applications, Image Processing Applications.

ARITHMETIC UNITS AND INTEGRATED CIRCUIT DESIGN

Conventional number system, redundant number system, residue number system - bit-parallel and bit-serial arithmetic, basic shift accumulator, reducing the memory size, complex multipliers, improved shift - accumulator - layout of very large scale integrated circuits, fast fourier transform processor, discrete cosine transform processor and interpolator as case studies.

TEXT BOOK

1. Monson H. Hayes, Statistical Digital Signal Processing and modeling, John Wiley and sons, 2003.
2. Sajit K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998
3. John G. Proakis and Dimitris G. Manolakis, 'Digital Signal Processing, Algorithms and Applications'. PHI, New Delhi, 1995

REFERENCES

1. Lars Wanhammer, DSP Integrated Circuits, Academic press, New York, 2002.
2. Oppenheim. A. V, Discrete-time Signal Processing Pearson education, 2000.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, Digital signal processing – A practical approach, 2nd edition, Pearson edition, Asia.

4. Keshab K. Parhi, VLSI digital Signal Processing Systems design and Implementation, John Wiley and Sons, 2004.

EEE5111	DATA COMMUNICATION & NETWORKS	L	T	P	C
		3	0	0	3

NETWORK TOPOLOGIES

Components of network – topologies – wireless area network / local area network – open system interconnection - international standard organization layered architecture modulation and demodulation – bit error rates – line coding – error correcting codes.

DATA LINK LAYER

Design issues – cyclic redundancy check technique and sliding window techniques – performance analysis of sliding window techniques – framing formats – case study – high level data link control protocols – medium access control – carrier sense multiple access / collision detection, token ring and token bus, fiber distributed data interface – wireless local area network – performance analysis of medium access control protocols – bridges.

NETWORK LAYER

Circuit switching – packet switching – design issues – internet protocol addressing and internet protocol diagram – routers and gateways – routing –sub netting – classless inter domain routing protocol, internet control message protocol, address resolution protocol, reverse address resolution protocol, internet protocol version 6, quality of service

TRANSPORT LAYER

Transmission control protocol and user datagram protocol – error handling and flow control – congestion control – transmission control protocol retransmission – timeout – socket abstraction.

APPLICATION SERVICES

Simple mail transfer protocol (SMTP) – file transfer protocols (FTP), telnet, world wide web (WWW), hypertext transfer protocol (HTTP), domain name service (DNS), security, multimedia applications.

TEXT BOOK

1. William Stallings, Data and Computer Communications, 7th Edition, Prentice Hall, 2005.

REFERENCES

1. Larry Peterson, Bruce S Davie, Computer Networks: A Systems Approach, Morgan Kaufmann Publishers, 2nd Edition, 2005.
2. James F Kurose, Computer Networking: A Top – Down Approach Featuring the Internet, Addison Wesley, 2nd Edition, 2002.

EEE5112	ROBOTICS AND AUTOMATION	L	T	P	C
		3	0	0	3

ROBOTIC CONCEPTS

Definition – need - robot classification - terminology and systems - benefits and limitations – basic problems of intelligent robotics – computers for logic and logic programming.

ROBOT SYSTEM

Robot physical configuration - basic robot motions - end effectors work cell control and interlocks.

ROBOT SENSORS

Vision tactile and proximity – voice - robot control - kinetics and necessary control systems – advanced programming skills to write artificial intelligence robotic programs in LISP.

ROBOT APPLICATION

General considerations and problems - material transfer - machine loading – welding - spray coating - processing operations – assembly – inspection - robot in FMS and automation – robots in health care and intelligent homes.

ROBOT ARM KINEMATICS

Robot arm kinematics - homogenous transformation matrix – robot arm dynamic control by computer – two joint robotic arm - kinematics equations - [Human arm kinematics for robot based rehabilitation](#).

TEXT BOOK

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 2004.

REFERENCES

1. World Robotics, International Federation of Robotics, 2006.
2. Aures R. U, Miller S. M, Robotics applications and social implications, 2002.
3. Tanner W.R, Industrial Robots, Vol.-1 and Vol.-2, 2005.
4. Groover M. P, and Zimmer E. W, Computer Aided Design and Manufacturing, Prentice Hall, 2000.

EEE5113	DATA COMPRESSION TECHNIQUES	L	T	P	C
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COMPRESSION FEATURES

Special features of multimedia – graphics and image data representations – fundamental concepts in video and digital audio – storage requirements for multimedia applications - need for compression - taxonomy of compression techniques – overview of source

coding, source models, scalar and vector quantization theory – evaluation techniques – error analysis and methodologies.

TEXT COMPRESSION

Compaction techniques – huffmann coding, adaptive huffmann coding, arithmetic coding, shannon-fano coding, dictionary techniques, Lempel-Ziv-Welch family algorithms .

AUDIO COMPRESSION

Audio compression techniques - μ - law and a- law companding. frequency domain and filtering – basic sub-band coding – application to speech coding – G.722 – Application to audio coding – moving picture expert group audio, progressive encoding for audio – silence compression, speech compression techniques – format and CELP Vocoders.

IMAGE COMPRESSION

Predictive techniques – delta modulation, pulse code modulation, differential pulse code modulation - optimal predictors and optimal quantization – contour based compression – transform coding – joint photographic expert group standard – sub-band coding algorithms - design of filter banks – wavelet based compression - implementation using filters – embedded zerotree wavelet, set partitioning in hierarchical trees coders – joint photographic expert group 2000 standards - JBIG, JBIG2 standards.

VIDEO COMPRESSION

Video compression techniques and standards – moving picture expert group video coding I - moving picture expert group – 1 and 2 – moving picture expert group video coding II - moving picture expert group – 4 and 7 – motion estimation and compensation techniques – H.261 Standard, digital visual interface technology – production level video performance – digital visual interface real time compression, packet video.

TEXT BOOKS

1. Peter Symes, Digital Video Compression, McGraw Hill Pub., 2004.
2. Mark S. Drew, Ze-Nian Li, Fundamentals of Multimedia, PHI, 1st Edition, 2003.

REFERENCES

1. Khalid Sayood, Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon, Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q.Shi, Huifang Sun, Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.

EEE5114	<u>WIRELESS & MOBILE COMMUNICATION</u>	L	T	P	C
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TRANSMISSION CONCEPTS

Technical background - transmission fundamentals - communication networks - protocols and TCP/IP Suite - antennas and propagation signal - encoding techniques - spread spectrum coding and error control.

WIRELESS NETWORKING

Satellite communications - cellular transmission principles - cordless systems and wireless local loop mobile internet protocol and wireless access protocol.

WIRELESS LANs

Wireless local area network technology – institute of electrical and electronics engineering, 802 - 11 wireless local area network standard.

CDMA STANDARDS

System architecture for code division multiple access - network and data link layers of code division multiple access – signaling applications in code division multiple access system - voice applications in code division multiple access system.

RF ENGINEERING AND FACILITIES

Wireless data - cellular communication fundamentals - global system for mobile communication architecture and interfaces - radio link features in global system for mobile communication - global system for mobile communication logical channels and frame structure - speech coding in global system for mobile communication.

TEXT BOOK

1. William Stallings, Wireless Communication and Networking, Pearson Education, Asia 2005.

REFERENCES

1. Garg. V. K, Smolik. K, Applications of CDMA in Wireless/Personal Communications, Prentice Hall, 2004.
2. Garg V. K, Principles and Applications of GSM, Prentice Hall, 2002.

EEE5115	<u>MULTIMEDIA SYSTEMS</u>	L	T	P	C
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MULTIMEDIA CONCEPTS

Introduction – multimedia modalities, channels and medium – interaction – communicative interaction – objects and agents – channels of communication – artificial

languages – natural communication – meta-languages – components of interactive multimedia systems.

KNOWLEDGE AND USER UNDERSTANDING

Knowledge – basic idea of knowledge – a working definition – knowledge representation, knowledge elicitation – know about user applying user knowledge – acquiring user knowledge – user profiling, user modelling .

INTERACTION, INTERFACE & SEMIOTICS

Traditional human computer interaction – modalities and the interface – interface channels – functionality and usability – visual appearance and graphic design – multimedia content – semiotics – idea of a sign – complex signs – semiotics and media.

TEXT AND SOUND

Visual perception of text – images on page – meaning and text readability – text and the screen – modality of sound – channels of communication – combining sound channels – technology of sound – musical instrument digital interface.

IMAGES

Psychology of vision – representational images – juxtaposition of images – perception of motion – constructing a shot – shots into narrative – modern languages of film and television.

TEXT BOOK

1. Prabhat K. Andleigh, and Kiran Thakrar, Multimedia System Design, PHI, 2004.

REFERENCES

1. Mark Elsom-Cook, Principles of Interactive Multimedia McGraw Hill, International Edition 2001.
2. Fred. T. Hofstetter, Multimedia Literacy, Tata McGraw Hill, International 3rd Edition, 2004.

EEE5116	COMPUTER ARCHITECTURE	L	T	P	C
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DESIGN CONCEPTS

Review of fundamentals of central processing unit, memory and I/O – performance evaluation – instruction set principles – design issues – example architectures – instruction level parallelism-pipelining and handling hazards – dynamic scheduling –

dynamic hardware prediction – multiple issue – hardware based speculation – limitations of instruction level programming – case studies.

INSTRUCTION LEVEL PARALLELISM

Compiler techniques for exposing instruction level programming – static branch prediction – very long instruction word and electronic privacy information center – advanced compiler support – hardware support for exposing parallelism - hardware versus software speculation mechanisms – IA 64 and Itanium processor.

MEMORY AND I/O

Cache memory - cache performance, reducing cache miss penalty and miss rate, reducing hit time – main memory and performance – memory technology - types of storage devices – buses – redundant array of independent disk – reliability, availability and dependability – I/O performance measures – designing an I/O system.

INTERCONNECTION NETWORKS AND CLUSTERS

Simple network - interconnection network media, connecting more than two computers - network topology - practical issues for commercial interconnecting networks – examples - crosscutting issues for interconnecting networks – clusters - designing a cluster fallacies and pitfalls.

MULTIPROCESSORS AND THREAD LEVEL PARALLELISM

Symmetric and distributed shared memory architectures – performance issues – synchronization – models of memory consistency – multithreading.

TEXT BOOK

1. John L. Hennessey, and David A. Patterson, Computer Architecture: A Quantitative Approach, 3rd Edition, Morgan Kaufmann, 2003.

REFERENCE

1. Sia D, Fountain T, and P. Kacsuk, Advanced computer Architectures: A Design Space Approach, Addison Wesley, 2004.

EEE5117	SOFT COMPUTING	L	T	P	C
		3	0	0	3

ARTIFICIAL INTELLIGENCE (AI)

Intelligent search – Predicate Calculus – Learning Systems - Knowledge Representation and Reasoning – Semantic Networks – Frames - Knowledge Acquisition - Expert Systems - Intelligent Control.

ARTIFICIAL NEURAL NETWORKS (ANN)

Biological Neural Networks - Artificial Neural Networks - Topology of ANN – Learning rules – Supervised, Unsupervised, and Reinforcement Learning – Single Layer and Multilayer Perceptrons - Feed forward neural networks-The Back-propagation Training

Algorithm - Binary and Continuous Hopfield Network - Associative Memory - Self-Organizing Maps.

FUZZY SYSTEMS

Classical Set – Fuzzy Set – Linguistic Variables - Membership Functions - Fuzzy relations – Fuzzy rules and Reasoning – Fuzzy Inference Systems – Defuzzification methods – Mamdani, Sugeno and Tsukamoto Fuzzy models – Fuzzy Decision Making – Fuzzy logic control

GENETIC ALGORITHMS (GA)

Survival of Fittest – GA Terminologies - Working Principle of Binary GA – Genetic Operators – Reproduction, Cross over and Mutation – Similarities and Differences with traditional methods – Schema and Schemata – GA theorem – Real Coded GA - Advantages and Limitations of GA – Applications.

CASE STUDIES/APPLICATIONS

Case studies in neural networks -Applications of fuzzy logic control - Hybrid system-Neuro fuzzy system-ANFIS applications.

TEXT BOOK:

1. J.S.R. Jang., et al., “Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence”, PHI, 2010.
2. Amit Konar, “Artificial Intelligence and Soft Computing: Behavioral and Cognitive modeling of the Human Brain”, CRC Press, 2008.

REFERENCE BOOKS:

1. Simon Haykin, “Neural Networks and Learning Machines”, 3rd Edition, Pearson, 2009.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, 3rd Edition, Wiley, 2010.
3. Kalyanmoy Deb, “Multi-Objective Optimization Using Evolutionary Algorithms”, 3rd Edition, Wiley, 2010.
4. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Pearson, 2009.
5. N.P.Padhy, “Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2008.

EEE5118	DISTRIBUTED EMBEDDED COMPUTING	L	T	P	C
		3	0	0	3

THE HARDWARE INFRASTRUCTURE

Broad Band Transmission facilities – Open Interconnection standards – Local Area Networks – Wide Area Networks – Network management – Network Security – Cluster computers.

INTERNET CONCEPTS

Capabilities and limitations of the internet – Interfacing Internet server applications to corporate databases HTML and XML Web page design and the use of active components.

DISTRIBUTED COMPUTING USING JAVA

IO streaming – Object serialization – Networking – Threading – RMI – multicasting – distributed databases – embedded java concepts – case studies.

EMBEDDED AGENT

Introduction to the embedded agents – Embedded agent design criteria – Behaviour based, Functionality based embedded agents – Agent co-ordination mechanisms and benchmarks embedded-agent. Case study: Mobile robots.

EMBEDDED COMPUTING ARCHITECTURE

Synthesis of the information technologies of distributed embedded systems – analog/digital co-design – optimizing functional distribution in complex system design – validation and fast prototyping of multiprocessor system-on-chip – a new dynamic scheduling algorithm for real-time multiprocessor systems.

TEXT BOOKS:

1. Dietel & Dietel, “JAVA how to program”, Prentice Hall 1999.
2. Sape Mullender, “Distributed Systems”, Addison-Wesley, 1993.

REFERENCES:

1. George Coulouris and Jean Dollimore, “Distributed Systems – concepts and design”, Addison –Wesley 1988.
2. “Architecture and Design of Distributed Embedded Systems”, edited by Bernd Kleinjohann C-lab, Universitat Paderborn, Germany, Kluwer Academic Publishers, Boston, April 2001, 248 pp.

EEE5119	REAL TIME SYSTEMS	L	T	P	C
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REAL TIME COMPUTING

Introduction – issues in real time computing, structure of a real time system, task classes, performance measures for real time systems, estimating program run times - task assignment and scheduling – classical uniprocessor scheduling algorithms - uniprocessor scheduling tasks, task assignment, mode changes, and fault tolerant scheduling.

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.

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.

COMMUNICATION

Real – time communication – communications media, network topologies protocols, fault tolerant routing. fault tolerance techniques – fault types, fault detection, fault error containment redundancy, data diversity, reversal checks, integrated failure handling.

CLOCK SYNCHRONIZATION

Introduction to clock synchronization – clock, a nonfault – tolerant synchronization algorithm, impact of faults, fault tolerant synchronization in hardware, fault tolerant synchronization in software.

TEXT BOOK

1. Krishna C. M, Kang G, Shin, Real Time Systems, McGraw Hill, 2003.

REFERENCES

1. Herma K, Real Time Systems – Design for distributed Embedded Applications, Kluwer Academic, 2002.

EEE6110	EMBEDDED CONTROL OF ELECTRICAL DRIVES	L	T	P	C
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ELECTRICAL DRIVES

Electric drive systems - solid state devices - solid state switching circuits - characteristics of electric motors - speed torque characteristics of electric motors – pulse width modulation techniques - rating and heating of motors.

AC AND DC ELECTRIC DRIVES

Introduction – classification of electric drives – dynamic conditions of a drive system – stability considerations of electrical drives – direct current choppers, inverters, cycloconverters, alternating current voltage controllers, stepper motor.

POWER CONVERTERS

Induction motor drives – synchronous motor drives – direct current drives – block diagram representation of drive systems, signal flow graph representation of the systems, transient response, frequency response, stability of controlled drives.

CLOSED LOOP CONTROL OF ELECTRICAL DRIVES

Drive considerations – control system components – mathematical preliminaries – Nyquist stability criterion – assessment of relative stability using Nyquist criterion –

closed loop frequency response – sensitivity analysis in frequency domain – proportional integral derivative controllers – feed back compensation, robust control system design.

MICROCONTROLLERS AND DSP APPLICATIONS

Introduction – dedicated hardware system versus microcontroller control – application areas and functions of microcontroller and digital signal processor in drive technology – control of electric drives using microcontroller and digital signal processor – control system design of microcontroller based variable speed drives – applications in textile mills, steel rolling mills, cranes and hoist drives, cement mills, sugar mills, machine tools, coal mills, paper mills, centrifugal pumps, turbo compressors.

TEXT BOOKS

1. Vedam Subrahmanyam, Electric drives – concepts and applications, Tata McGraw Hill publishing company limited, New Delhi, 2003.
2. John. B. Peatman, Design with PIC Microcontrollers, Pearson Education, Asia 2004.

REFERENCES

1. Mohammed. A. El-sharkawi, Fundamentals of Electrical drives, Books/cole, Thomson learning, A division of Thomson learning, 2001.
2. Gopal. M, Control System Principles and Design, Tata McGraw Hill publishing company limited, New Delhi, 2nd edition 2001.
3. Nagrath. I. J, Gopal. M, Control Systems Engineering, New age international publishers, 3rd edition, 2000.

EEE6111	APPLICATION SPECIFIC INTEGRATED CIRCUITS	L	T	P	C
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INTEGRATED CIRCUIT LIBRARY DESIGN

Types of application specific integrated circuit – design flow – complementary metal oxide semiconductor transistors, complementary metal oxide semiconductor design rules – combinational logic cell – sequential logic cell – data path logic cell – transistors as resistors – transistor parasitic capacitance – logical effort – library cell design, library architecture.

PROGRAMMABLE CELLS

Anti fuse – static random access memory – electrical programmable read only memory and electrically erasable programmable read only memory technology – PREP bench marks – actel ACT - xilinx LCA - altera FLEX - altera MAX direct current and alternating current inputs and outputs – clock and power inputs – xilinx I/O blocks.

DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY

Actel ACT – xilinx LCA – xilinx EPLD – altera MAX 5000 and 7000 – altera MAX 9000 altera FLEX – design systems – logic synthesis – half gate application specific

integrated circuit – schematic entry – low level design language – PLA tools – EDIF – CFI design representation.

LOGIC SYNTHESIS, SIMULATION AND TESTING

Verilog and logic synthesis – very high speed integrated circuit hardware description language and logic synthesis - types of simulation – boundary scan test, fault simulation, automatic test pattern generation.

ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING

System partition – field programmable gate array partitioning – partitioning methods – floor planning, placement – physical design flow, global routing, detailed routing, special routing – circuit extraction .

TEXT BOOK

1. Smith M. J. S, Application – Specific Integrated Circuits, Addison Wesley Longman Inc., 2003.

REFERENCES

1. Andrew Brown, VLSI Circuits and Systems in Silicon, McGraw Hill, 2004.
2. Brown. S. D, Francis. Et.al, Field Programmable Gate Arrays Kluewer Academic Publishers, 2003.
3. Mohammed Ismail and Terri Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 2004.
4. Kung. S. Y, et.al, VLSI and Modern Signal Processing, Prentice Hall, 2005.

EEE6112	MIXED SIGNAL EMBEDDED SYSTEMS	L	T	P	C
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ANALOG AND MIXED SIGNAL CIRCUITS

Design and verification – applications challenges - market perspective - analog complementary metal oxide semiconductor circuits - current mirrors - current and voltage references - bandgap references.

CMOS AMPLIFIERS

Opamps - high performance complementary metal oxide semiconductor amplifiers – comparators – characterization - two stage open loop comparators - discrete time comparators - high-speed comparators.

SWITCHED CAPACITOR CIRCUITS

Switched capacitor (SC) introduction - offset cancellation - clock feed - through - switched capacitor amplifiers - switched capacitor integrators - switched capacitor filters.

DAC AND ADC

Introduction - Nyquist rate converters – over sampling converters - pipelined/parallel converters - high speed analog to digital converter design, high speed digital to analog converter design and mixed signal design for radar application - analog to digital converter and digital to analog converter modules used for LIGO.

PHASE LOCKED LOOP

Frequency synthesizers - design of phase locked loop and frequency synthesizers – phase locked loop with voltage driven oscillator – phase locked loop with current driven oscillator – embedded phase locked loop test - phase locked loop synthesizer oscillator by MC14046B.

TEXT BOOKS

1. Allen, CMOS Analog Circuit Design, Oxford, 2005.
2. Behzad Razavi, Design of Analog CMOS integrated circuit, Tata McGraw Hill, 2004.

REFERENCES

1. Breems, Continuous-Time Sigma Delta Modulations for A/D Conversion, Kluwer, 2002.
2. Michelle Steyaert, Analog Circuit Design, Kluwer, 2003.
3. Gray and Meyer, Analysis and Design of Analog Integrated Circuits, Wiley, 2004.
4. Baker, CMOS Mixed-Signal Circuit Design, Wiley, 2004.

EE6113	HARDWARE SOFTWARE CO-DESIGN	L	T	P	C
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CO-DESIGN CONCEPTS

Problem description, goals of co-design, co-design steps, co-design approaches and accomplishments, challenges.

ARCHITECTURES FOR EMBEDDED SYSTEMS

Single processor-coprocessor architecture - multiprocessor architectures – internet protocol core based design - reconfigurable systems - platform-based design - interfacing embedded systems to the external environment: sensors.

SYSTEM MODELING AND SPECIFICATION

Models of computation - finite state machines, extended finite state machines, control/data flow nets, petrinets, task graphs, hierarchical models - system specification languages - statecharts, very high speed integrated circuit hardware description language, system C.

PERFORMANCE MODELING

System-level performance modeling vs. low-level performance modeling - modeling of execution speed (system latency) and energy consumption for hardware and software - estimation of memory requirements.

HARDWARE SYNTHESIS

High-level synthesis - behavioral specification of hardware, module set allocation, resource binding, operation scheduling, controller synthesis.

TEXT BOOK

1. Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C, CMP Books, 2005.

REFERENCES

1. Arnold S. Berger, Embedded System Design CMP books, USA 2002.
2. Wayne Wolf, Computers as Components: Principles of Embedded Computer Systems Design, Morgan Kaufman Publishers, 2005.

EEE6114	NETWORK PROCESSORS	L	T	P	C
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EMBEDDED SYSTEM

Embedded system design life cycle – selection process – partitioning decision – development environment – special software techniques – basic toolset – BDM, joint text action group and Nexus – ICE an integrated solution – testing.

INSTRUCTION SET

Ti320C67xx and Ti320C55xx processors - instruction set - programming examples – pipelining of instructions – special features of Ti320C67xx and Ti320C55xx processor.

APPLICATIONS

Case Study - 67xx processor in image / video applications – applications with IXP1200 network processors, single chip OC-12 network processor, CISCO network processor.

SPECIAL PROCESSORS

Ti320C55xx digital signal processor - architecture of Ti320C55xx processor - instruction set and programming examples - Ti320C67xx digital signal processor - introduction to very large instruction word architecture - arithmetic computation – memory accessing.

CASE STUDY OF DSP

Case Study- digital signal processor for audio/video applications – architecture of digital signal processors – digital signal processor versus conventional processors – fixed point arithmetic versus floating point arithmetic – digital signal processor for embedded systems.

TEXT BOOKS

1. Rulph Chassing Wiley, DSP Applications Using C and the TMS320C6x DSK, 2005.
2. Arnold S Berger Embedded System Design, CMP Books, 2005.

REFERENCES

1. Sen M Kuo and Bob H Lee, Real Time Signal Processing, John Wiley and Sons, 2005.
2. Raj Kamal, Embedded Systems – Architecture, Programming and Design, Tata McGraw Hill, New Delhi, 2006.

EEE6115	NETWORK SECURITY	L	T	P	C
		3	0	0	3

SECURITY

Classical security - techniques and computer network security concepts - confidentiality and security - security policy and operations life cycle - security system development and operations.

SECURE NETWORKING THREATS

Attack process - attacker types - vulnerability types - attack results, attack taxonomy, threats to security, physical security - biometric systems - monitoring controls, data security, intrusion, detection systems.

ENCRYPTION TECHNIQUES

Conventional techniques - modern techniques – data encryption standard, data encryption standard chaining, triple data encryption standard, RSA algorithm - key management - message authentication - hash algorithm - authentication requirements, functions secure hash algorithm, message digest algorithm - digital signatures – advanced encryption standard algorithms.

DESIGNING OF SECURE NETWORKS

components of a hardening strategy - network devices - host operating systems – applications - based network services - rogue device detection - network security technologies - the difficulties of secure networking - security technologies - emerging security technologies general design considerations - layer 2 security considerations – internet protocol addressing design considerations – internet control message protocol design considerations - routing considerations - transport protocol design considerations.

NETWORK SECURITY PLATFORM

Network security platform options -network security device best practices - common application design considerations - E-Mail – distributed network security – hyper text transfer protocol – file transfer protocol - instant messaging - IPsec virtual private network design considerations – virtual private network basics - IPsec modes of operation and security options - topology considerations - secure network management and network security management - organizational realities - protocol capabilities - network security management – firewalls - cyber laws.

TEXT BOOKS

1. Sean Convery, Network Security Architectures, Published by Cisco Press, 1st edition, 2004.
2. William Stallings, Cryptography and Network Security Pearson Education, Asia, 2005.

REFERENCES

1. Charels P. Pfleeger, Security in Computing, Prentice Hall, 2005.
2. Jeff Crume, Inside Internet Security, Addison Wesley, 2005.

EEE6116	DIGITAL IMAGE PROCESSING	L	T	P	C
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FUNDAMENTALS OF IMAGE PROCESSING

Introduction – fundamental steps in digital image processing – image sensing and acquisition – sampling and quantization – pixel relationships – color fundamentals and models, file formats, image operations – arithmetic, geometric and morphological – sampling and quantization.

IMAGE ENHANCEMENT

Spatial domain - gray level transformations – histogram processing – basics of spatial filtering – smoothing and sharpening spatial filters - frequency domain - filtering in frequency domain – discrete fourier transform, fast fourier transform – smoothing and sharpening filters – homomorphic filtering.

IMAGE SEGMENTATION AND FEATURE ANALYSIS

Detection of discontinuities – edge operators – edge linking and boundary detection – threshold – region based segmentation – morphological watersheds – motion segmentation, feature analysis and extraction – spatial techniques.

MULTI RESOLUTION ANALYSIS AND COMPRESSIONS

Multi resolution analysis: image pyramids – multi resolution expansion – wavelet transforms in one dimension - image compression: fundamentals – models – elements of information theory – error free compression – lossy compression – image compression standards

APPLICATIONS OF IMAGE PROCESSING

Image classification – image recognition – image understanding – video motion analysis – image fusion – steganography – digital compositing – mosaics – color image processing – string matching – syntactic recognition of strings.

TEXT BOOK

1. Jain. K, Fundamentals of Digital Image Processing, Pearson Education, 2003.

REFERENCES

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 2nd edition, Pearson Education, 2003.
2. Milan Sonka et.al Image Processing, Analysis and Machine Vision, 2nd edition, Thomson Learning, 2001.

EEE6117	VLSI DESIGN & PROGRAMMABLE DEVICES	L	T	P	C
		3	0	0	3

VHDL FUNDAMENTALS

Fundamental concepts – modeling digital systems – domains and levels of modeling – modeling languages – very high speed integrated circuit hardware description language modeling concepts – scalar data types and operations – constants and variables – scalar types – type classification – attributes and scalar types – expressions and operators – sequential statements – if statements, case statements, null statements, loop statements, assertion and report statements.

COMPOSITE DATA TYPES AND BASIC MODELING CONSTRUCTS

Arrays – unconstrained array types – array operations and referencing – records – basic modeling constructs – entity declarations – architecture bodies – behavioral descriptions – structural descriptions – design processing - case study - a pipelined multiplier accumulator.

SUBPROGRAMS AND PACKAGES

Procedures – procedure parameters – concurrent procedure call statements – functions – overloading – visibility of declarations – packages and use clauses – package declarations – package bodies – use clauses – the predefined – aliases - aliases for data objects – aliases for non-data items - case study - a bit-vector arithmetic package.

SIGNALS, COMPONENTS, CONFIGURATIONS

Basic resolved signals – IEEE Std_Logic_1164 resolved subtypes – resolved signal parameters – generic constants – parameterizing behavior, parameterizing structure – components and configurations – components, configuring component instances, configuration specification – generate statements – generating iterative structure – conditionally generating structures – configuration of generate statements - case study - the DLX computer system.

ABSTRACT DATA TYPES AND FILES

Access types – linked data structures – abstract data types using packages – files and input/output – files – the package textio – verilog - case study - queuing networks.

TEXT BOOK

1. Peter J. Ashenden, The Designer's Guide to VHDL, Morgan Kaufmann Publishers, San Francisco, Second Edition, May 2001.

REFERENCES

1. Zainalabedin Navabi, VHDL Analysis and Modeling of Digital Systems, McGraw Hill International Editions, 2nd Edition, 2005.
2. James M. Lee, Verilog Quick start, Kluwer Academic Publishers, 2nd Edition, 2005.

EEE6118	ADVANCED EMBEDDED SYSTEMS	L	T	P	C
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INTRODUCTION TO EMBEDDED HARDWARE AND SOFTWARE

Terminology – Gates – Timing diagram – Memory – Microprocessor buses – Direct memory access – Interrupts – Built interrupts – Interrupts basis – Shared data problems – Interrupt latency - Embedded system evolution trends – Interrupt routines in an RTOS environment.

SYSTEM MODELLING WITH HARDWARE/SOFTWARE PARTITIONING

Embedded systems, Hardware/Software Co-Design, Co-Design for System Specification and modelling- Single- processor Architectures, Multi-Processor Architectures, comparison of Co-Design Approaches, Models of Computation, Requirements for Embedded System Specification, Hardware/Software Partitioning Problem, Hardware/Software Cost Estimation, Generation of Partitioning by Graphical modelling, Formulation of the HW/SW scheduling, Optimization.

HARDWARE/SOFTWARE CO-SYNTHESIS

The Co-Synthesis Problem, State-Transition Graph, Refinement and Controller Generation, Distributed System Co-Synthesis.

MEMORY AND INTERFACING

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.

CONCURRENT PROCESS MODELS AND HARDWARE SOFTWARE CO-DESIGN

Modes of operation – Finite state machines – Models – HCFSL and state charts language – state machine models – Concurrent process model – Concurrent process – Communication among process – Synchronization among process – Implementation – Data Flow model. Design technology – Automation synthesis – Hardware software co-simulation – IP cores – Design Process Model.

TEXT BOOKS:

1. David. E. Simon, “An Embedded Software Primer”, Pearson Education, 2001.
2. Tammy Noergaard, ”Embedded System Architecture, A comprehensive Guide for Engineers and Programmers”, Elsevier, 2006

REFERENCES:

1. Raj Kamal, “Embedded Systems- Architecture, Programming and Design” Tata McGraw Hill, 2006.

2. Frank Vahid and Tony Gwargie, “Embedded System Design”, John Wiley & sons, 2002.

4. Steve Heath, “Embedded System Design”, Elsevier, Second Edition, 2004
5. 4. Ralf Niemann, “Hardware/Software Co-Design for Data Flow Dominated Embedded Systems”, Kluwer Academic Pub, 1998.

5. Jorgen Staunstrup, Wayne Wolf, “Harware/Software Co-Design:Principles and Practice”, Kluwer Academic Pub, 1997.

6. Giovanni De Micheli, Rolf Ernst Morgon, “Reading in Hardware/Software Co-Design” Kaufmann Publishers, 2001.

EEE6119	EMBEDDED LINUX	L	T	P	C
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FUNDAMENTALS OF OPERATING SYSTEMS

Overview of operating systems – Process and threads – Processes and Programs – Programmer view of processes – OS View of processes – Threads - Scheduling – Non preemptive and preemptive scheduling – Real Time Scheduling – Process Synchronization – Semaphores – Message Passing – Mailboxes – Deadlocks.

LINUX FUNDAMENTALS

Introduction to Linux – Basic Linux commands and concepts – Logging in - Shells - Basic text editing - Advanced shells and shell scripting – Linux File System –Linux programming - Processes and threads in Linux - Inter process communication – Devices – Linux System calls.

INTRODUCTION TO EMBEDDED LINUX

Embedded Linux – Introduction – Advantages- Embedded Linux Distributions - Architecture - Linux kernel architecture - User space – linux startup sequence – GNU cross platform Tool chain.

BOARD SUPPORT PACKAGE AND EMBEDDED STORAGE

Inclusion of BSP in kernel build procedure - The bootloader Interface – Memory Map – Interrupt Management – PCI Subsystem – Timers – UART – Power Management – Embedded Storage – Flash Map – Memory Technology Device (MTD) –MTD Architecture - MTD Driver for NOR Flash – The Flash Mapping drivers – MTD Block and character devices – mtdutils package – Embedded File Systems – Optimizing storage space – Turning kernel memory.

EMBEDDED DRIVERS AND APPLICATION PORTING

Linux serial driver – Ethernet driver – I2C subsystem – USB gadgets – Watchdog timer – Kernel Modules – Application porting roadmap - Programming with pthreads – Operating System Porting Layer – Kernel API Driver - Case studies - RT Linux – uClinux.

TEXT BOOK:

1. Mark Mitchell, Jeffrey Oldham and Alex Samuel ‘Advanced Linux Programming’ New Riders Publications.

REFERENCES:

1. Dhananjay M. Dhamdhere, ‘Operating Systems A concept based Approach’, Tata Mcgraw-Hill Publishing Company Ltd
2. Matthias Kalle Dalheimer, Matt Welsh, ’Running Linux’, O’Reilly Publications 2005
3. P. Raghavan ,Amol Lad , Sriram Neelakandan, ‘Embedded Linux System Design and Development’, Auerbach Publications 2006
4. Karim Yaghmour, ‘Building Embedded Linux Systems’, O’Reilly Publications 2003