

**CURRICULUM AND SYLLABUS  
REGULATIONS – 2007**

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



**KALASALINGAM UNIVERSITY  
FACULTY OF ELECTRICAL ENGINEERING  
KRISHNANKOIL – 626190**



**KALASALINGAM UNIVERSITY**  
**ANAND NAGAR, KRISHNAN KOIL**  
**M.Tech - EMBEDDED SYSTEM TECHNOLOGIES**  
**CURRICULUM**  
**SEMESTER – I**

Code No.	Course Title	L	T	P	C
MAT5101	Applied Mathematics	3	0	0	3
EEE5101	Embedded Systems Design	3	0	0	3
EEE5102	Digital Systems Design	3	0	0	3
EEE5103	Microprocessors & Microcontrollers	3	0	0	3
EEE5104	Real Time Systems	3	0	0	3
EEE****	Elective –I	3	0	0	3
EEE5181	Embedded System Lab- I	0	0	3	2
	Total	18	0	3	20

**SEMESTER – II**

Code No.	Course Title	L	T	P	C
EEE5105	Embedded Control Systems	3	0	0	3
EEE5106	Software Technology for Embedded Systems	3	0	0	3
EEE5107	Real Time Operating System	3	0	0	3
EEE5108	Embedded Networking	3	0	0	3
EEE5109	Data Communication & Networks	3	0	0	3
EEE****	Elective –II	3	0	0	3
EEE5182	Embedded System Lab- II	0	0	3	2
	Total	18	0	3	20

**SEMESTER – III**

Code No.	Course Title	L	T	P	C
EEE6101	Hardware Software Co-design	3	0	0	3
EEE****	Elective III	3	0	0	3
EEE****	Elective IV	3	0	0	3
EEE6198	Project Work (Phase-I)	0	0	18	6
	Total	9	0	18	15

**SEMESTER – IV**

Code No.	Course Title	L	T	P	C
EEE6199	Project Work (Phase-II)	0	0	36	12

**TOTAL CREDITS – 67**

### LIST OF ELECTIVES

Course Code	Course Title	L	T	P	C
<b>I Year</b>					
EEE5110	Digital Signal Processing	3	0	0	3
EEE5111	Embedded Processors & Peripherals	3	0	0	3
EEE5112	Robotics & Automation	3	0	0	3
EEE5113	Cryptography	3	0	0	3
EEE5114	Data Compression Techniques	3	0	0	3
EEE5115	Wireless & Mobile Communication	3	0	0	3
EEE5116	Multimedia Systems	3	0	0	3
EEE5117	Computer Architecture	3	0	0	3
EEE5118	Soft Computing	3	0	0	3
<b>II Year</b>					
EEE6110	Embedded control of Electrical Drive	3	0	0	3
EEE6111	Application Specific Integrated Circuits	3	0	0	3
EEE6112	Mixed Signal Embedded systems	3	0	0	3
EEE6113	Embedded Communication Software 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

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.

### Z TRANSFORM AND FOURIER TRANSFORM

Z Transform – properties- Region of Convergence – Single and Double side Z Transform – Inverse Z Transform.

Discrete Fourier transform properties-signals – Inverse Fourier transform- Discrete convolutions – Discrete time Fourier Transform – Radix -2 fast Fourier Transform (FFT) - Decimation in time – Decimation in frequency- comparison between Z Transform and DFT.

### WAVELET TRANSFORM

Frames – wavelet series – Multiresolution – analysis – scaling functions and wavelet – Harr, sine and spline wavelets – Iterated filter banks – Construction of compactly supported wavelets – wavelet packets – Bilinear time – frequency distribution.

### RANDOM PROCESSES

Classification – stationary random processes – auto correlation – cross correlations – power spectral density – linear system with random input – gaussian Process.

### TEXT BOOK:

1. Singiresu S.Rao ,Engineering Optimization , New Age International (P) Ltd , 2001
2. Sanjit K Mitra, Digital signal Processing, Tata McGraw-Hill 3<sup>rd</sup> Edition, New Delhi, 2006.
3. Stephane Mallat, A Wavelet tour of signal Processing, Academic press, California, 2006.

### REFERENCES :

1. S.Salivahanan, A.Vallavaraj and C.Gnanapriya , “Digital signal processing”, TMH Edition, New Delhi.
2. Chui C.K., An introduction Wavelets, Academic Press, 1992.
3. Ochi M.K., Applied Probability and Stochastic processes, John Wiley & sons 1992.

EEE5101	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 Processes – Microprocessor Vs Micro Controller – Performance tools, Bench marking, RTOS Micro Controller – Performance tools, Bench marking, RTOS availability, Tool chain availability, Other issues in selection processes.

### PARTIONING

Partitioning decision – Hardware / Software duality, coding Hardware – ASIC revolution – Managing the Risk, Co-verification, execution environment, memory organization, System startup – Hardware manipulation – memory, mapped access, speed and code density.

### INTERRUPT SERVICE ROUTINES

Interrupt Service routines – Watch dog timers – Flash memory Basic toolset – Host and debugging – Remote debugging – ROM emulators, logic Analyzer, Caches – Computer optimization – Statistical profiling - Serial/parallel port interfacing and drivers, DMA & high speed I/O interfacing, Memory selection for embedded systems.

### EMULATORS AND TESTING

Buller proof run control – Real time trace, Hardware break points –Timing constraints – Triggers, Testing, Bug tracking, reduction of risks & costs – Performance – Unit testing, Regression testing, Choosing test cases – Functional tests, Coverage tests, Testing embedded software .

### REAL TIME SYSTEMS

Characterizing real time systems & tasks - Performance measures, Estimating program runtimes, Task assignment & scheduling, Real time operating systems (RTOS), Task management, Race condition - Inter-task communication, Implementation aspects and estimation modeling in embedded systems, Validation and debugging of embedded systems, Real time communication - Hardware-software co-design in an embedded system, Applications of real time systems.

### TEXT BOOK:

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

### REFERENCE BOOKS:

1. Wayne Wolf, Computers as Components: Principles of Embedded Computer Systems Design, “Morgan Kaufman Publishers, 2004.

- Jean J. Labrosse, “Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C”, the publisher, Paul Temme, 2004.
- Krishna,C.M, Kang, G.Shin, “Real Time Systems”, McGraw Hill, 2003.

<b>EEE5102</b>	<b>DIGITAL SYSTEM DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **SEQUENTIAL CIRCUIT DESIGN**

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits, ASM Chart, ASM Realization.

### **ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN**

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC, State Assignment, Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards, Essential Hazards, Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits.

### **FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS**

Fault Table Method – Path Sensitization Method – Boolean Difference Method, Kohavi Algorithm, Tolerance Techniques, The Compact Algorithm – Practical PLA’s – Fault in PLA – Test Generation – Masking Cycle, DFT Schemes, Built-in Self Test.

### **SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES**

EPLD to Realize a Sequential Circuit – Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a GAL – EPLD – Realization State machine using PLD, FPGA, Xilinx FPGA, Xilinx 2000, Xilinx 3000

### **SYSTEM DESIGN USING VHDL**

VHDL Description of Combinational Circuits – Arrays, VHDL Operators, Compilation and Simulation of VHDL Code - Modelling using VHDL – Flip Flops, Registers, Counters – Sequential Machine – Combinational Logic Circuits - VHDL Code for – Serial Adder, Binary Multiplier, Binary Divider – complete Sequential Systems – Design of a Simple Microprocessor.

### **TEXT BOOKS:**

- Charles H. Roth , “Fundamentals of Logic design” Thomson Learning, 2004.
- Donald G. Givone, “Digital principles and Design” Tata McGraw Hill 2002.

### **REFERENCE BOOKS:**

- John M Yarbrough, “Digital Logic applications and Design” Thomson Learning, 2001.
- Nripendra N Biswas, “Logic Design Theory” Prentice Hall of India, 2001.
- Parag K Lala, “Digital System design using PLD” BS Publications, 2003.

4. Stephen Brown and Zvonk Vranesic, “Fundamentals of Digital Logic with VHDL Design” Tata McGraw Hill, 2002.

<b>EEE5103</b>	<b>MICROPROCESSORS AND MICROCONTROLLERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **MICROPROCESSOR ARCHITECTURE**

Instruction set – Data formats – Instruction formats – Addressing modes – Memory Hierarchy – register file – Cache – Virtual memory and paging – Segmentation – Pipelining – The instruction pipeline, pipeline hazards, Instruction level parallelism – reduced instruction set – Computer principles – RISC versus CISC, RISC properties, RISC evaluation – On-chip register files versus cache evaluation.

### **HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM**

The software model – functional description – CPU pin descriptions – RISC 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 – Virtual 8086 model – Interrupt processing – Instruction types – Addressing modes – Processor flags – Instruction set – Basic programming the Pentium Processor.

### **P89C66x MICROCONTROLLER**

Introduction – Timers 0 and 1, Timers 2 – External interrupt – Interrupt priority – Programmable count array – pulse width modulation – watch dog timer – universal asynchronous receiver transmitter – inter integrated circuit – project applications.

### **MOTOROLA 68HC11 MICROCONTROLLER**

Instructions and addressing modes – operating modes – Hardware reset, Interrupt system – Parallel I/O ports – Flats – Real time clock – Programmable timer – pulse accumulator – serial communication interface – A/D converter – hardware expansion – Basic Assembly Language programming.

### **PIC MICROCONTROLLER AND ARM**

CPU Architecture – Instruction set – Interrupts – Timers – Memory – I/O port expansion – I<sup>2</sup>C bus for peripheral chip access – A/D converter – UART - ARM architecture – ARM organization and implementation, The ARM instruction set, The thumb instruction set, Basic ARM Assembly language program, ARM CPU cores.

### **TEXT BOOKS:**

1. John.B. Peatman, “Design with PIC Micro controller”, Pearson Education, 2003.
2. Gene. H.Miller, “Micro Computer Engineering”, Pearson Education, 2003.

### **REFERENCE BOOKS:**

1. David Calcutt, Fred Cowan, and Hassan Parchizadeh, “8081 Microcontrollers “ An imprint of Elsevier, 2006.

- Barry B.Breg, “The Intel Microprocessors Architecture, Programming and Interfacing” PHI, 2002.
- Steave Furber, “ARM system – on – chip architecture” Addison Wesley, 2000.

<b>EEE5104</b>	<b>REAL TIME SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INTRODUCTION**

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 of IRIS 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.

### **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.

### **TEXT BOOK:**

- Krishna. C. M, Kang. G, Shin, “Real Time Systems”, McGraw Hill, 2003.

### **REFERENCE BOOKS:**

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

2. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill 2004.
3. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI 2002.

<b>EEE5181</b>	<b>EMBEDDED SYSTEM LAB - I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

1. Micro controller 8051/8031 based application programs with kit and through assembler.
2. Flash controller programming using keil software
  - a) Data flash with erase, verify, fusing through ATMEL and INTEL tools.
  - b) SRAM with erase, verify, fuse tools
3. Testing RTOS Environment and System Programming.
  - a) Keil Tools
  - b) RTOS System Solutions with Tornado tools.
4. Mixed Signal Application Programming- Telephone Lines blending with controller.
5. Complex Programmable Logic Devices and Device Programming with VHDL fitter and Cool runner
  - a) Warp tools-Cypress-Active HDL Simulator & Galaxy-VHDL, FSM models
  - b) Mixed signal handling.
6. Third party design tools
  - a) Mentor Graphics
  - b) Cadence.

<b>EEE5105</b>	<b>EMBEDDED CONTROL SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## INTRODUCTION

Controlling the hardware with software – Data lines, Address lines, Ports – Schematic representation – Bit masking – Programmable peripheral interface – Switch input detection – 74 LS 244

## INPUT-OUTPUT DEVICES

Keyboard basics – Keyboard scanning algorithm – Multiplexed LED displays – Character LCD modules, LCD module display, Configuration – Time-of-day clock – Timer manager - Interrupts - Interrupt service routines, IRQ, ISR, Interrupt vector or dispatch table multiple-point - Interrupt-driven pulse width modulation.

### **D/A AND A/D CONVERSION**

R 2R ladder - Resistor network analysis - Port offsets - Triangle waves analog vs. digital values - ADC0809 – Auto port detect - Recording and playing back voice - Capturing analog information in the timer interrupt service routine - Automatic, multiple channel analog to digital data acquisition.

### **ASYNCHRONOUS SERIAL COMMUNICATION**

Asynchronous serial communication – RS-232, RS-485 – Sending and receiving data – Serial ports on PC – Low-level PC serial I/O module, Buffered serial I/O.

### **CASE STUDIES: EMBEDDED C PROGRAMMING**

Multiple closure problems – Basic outputs with PPI – Controlling motors – Bi-directional control of motors – H bridge – Telephonic systems – Stepper control – Inventory control systems.

### **TEXT BOOKS:**

1. Jean J. Labrosse, “Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C”, The publisher, Paul Temme, 2003.
2. Ball S.R., ‘Embedded microprocessor Systems – Real World Design’, Prentice Hall, 2001.

### **REFERENCE BOOKS:**

1. Herma K, “Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 2003.
2. Daniel W. Lewis, “Fundamentals of Embedded Software where C and Assembly meet”, PHI, 2002.

<b>EEE5106</b>	<b>SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **PROGRAMMING EMBEDDED SYSTEMS**

Embedded Program – Role of Infinite loop – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Toper of memory – Timing diagram - Memory testing – Flash Memory – shared – data problems – interrupt latency – round robin with interrupts.

### **OPERATING SYSTEM**

Embedded operating system – Real time characteristics – Selection process – Flashing the LED – serial ports – Zilog 85230 serial controlled code efficiency – Code size, Reducing memory usage, Impact of C++.

### **HARDWARE**

Hardware fundamentals – Buses – DMA – interrupts – Built-in on the microprocessor – Conventions used on schematics – Microprocessor Architectures – Software Architectures – RTOS Architectures – Selecting Architecture.

### **RTOS**

Tasks and Task states – Semaphores - Shared data – Message queues, Mail boxes and pipes – Memory management – Interrupt routines – Encapsulating semaphore and queues – Hard Real-time scheduling – Power saving.

### **SOFTWARE TOOLS**

Embedded Software development tools – Host and target machines – Linkers / Locators for Embedded Software – Debugging techniques – Instruction set simulators Laboratory tools – Practical example – Source code.

### **TEXT BOOKS:**

1. David E. Simon, An Embedded Software Primer Pearson Education, 2003.
2. Michael Bass, Programming Embedded Systems in C and C++ O'Reilly, 2003.

### **REFERENCE BOOK:**

1. Daniel W. Lewis, “Fundamentals of Embedded software where C and assembly meet”, PHI 2002.

<b>EEE5107</b>	<b>REAL TIME OPERATING SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **REVIEW OF OPERATING SYSTEMS**

Basic Principles – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Operating System structures.

### **DISTRIBUTED OPERATING SYSTEMS**

Topology – Network types – Communication – RPC – Client server model – Distributed file system – Design strategies.

### **REAL TIME MODELS AND LANGUAGES**

Event Based – Process Based and Graph based Models – Petrinet Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

### **REAL TIME KERNEL**

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and study of various RTOS like QNX, VX works, PSOS, C Executive – Case studies.

### **RTOS APPLICATION DOMAINS**

RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

**TEXT BOOKS:**

1. Herma K., “Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 2003.
2. Charles Crowley, “Operating Systems-A Design Oriented approach” McGraw Hill 2003.

**REFERENCE BOOKS:**

1. Krishna C.M., Kang, Shin G., “Real Time Systems”, McGraw Hill, 2004.
2. Raymond J.A.Bhur, Donald L.Bailey, “An Introduction to Real Time Systems”, PHI 2001.

<b>EEE5108</b>	<b>EMBEDDED NETWORKING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**EMBEDDED NETWORK REQUIREMENTS**

Embedded networking – code requirements – Communication requirements – Introduction to CAN open – CAN open standard – Object directory – Electronic Data Sheets & Device – Configuration files – Service Data Objectives – Network management CAN open messages – Device profile encoder.

**CAN OPEN**

CAN open configuration – Evaluating system requirements choosing devices and tools – Configuring single devices – Overall network configuration – Network simulation – Network Commissioning – Advanced features and testing.

**CAN**

Controller Area Network – Underlying Technology CAN Overview – Selecting a CAN Controller – CAN development tools.

**IMPLEMENTATION OF CAN OPEN**

Implementing CAN open Communication layout and requirements – Comparison of implementation methods – Micro CAN open – CAN open source code – Conformance test – Entire design life cycle.

**ISSUES**

Physical layer – Data types – Object dictionary – Communication object identifiers – Emerging objects – Node states.

**TEXT BOOK:**

1. Glaf P.Feiffer, Andrew Ayre and Christian Keyold, “Embedded Networking with CAN and CAN open”. Embedded System Academy 2005.

**REFERENCE BOOK:**

1. Gregory J. Pottie, William J. Kaiser “Principles of Embedded Networked Systems Design”, Cambridge University Press, Second Edition, 2005.

EEE5109	DATA COMMUNICATION & NETWORKS	L	T	P	C
		3	0	0	3

**INTRODUCTION**

Components of network – Topologies – WAN / LAN – OSI – ISO layered Architecture  
Modulation and demodulation – Bit error rates – Line coding – Error correcting codes.

**DATA LINK LAYER**

Design issues – CRC technique and sliding window techniques – Performance analysis of sliding window techniques – Framing formats – Case Study – HDLC protocols – Medium access control – CSMA / CD, Token ring and token bus, FDDI – Wireless LAN – Performance analysis of MAC protocols – Bridges.

**NETWORK LAYER**

Circuit switching – packet switching – Design issues – IP addressing and IP diagram – Routers and gateways – Routing –Sub netting – CIDR, ICMP, ARP, RARP, Ipv6, QoS.

**TRANSPORT LAYER**

TCP and UDP – Error handling and flow control – Congestion control – TCP Retransmission – Timeout – Socket Abstraction.

**APPLICATION SERVICES**

Simple Mail Transfer Protocol (SMTP) – File Transfer Protocols (FTP), telnet, the World Wide Web (WWW), Hypertext Transfer Protocol (HTTP), Domain name service (DNS), Security, Multimedia applications.

**TEXT BOOK:**

1. William Stallings, “Data and Computer Communications”, Seventh Edition, Prentice Hall, 2003.

**REFERENCE BOOKS:**

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

3. Richard Stevens W. and Gary R Wright, "TCP / IP Illustrated", Addison Wesley, Volume 1 & 2, 2001.
4. Douglas E Corner, "Internetworking with TCP / IP", Volume 1 & 2, 2000.

<b>EEE5182</b>	<b>EMBEDDED SYSTEM LAB – II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

1. RTOS System solution & tools
2. VLSI designing with various Tools and Design methodologies
  - a) AT40K FPGA series-synthesis-design-simulation of application programs.
  - b) Xilinx EDA design tools-device programs –PROM programming.
  - c) ALTERA and Mentor graphics-IC design tools.
3. Embedded DSP based System Designing.
  - a) Code compressor studio (CCS) for embedded DSP using Texas tool kit.
  - b) Analog DSP tool kit.
4. IPCORE usage in VOIP 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 ASICs- Sample programs for risk and security plans.

<b>EE6101</b>	<b>HARDWARE SOFTWARE CO-DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INTRODUCTION TO CO-DESIGN**

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 - IP 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, Petri nets, Task graphs, hierarchical models - System Specification Languages - StateCharts, VHDL, SystemC.

### 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 BOOKS:

1. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", the publisher, Paul Temme, 2003.

### REFERENCE BOOKS:

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.

### LIST OF ELECTIVES

EEE5110	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 DSP algorithms, DFT-The Discrete Fourier Transform, FFT-The Fast Fourier Transform Algorithm, Image coding, Discrete cosine transforms.

### DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS

FIR filters - FIR filter structures, FIR chips, IIR filters, Specifications of IIR filters, Mapping of analog transfer functions, Mapping of analog filter structures - Multirate systems, Interpolation with an integer factor L, Sampling rate change with a ratio L/M, Multirate filters. Finite word length effects -Parasitic oscillations - Scaling of signal levels, Round-off noise, measuring round-off noise, Coefficient sensitivity, Sensitivity and noise.

### DSP ARCHITECTURES AND SYNTHESIS OF DSP ARCHITECTURES

DSP system architectures - Standard DSP architecture, Ideal DSP architectures, Multiprocessors and multicomputers, Systolic and Wave front arrays, Shared memory architectures - Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit – serial PES.

### **DSP INTEGRATED CIRCUITS AND VLSI CIRCUIT TECHNOLOGIES**

Standard digital signal processors - Application specific IC's for DSP, DSP systems, DSP system design - Integrated circuit design - MOS transistors, MOS logic, VLSI process technologies, Trends in CMOS technologies.

### **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 VLSI circuits, FFT processor, DCT processor and Interpolator as case studies.

#### **TEXT BOOK:**

1. Monson H.Hayes, “Statistical Digital Signal Processing and modeling”, John Wiley and sons, 2003.

#### **REFERENCE BOOKS:**

1. Lars Wanhammer, “DSP Integrated Circuits”, 2002 Academic press, New York.
2. Oppenheim. A.V., ‘Discrete-time Signal Processing’ Pearson education, 2000.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, “ Digital signal processing – A practical approach”, Second edition, Pearson edition, Asia.
4. Keshab K.Parhi, ‘VLSI digital Signal Processing Systems design and Implementation’ John Wiley & Sons, 2004.

<b>EEE511</b>	<b>EMBEDDED PROCESSORS &amp; PERIPHERALS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INTRODUCTION**

Introduction to Processor and peripherals – keyboards – Multiplexed LED Displays – Character LCD modules – Time of Day Clock – Timer Manager – Discrete Inputs and Outputs – Fixed point Math – Analog Math.

### **ANALOG DSP**

Analog DSP “Blackfin” Processor – introduction, architecture, features, applications - instruction-set architecture and hardware micro architecture – ADSP 2100 – introduction, architecture, features, applications.

### **ARM PROCESSOR**

Introduction, architecture, instruction set, addressing modes, applications - PalmOne OS5-based device with ARM processor – ARM application processor – ARM720T and ARM920T.

### **OMAP**

Introduction, architecture, instruction set, addressing modes, applications – OMAP5910 – module overview, display specification, LCD controller operation, Lookup palette, color dithering, output FIFO, LCD controller pins, LCD controller registers, interface to LCD panel signal reset values.

### **CASE STUDY**

Audio/video and VOIP application for multimedia application using OMAP TI-5012 - TI OMAP Applications Processor - OMAP2420 and OMAP1710 – architecture, features, and applications.

### **TEXT BOOK:**

1. Jean J Labrose, “Embedded Systems Building Blocks, CMP Books, second edition, 2005.

### **REFERENCE BOOKS:**

1. ARM reference manual from Texas Instruments, 2006.
2. OMAP reference manual from Texas Instruments, 2006.
3. Technical documents from Texas Instruments Hall for OMAP TI – 5012, 2006.

<b>EEE5112</b>	<b>ROBOTICS &amp; AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INTRODUCTION**

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.

### **ROBORT SENSORS**

Vision tactile and proximity – voice - robot control - kinetics and necessary control systems – advanced programming skills to write AI 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.

### TEXT BOOK:

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

### REFERENCE BOOKS:

- 1) Handbook of Industrial robotics, 2005.
- 2) Aures R.U. & Miller S.M, Robotics applications and social implications, 2002.
- 3) Tanner W.R, Industrial Robots Vol.-1 & Vol.-2, 2005.

EEE5113	CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

## SYMMETRIC CIPHERS

Overview – classical Encryption Techniques – Block Ciphers and the Data Encryption standard – Introduction to Finite Fields – Advanced Encryption standard – Contemporary Symmetric Ciphers – Confidentiality using Symmetric Encryption.

## PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

Introduction to Number Theory – Public-Key Cryptography and RSA – Key Management – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Message Authentication and Hash Functions – Hash Algorithms, Digital Signatures and Authentication Protocols.

## NETWORK SECURITY PRACTICE

Authentication Applications – Kerberos, X.509 Authentication Service – Electronic mail Security – Pretty Good Privacy – S/MIME – IP Security architecture – Authentication Header – Encapsulating Security Payload – Key Management.

## SYSTEM SECURITY

Intruders – Intrusion Detection, Password Management – Malicious Software – Firewalls – Firewall Design Principles – Trusted Systems.

## WIRELESS SECURITY

Introduction to Wireless LAN Security Standards – Wireless LAN Security Factors and Issues.

### TEXT BOOKS:

1. William Stallings, “Cryptography and Network Security – Principles And Practices”, Pearson Education, 3<sup>rd</sup> Edition, 2003.

### REFERENCE BOOKS:

1. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2003.
2. Bruce Schneier, “Applied Cryptography”, John Wiley and Sons Inc, 2001.
3. Stewart S. Miller, “Wi-Fi Security”, McGraw Hill, 2003.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security In Computing”, 3<sup>rd</sup> Edition, Pearson Education, 2003.

<b>EEE5114</b>	<b>DATA COMPRESSION TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INTRODUCTION**

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, LZW family algorithms.

### **AUDIO COMPRESSION**

Audio compression techniques -  $\mu$ - Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

### **IMAGE COMPRESSION**

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms - Design of Filter banks – Wavelet based compression - Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

### **VIDEO COMPRESSION**

Video compression techniques and standards – MPEG Video Coding I - MPEG – 1 and 2 – MPEG Video Coding II - MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard, DVI technology – PLV performance – DVI 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, 1<sup>st</sup> Edition, 2003.

### **REFERENCE BOOKS:**

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kauffman Harcourt India, 2<sup>nd</sup> Edition, 2000.

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- David Salomon, "Data Compression – The Complete Reference", Springer Verlag New York Inc., 2<sup>nd</sup> Edition, 2001.
- Yun Q.Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards", CRC press, 2003.

EEE5115	WIRELESS & MOBILE COMMUNICATION	L	T	P	C
		3	0	0	3

### INTRODUCTION

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 IP and Wireless access protocol.

### WIRELESS LANs

Wireless LAN Technology - IEEE 802 - 11 Wireless LAN standard.

### CDMA STANDARDS

System Architecture for CDMA - Network and Data Link Layers of CDMA – Signaling Applications in CDMA System - Voice Applications in CDMA System.

### RF ENGINEERING AND FACILITIES

Wireless Data - Cellular Communication Fundamentals - GSM Architecture and Interfaces - Radio Link Features in GSM - GSM Logical Channels and Frame Structure. Speech Coding in GSM (Messages, Services and Call Flows in GSM).

### TEXT BOOK:

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

### REFERENCE BOOKS:

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

EEE5116	MULTIMEDIA SYSTEMS	L	T	P	C
		3	0	0	3

### MULTIMEDIA

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 HCI – 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 – MIDI.

### **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.

### **REFERENCE BOOKS:**

1. Mark Elsom-Cook, “Principles of Interactive Multimedia” McGraw Hill, International Edition 2001.
2. Fred. T. Hofstetter, “Multimedia Literacy “, Tata McGraw Hill, International third Edition.

<b>EEE1617</b>	<b>COMPUTER ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INTRODUCTION TO COMPUTER DESIGN**

Review of fundamentals of CPU, Memory and IO – 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 ILP – Case studies.

### **INSTRUCTION LEVEL PARALLELISM WITH SOFTWARE APPROACHES**

Compiler techniques for exposing ILP – Static branch prediction – VLIW & EPIC – 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 – RAID – 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”, Third Edition, Morgan Kaufmann, 2003.

### REFERENCE BOOK:

1. Sia D, Fountain T and P.Kacsuk, “Advanced computer Architectures: A Design Space Approach”, Addison Wesley, 2000.

EEE5118	SOFT COMPUTING	L	T	P	C
		3	0	0	3

### INTRODUCTION TO SOFT COMPUTING

Soft computing constituents - Conventional Artificial Intelligence system - Fundamental elements of soft computing, Computational learning theory, Hybrid soft computing system.

### NEURAL NETWORKS

Overview of biological Neuro-system - ANN architecture - Learning methods – feed forward and feedback networks – Adaptive networks, Back propagation Algorithm – Hop field network – Boltzmann Machine – Self organizing Map - Applications of Artificial Neural Networks.

### FUZZY LOGIC

Fuzzy Sets - Fuzzy rules and Fuzzy reasoning, Fuzzy inference systems, Fuzzy classifiers, Fuzzy logic control, Application of Fuzzy logic

### NEURO FUZZY MODELLING

ANFIS – Coactive Neuro Fuzzy Modeling – Classification and Regression trees – Data clustering Algorithm – Rule base structure, Identification – Neuro Fuzzy control – Expert control – Recurrent learning – Reinforcement - Advanced Applications

### EVOLUTIONARY COMPUTATION

Introduction to Evolutionary programming – Evolutionary strategy – Comparison - Robustness of Traditional optimization and search techniques - The goals of optimization - Genetic Algorithm - An Overview of GA, Genetic operators, GA in problem solving, Implementation, Applications.

### TEXT BOOKS:

1. Jang. J. S. R, Sun. C. T and Mizutani. E, “Neuro Fuzzy and soft computing”, PHI, 2004.
2. Timothy J.Ross. “Fuzzy Logic with Engineering Applications”, McGraw- Hill, 2003.
3. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 2005.
4. Goldberg, “Genetic Algorithm in search, Optimization and machine learning”, Addison Wesley, 2003.

### REFERENCE BOOKS:

1. Kosko. B, "Neural Networks and Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 2004.
2. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 2005.

EEE6110	EMBEDDED CONTROL OF ELECTRICAL DRIVES	L	T	P	C
		3	0	0	3

### INTRODUCTION

Electric drive systems - solid state devices - solid state switching circuits - characteristics of electric motors - speed torque characteristics of electric motors – PWM 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 – dc choppers, inverters, cycloconverters, ac voltage controllers, stepper motor.

### POWER CONVERTERS

Induction motor drives – synchronous motor drives – dc 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 – PID 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 dsp in drive technology – control of electric drives using microcontroller and dsp – 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 edition.
2. John. B. Peatman, “Design with PIC Microcontrollers “, Pearson Education, Asia 2004.

#### **REFERENCE BOOKS:**

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

<b>EEE6111</b>	<b>APPLICATION SPECIFIC INTEGRATED CIRCUITS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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### **INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIG**

Types of ASICs – Design Flow – CMOS transistors, CMOS 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 ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS**

Anti fuse – static RAM – EPROM and EEPROM technology – PREP bench marks – Actel ACT, Xilinx LCA, Altera FLEX, Altera MAX DC & AC inputs and outputs – Clock and power inputs – Xilinx I/O blocks.

**PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC 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 ASIC – Schematic entry – Low level design language – PLA tools – EDIF – CFI design representation.

**LOGIC SYNTHESIS, SIMULATION AND TESTING**

Verilog and logic synthesis – VHDL and logic synthesis - Types of simulation – Boundary scan test, Fault simulation, Automatic test pattern generation.

**ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING**

System partition – FPGA partitioning – partitioning methods – floor planning, placement – physical design flow, global routing, detailed routing, special routing – circuit extraction – DRC.

**TEXT BOOK:**

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

**REFERENCE BOOKS:**

1. Andrew Brown, “VLSI Circuits and Systems in Silicon”, McGraw Hill, 2004.
2. Brown. S. D, Francis. R. J, Rox. J, Uranesic. Z. G, “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, Whilo House. H. J, Kailath. T, “VLSI and Modern Signal Processing”, Prentice Hall, 2005.
5. Jose E.France, Yannis Tsvividis, “Design of Analog – Digital VLSI Circuits for Telecommunication and Signal Processing”, Prentice Hall, 2004.

<b>EEE6112</b>	<b>MIXED SIGNAL EMBEDDED SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**INTRODUCTION TO ANALOG AND MIXED SIGNAL CIRCUITS**

Design & Verification – Applications Challenges - Market Perspective - Analog CMOS circuits - Current Mirrors - Current & Voltage References - Bandgap References.

**CMOS AMPLIFIERS**

Opamps - High Performance CMOS 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 & ADC**

Introduction - Nyquist rate converters – Over sampling converters - Pipelined/parallel converters - High speed ADC design, High speed DAC design and Mixed signal design for radar application - ADC and DAC modules used for LIGO.

### **PLL**

Introduction - Frequency Synthesizers - Design of PLL and Frequency Synthesizers – PLL with voltage driven oscillator – PLL with current driven oscillator – ETPLL - PLL 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.

### **REFERENCE BOOKS:**

1. Breems, “Continuous-Time Sigma Delta Modulations for A/D Conversion”, Kluwer, 2002.
2. Michelle Steyaert, “Analog Circuit Design”, Kluwer, 2003.
3. Gray & Meyer, Analysis and Design of Analog Integrated Circuits, Wiley, 2004.
4. Baker, CMOS Mixed-Signal Circuit Design, Wiley, 2004.
5. Behzad Razavi, Design of Analog CMOS integrated circuit, Tata McGraw Hill, 2004.

<b>EEE6113</b>	<b>EMBEDDED COMMUNICATION SOFTWARE DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **INTRODUCTION**

OSI Reference Model – Communication Devices – Communication Echo System – Design Consideration – Host Based Communication – Embedded Communication System – OS Vs RTOS.

### **SOFTWARE PARTITIONING**

Limitation of strict Layering – Tasks & 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 BOOK:

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

EEE6114	NETWORK PROCESSORS	L	T	P	C
		3	0	0	3

### INTRODUCTION

Embedded System Design Life Cycle – Selection Process – Partitioning Decision – Development Environment – Special Software Techniques – Basic Toolset – BDM, JTAG 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 DSP Processor - Architecture of Ti320C55xx processor - Instruction set and programming examples - Ti320C67xx DSP Processor - Introduction to VLIW Architecture - Arithmetic Computation – Memory Accessing.

### CASE STUDY

Case Study- DSP processor for audio/video applications – Architecture of digital signal processors – DSP processor versus Conventional Processors – fixed point arithmetic versus floating point arithmetic – DSP for Embedded Systems.

**TEXT BOOK:**

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

**REFERENCE BOOKS:**

1. Sen M Kuo & Bob H Lee, “Real Time Signal Processing” John Wiley and Sons, 2005.
2. Technical Documents from Texas Instruments, 2006.
3. 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

**INTRODUCTION**

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 – DES, DES chaining, Triple DES, RSA algorithm - Key management - Message Authentication - Hash Algorithm - Authentication requirements, functions secure Hash Algorithm, Message digest algorithm - digital signatures - AES Algorithms.

**DESIGNING 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 - IP Addressing Design Considerations - ICMP Design Considerations - Routing Considerations - Transport Protocol Design Considerations.

**NETWORK SECURITY PLATFORM OPTIONS**

Network Security Platform Options -Network Security Device Best Practices - Common Application Design Considerations - E-Mail – DNS - HTTP/HTTPS – FTP - Instant Messaging - IPsec VPN Design Considerations - VPN 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 - IT act and cyber laws.

**TEXT BOOKS:**

1. Sean Convery, “ Network Security Architectures, Published by Cisco Press, First Ed. 2004.
2. William Stalling, “Cryptography and Network Security” Pearson Education, Asia, 2005.

**REFERENCE BOOKS:**

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
		3	0	0	3

**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 – DFT, FFT – 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.

**REFERENCE BOOKS:**

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 2<sup>nd</sup> Edition, Pearson Education, 2003.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", 2<sup>nd</sup> Edition, Thomson Learning, 2001.