KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

M.E. DEGREE IN EMBEDDED SYSTEMS (FULL TIME)

CURRICULUM

(For the candidates admitted from the academic year 2012 – 13 onwards)

SEMESTER - I

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
11VL101	Applied Mathematics for Electronic Engineers	3	1	0	4	50	50	100
11AE102	Advanced Digital Signal Processing	3	1	0	4	50	50	100
11ES101	Advanced Digital System Design for Embedded Systems	3	1	0	4	50	50	100
11ES102	Microcontroller System Design and Analysis	3	0	0	3	50	50	100
11ES103	Design of Embedded Systems	3	0	0	3	50	50	100
11ES104	Embedded Networking	3	0	0	3	50	50	100
	PRACTICAL							
11ES105	Microcontroller System Design Laboratory	0	0	4	2	100	0	100
				Total	**23**			

CA – Continuous Assessment, ESE – End Semester Examination

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

M.E. DEGREE IN EMBEDDED SYSTEMS (FULL TIME)

CURRICULUM

(For the candidates admitted from the academic year 2012 – 13 onwards)

SEMESTER - II

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
11ES201	Real Time Operating Systems	3	0	0	3	50	50	100
11ES202	Embedded Linux	3	0	0	3	50	50	100
11ES203	ASIC Design for Embedded Systems	3	0	0	3	50	50	100
11ES204	Advanced Microcontroller	3	0	0	3	50	50	100
	Elective-I	3	0	0	3	50	50	100
	Elective-II	3	0	0	3	50	50	100
	PRACTICAL							
11ES205	Advanced Embedded Systems Laboratory	0	0	4	2	100	0	100
11ES206	Mini Project	0	0	4	2	100	0	100
				Total	**22**			

CA – Continuous Assessment, ESE – End Semester Examination

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

M.E. DEGREE IN EMBEDDED SYSTEMS (FULL TIME)

CURRICULUM

(For the candidates admitted from the academic year 2012 – 13 onwards)

SEMESTER - III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective - III	3	0	0	3	50	50	100
	Elective – IV	3	0	0	3	50	50	100
	Elective - V	3	0	0	3	50	50	100
	PRACTICAL							
11ES301	Project Work – Phase- I	0	0	12	6	50	50	100
				Total	**15**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER – IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
11ES401	Project Work – Phase- II	0	0	24	12	100	100	200
				Total	**12**			

CA – Continuous Assessment, ESE – End Semester Examination

LIST OF ELECTIVES

Course Code	Course Title	L	T	P	C
11ES011	Software Technology for Embedded Systems	3	0	0	3
11ES012	Advanced Soft Computing Techniques	3	0	0	3
11ES013	Design of Embedded Control Systems	3	0	0	3
11ES014	Wireless Embedded Systems	3	0	0	3
11ES015	Embedded Buses and Data Acquisition Techniques	3	0	0	3
11ES016	RISC Processor Architecture and Programming	3	0	0	3
11ES017	Advanced Embedded Systems	3	0	0	3
11ES018	HDL for Embedded FPGA Processor	3	0	0	3
11ES019	Computers in Networking and Digital control	3	0	0	3
11ES020	Distributed Embedded Computing	3	0	0	3
11ES021	Robotics	3	0	0	3
11ES022	Cryptography and Network Security	3	0	0	3
11ES023	Embedded Automotive Networking	3	0	0	3
11ES024	Real Time Systems	3	0	0	3
11ES025	Network on Chip	3	0	0	3
11ES026	Medical Imaging Systems	3	0	0	3
11VL019	Advanced Computer Architecture	3	0	0	3
11VL023	System on Chip	3	0	0	3
11VL025	Digital Image Processing	3	0	0	3
11AE020	Micro Sensors and MEMS	3	0	0	3

11VL101 APPLIED MATHEMATICS FOR ELECTRONIC ENGINEERS

(Common to VLSI Design, Communication System, Embedded Systems & Computer and Communication Engineering Branches)

3 1 0 4

Objective:

On completion of the course the students are expected

- To understand the numerical techniques of linear algebraic equations and solution of boundary value problem using Laplace Transforms.
- To know the properties and applications of Special functions.
- To understand the basic concepts and properties of random variables and queuing theory.

MODULE – I **15**

Numerical Methods: System of equations- Solution by Gauss Elimination, Gauss-Jordan and LU decomposition method- Jacobi, Gauss-Seidal iteration method- Eigen values of a matrix by Jacobi and Power method.

Wave Equation: Solution of initial and boundary value problems- Characteristics- D'Alembert's Solution - Laplace transform solutions for displacement in a long string - a long string under its weight - a bar with prescribed force on one end.

MODULE– II **15**

Bessel Functions : Bessel's equation - Bessel Functions- Series Representation of Bessel functions – Recurrence relations of Bessel functions – Generating function – Jacobi series – Orthogonal property for Bessel functions

Legendre Polynomials: Legendre's equation - Legendre polynomials -Rodrigue's formula - Recurrence relations- Generating functions – Orthogonal property for Legendre polynomials – Expansion of an arbitrary function in a series of Legendre polynomials.

MODULE–III **15**

Random Variables: One dimensional Random Variable - Moments and MGF – Binomial, Poisson, Geometrical, Normal Distributions- Two dimensional Random Variables – Marginal and Conditional Distributions – Covariance and Correlation Coefficient.

Queuing Theory: Single and Multiple server Markovian queueing models - Steady state system size probabilities – Little's formula – Priority queues – M/G/1 queueing system – P.K. formula.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. Kapur, J.N. and Saxena, H.C., "Mathematical Statistics", S.Chand & Co., New Delhi, 2007.
2. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 2007.
3. Sankara Rao, K. "Introduction to Partial Differential Equation", Prentice Hall of India, New Delhi, 1995.
4. Taha, H.A., "Operations Research- An Introduction", 6th Edition, Prentice Hall of India, New Delhi, Reprint 2010.
5. Jain, M.K., Iyengar, S.R.K. and Jain, R.K., "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Publishers, New Delhi, 2008.

11AE102 ADVANCED DIGITAL SIGNAL PROCESSING

(Common to M.E. Applied Electronics, Communication Systems, Power Electronics, Control and Instrumentation, Computer and Communication, Embedded Systems)

3 1 0 4

Objective:

- To introduce the concept of discrete random signal processing.
- To understand the spectrum estimation and analysis using parametric and non-parametric approach.
- To estimate the signal by linear prediction.
- To study the concepts of adaptive filter and various error minimization algorithm.
- To understand the concepts of multirate digital signal processing.

MODULE – I **15**

Discrete Random Signal Processing: Discrete time random process – Random process: Ensemble averages- Gaussian process – stationary process – The autocovariance and autocorrelation metrices – ergodicity – white noise the power spectrum. Filtering random process – spectral factorization. Parseval's theorem – Wiener Khintchine relation.

Spectrum Estimation and Analysis: Non parmetric methods: Periodogram, performance of periodogram, modified periodogram, Bartlett's method, Welch's method.

MODULE– II **15**

Parametric methods: AR model – Yule-Walker method, MA model – ARMA model.

Linear Prediction: Forward and backward linear predictions, Solution of the normal equations – Levinson-Durbin algorithms. Least mean squared error criterion – The FIR Wiener filter – filtering – linear prediction and The IIR Wiener filters – Non causal IIR Wiener filter – the causal IIR Wiener filter.

Adaptive Filter: Concepts of adaptive filter – FIR adaptive filters – LMS algorithm – Applications: Noise cancellation.

MODULE–III **15**

Adaptive Filter: Adaptive recursive filers– AR lattice structure and ARMA process, lattice – ladder filters.

Multirate Digital Signal Processing: Mathematical description of sampling rate – Interpolation and Decimation by integer factor – Sampling rate conversion by rational factor- Filter design for sampling rate conversion; direct form FIR structures, Polyphase structures, time-varient structures. Multistage implementation of sampling rate conversion. Applications – Subband coding of speech signals.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. Hayes, Monson H., "Statistical Digital Signal processing and Modeling", John Wiley and Sons, Inc., 1996.
2. Proakis, John G. and Manolakis, Dimitris G., "Digital Signal Processing: Principles Algorithms and Applications", PHI, 2006.
3. Ifeachor, Emmanuel C. and Jervis, Barrie N., "Digital Signal Processing: A Practical Approach", Addison-Wesley Publishing Company, 2002.

11ES101 ADVANCED DIGITAL SYSTEM DESIGN FOR EMBEDDED SYSTEMS

3 1 0 4

Objective:

- To design and test synchronous and asynchronous circuits.
- To analyse different testing algorithms for digital circuits.
- To design synchronous circuits using PLDs.

MODULE – I **15**

Sequential Circuit Design: Analysis of Clocked Synchronous Sequential Networks (CSSN)- Modeling of CSSN – State table Reduction- Stable Assignment – Complete Design of CSSN – Design of Iterative Circuits -Algorithmic State Machine (ASM)-ASM Chart – Synchronous Sequential Network Design Using ASM Charts- State Assignment- ASM Tables-ASM Realization- Asynchronous Inputs.

MODULE– II **15**

Asynchronous Circuit Design and Fault Diagnosis: 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 Table Method – Path Sensitization Method – Boolean Difference Method – D Algorithm – Tolerance Techniques – The Compact Algorithm

MODULE–III **15**

Testability Algorithms and Programmable Devices: Practical PLA's – Fault in PLA – Test Generation – Masking Cycle – DFT Schemes – Built-in Self Test. Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a PAL – Realization State machine using PLD – Complex Programmable Logic Devices (CPLDs) – FPGA– Xilinx and ALTERA FPGA - Reconfigurability and GALS

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. Givone Donald G., "Digital Principles and Design", Tata McGraw-Hill, New Delhi, 2002.
2. Biswas Nripendra N, "Logic Design Theory", Prentice Hall of India, New Delhi, 2001.
3. Yarbrough, John M., "Digital Logic Applications and Design", Thomson Learning, Singapore, 2001.
4. Roth Charles H., "Fundamentals of Logic Design", Thomson Learning, Singapore, 2005.
5. Ming-Bo Lin**, "**Digital System Design and Practices: Using Verilog HDL and FPGAs", Wiley Publisher, New York, 2008.

11ES102 MICROCONTROLLER SYSTEM DESIGN AND ANALYSIS

3 0 0 3

Objective:

- To study the architecture of 8051 microcontroller and PIC microcontroller.
- To acquire knowledge on 8051 microcontroller based system design.
- To develop application based on 8051 and PIC microcontroller.

MODULE-I **15**

8051 Architecture and Programming: Architecture – memory organization – addressing modes – instruction set – Timers - Interrupts - I/O ports, Interfacing I/O Devices – Serial communication.Addressing modes-Instruction set-Assembly language programming .Timer Counter Programming – Serial Communication Programming- Interrupt Programming – RTOS for 8051 – RTOSLite – FullRTOS –Task creation and run – LCD digital clock/thermometer using Full RTOS.

MODULE-II **15**

PIC Microcontroller: PIC18 series Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, MP-LAB. Timers – Interrupts, I/O ports- I^2C bus-A/D converter-UART- CCP modules.

MODULE-III **15**

System Design – Case Study: ADC, DAC and Sensor Interfacing –Flash and EEPROM memories. Interfacing LCD Display and touch screen – Keypad Interfacing –SPI Bus Protocol and DS1307 RTC Interfacing and programming using C- DC Motor Control using PWM– Relay and Stepper Motor interfacing.

TOTAL : 45

REFERENCE BOOKS

1 Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey, “PIC Microcontroller and Embedded Systems using Assembly and C for PIC18”, Pearson Education 2008

2 Mazidi Mohammed Ali and Mazidi Janice Gillispie, “The 8051 Microcontroller and Embedded Systems”, Pearson Education Asia, New Delhi, 2007.

3 John Iovine, “PIC Microcontroller Project Book”, McGraw Hill 2000

4 MykePredko, “Programming and customizing the 8051 microcontroller”, Tata McGraw Hill 2001

11ES103 DESIGN OF EMBEDDED SYSTEMS

3 0 0 3

Objective:

- To gain sufficient background for understanding embedded system design.
- To improve the knowledge on embedded design life cycle.
- To learn and analyse the testing and debugging of hardware system.
- To acquire knowledge on emulator tools.

MODULE – I **15**

Embedded Design Life Cycle: Embedded Design life cycle – Product specification – Hardware / Software partitioning –Detailed hardware and software design – Integration – Product testing

Selection Process: 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.

MODULE– II **15**

Partitioning Decision: 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 – Watch dog timers – Flash memory Basic toolset – Host Based debugging – Remote debugging – ROM emulators – logic Analyzer – Caches – Computer optimization – Statistical profiling.

MODULE–III **15**

IN Circuit Emulators: Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers

Testing: Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

TOTAL: 45

REFERENCE BOOKS

1. Arnold S. Berger, “Embedded System Design” CMP books, USA 2002.
2. Sriram Iyer, “Embedded Real time System Programming”, Tata McGraw-Hill, 2008.
3. Hill 2000 ARKIN, R.C., “Behaviour-based Robotics”, The MIT Press, 1998.

11ES104 EMBEDDED NETWORKING

3 0 0 3

Objective:

- To understand serial and parallel communication protocols.
- To develop applications using embedded ethernet for embedded system.
- To know the impact of wireless sensor protocols and its standards.

MODULE – I **15**

Embedded Communication USB and CAN Protocols: Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) – PC Parallel port programming -ISA/PCI Bus protocols – Firewire USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types – Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN

MODULE– II **15**

Ethernet and Embedded 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 Exchanging messages using UDP and TCP.

MODULE–III **15**

Wireless Embedded and Ethernet Networking: 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. Wireless sensor networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing.

TOTAL: 45

REFERENCE BOOKS

1. Frank Vahid, Givargis, "Embedded Systems Design: A Unified Hardware/Software Introduction", Wiley Publications,2009
2. Jan Axelson, 'Parallel Port Complete' , Penram Publications,2000
3. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008
4. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram Publications,2003
5. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge Press 2005

11ES105 MICROCONTROLLER SYSTEM DESIGN LABORATORY

0 0 4 2

Objective:

- To gain simulation and hands on experience with 8 bit microcontroller.
- To design and interface hardwares with different peripherals.
- To acquire knowledge on embedded applications.

1. Simulation and implementation of Switch/ Keypad and LED using 89c51 Microcontroller
2. Simulation and implementation of device ON / OFF using 89c51 microcontroller (Relay and LED).
3. Simulation and implementation of LCD
4. Simulation and implementation of 7 segment/ widget display using 89c51 microcontroller.
5. Simulation and implementation of motors using 89c51 microcontroller
6. Stepper Motor
7. DC Motor
8. Programming using Arithmetic, Logical and Bit Manipulation instructions of PIC16F877 microcontroller
9. Simulation and implementation of Real Time Clock using PIC 16F877 microcontroller
10. Programs for timers using PIC16F877 microcontroller.
11. PWM generation using PIC16F877 microcontroller.
12. I2C communication using PIC16F877 microcontroller.

Softwares : Proteus Professional, CCS Compiler

11ES201 REAL TIME OPERATING SYSTEMS

3 0 0 3

Objective:

- To learn the real time kernel of uC/OS II.
- To understand the concepts of multi tasking and scheduling.
- To study RTOS management system.

MODULE – I **15**

Review of Operating Systems and RTOS: Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes –Introduction to Distributed operating system – Distributed scheduling. Introduction – Advantage and Disadvantage of Using RTOS – Multitasking – Tasks -Real Time Kernels – Scheduler - Non-preemptive Kernels - Preemptive Kernels –Reentrancy- Reentrant Functions – Round Robin Scheduling - Task Priorities -Static Priorities – Mutual Exclusion – Deadlock – Intertask Communication –Message Mailboxes – Message Queues - Interrupts - Task Management – Memory Management -Time Management – Clock Ticks.

MODULE– II **15**

Introduction - µC/OS-II: Introduction - µC/OS-II Features - Goals of µC/OS-II - Hardware and Software Architecture – Kernel tructures: Tasks –Task States – Task Scheduling – Idle Task – Statistics Task – Interrupts Under µC/OS-II – Clock Tick - µC/OS-II Initialisation. Task Management: Creating Tasks – Task Stacks – Stack Checking – Task's Priority – Suspending Task – Resuming Task. Time Management: Delaying a Task – Resuming a Delayed Task – System Time. Event Control Blocks- Placing a Task in the ECB Wait List – Removing a Task from an ECB wait List.

MODULE–III **15**

RTOS Managements and Application: Semaphore Management: Overview – Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox – Deleting Mailbox – Waiting for a Message box – Sending Message to a Mailbox- Status of Mailbox .Message Queue Management: Creating Message Queue – Deleting a Message Queue – Waiting for a Message at a Queue – Sending Message to a Queue – Flushing a Queue. Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memory Block – Returning a Memory Block .Getting Started with µC/OS-II – Installing µC/OS-II – Porting µC/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with µC/OS-II - Case study of coding for an Automatic Chocolate Vending Machine using MUCOS RTOS.

TOTAL: 45

REFERENCE BOOKS

1. Jean J. Labrosse, "MicroC/OS – II The Real Time Kernel", CMP Books, 2nd Edition, 2002.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill, New Delhi", 2003.
3. Steve Furbe, "ARM System-on-Chip Architecture", Addison-Wesley Professional, 2nd Edition 2000.

11ES202 EMBEDDED LINUX

3 0 0 3

Objective:

- To get knowledge of open source linux architecture.
- To learn the concepts of board support package and embedded storage.
- To design applications using embedded linux platform.

MODULE - I **15**

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 – Synchronization and scheduling in multiprocessor Operating Systems

MODULE - II **15**

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

MODULE - III **15**

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 – Operting System Porting Layer – Kernel API Driver - Case studies - RT Linux – uClinux

TOTAL : 45

REFERENCE BOOKS

1. Dhananjay M. Dhamdhere, "Operating Systems A concept based Approach", Tata Mcgraw-Hill Publishing Company Ltd, 2006.
2. Matthias Kalle Dalheimer, Matt Welsh, "Running Linux", O'Reilly Publications, 2005
3. Mark Mitchell, Jeffrey Oldham and Alex Samuel "Advanced Linux Programming", New Riders Publications, 2001.
4. P.Raghavan ,Amol Lad , SriramNeelakandan, "Embedded Linux System Design and Development", Auerbach Publications 2006
5. Karim Yaghmour, "Building Embedded Linux Systems", O'Reilly Publications, 2003

11ES203 ASIC DESIGN FOR EMBEDDED SYSTEMS

3 0 0 3

Objective:

- To learn different types of programmable ASICs.
- To study the concepts od interconnection and design tools.
- To know the details of ASIC design flow.

MODULE - I **15**

Introduction to ASICs and Programmable ASICs: 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: Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks- Actel ACT - Xilinx LCA –Altera FLEX.

MODULE - II **15**

Interconnects and Design Tools, Logic Synthesis: Altera MAX DC & AC inputs and outputs -Clock & Power inputs - Xilinx I/O blocks.Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX9000 - Altera FLEX –Design systems - Logic Synthesis - Half gate ASIC – Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation.

MODULE – III **15**

Simulation, Testing and Physical Design: Simulation and Testing: Types of simulation –Boundary scan test - Fault simulation - Automatic test pattern generation. System partition - FPGA partitioning - Partitioning methods - Floor planning -Placement - Physical design flow –Global routing - Detailed routing - Special routing -Circuit extraction - DRC.

TOTAL: 45

REFERENCE BOOKS

1. Smith, M.J.S., "Application Specific Integrated Circuits", Addison –Wesley, New York, 1997.
2. Farzad Nekoogar and Faranak Nekoogar, "From ASICs to SOCs": A Practical Approach, Prentice Hall PTR, New Jersey, 2003.
3. Baskar, J., "VHDL Primer", McGraw-Hill, New York, 2005.
4. Wayne Wolf., "FPGA-Based System Design", Prentice Hall PTR, New Jersey,2004.
5. Razak Hossain, "High Performance ASIC Design: using Synthesizable Domino logic in an ASIC flow", Cambridge University Press,2008.
6. www.altera.com
7. www.xilinx.com
8. www.asic-world.com
9. www.ni2designs.com
10. www.iroi.seu.edu.cn

11ES204 ADVANCED MICROCONTROLLER

3 0 0 3

Objective:

- To study the architecture of freescale processors.
- To develop programming knowledge using codewarrior tool.
- To design systems using IDE.

MODULE - I **15**

Microprocessor and Coldfire Processor: Introduction to ColdFire Core- User and Supervisor Programming Model- Addressing modes- Special instructions,- Multiply-Accumulate Unit-EMAC- Exceptions and Interrupt controller- cache- Cryptographic Acceleration Unit-The MCF5222X Microprocessor: The 5222X Microprocessor- UART- I2C- ADC- Timers. Interfacing SDRAM and Flash to ColdFire processor

MODULE - II **15**

16 - Bit Microcontroller and Development Tools: Introduction to the S12 and S12X Microcontroller – Interrupts- Clock Generation- Resets- Parallel Ports - Timer Functions- Serial Communication Interface (SCI)- Serial Peripheral Interface (SPI)- Inter-Integrated Circuit (I2C) Interface- Hardware and Software Development Tools

MODULE – III **15**

Interfacing with peripherals: C Language Programming –Types -operators –expressions-control flow-input and output-functions and program structures-pointers-arrays-structures-unions. Writing C program to perform simple I/O. Codewarrior tools – Project IDE - Compiler - Assembler and Debugger - JTAG and hardware debuggers - Code optimization - Real time clock with I2C programming-Interfacing with serial EPROM.

TOTAL: 45

REFERENCE BOOKS

1. BannouraMunir, Bettelheim Rudan, and Soja Richard, "ColdFire Microprocessors & Microcontrollers" –AMT Publishing.
2. Huang Han-Way, "The HCS12/9S12: An Introduction to Hardware and Software Interfacing", Second Edition, 2006.
3. Cady Fredrick M., "Assembly and C Programming for the Free scale HCS12 Microcontroller", Second Edition, Oxford University Press,New York, 2008.
4. Valvano Jonathan W., "Embedded Microcomputer Systems: Real Time Interfacing", Second Edition, Thomson Asia, Singapore, 2001.

11ES205 ADVANCED EMBEDDED SYSTEMS LABORATORY

0 0 4 2

Objective:

- To gain hands-on experience with 16-bit microcontrollers.
- To get an exposure on 32-bit coldfire processor.

1. Interfacing of Switch and LED using S12X Controller.
2. Serial Communication Interface using S12X Controller
3. ADC Programming using S12X Controller
4. CAN bus Programming using S12X Controller
5. Bluetooth/Zigbee interfacing using S12X Controller
6. IR interfacing using S12X Controller
7. EEPROM Programming using S12X Controller
8. UART Programming using COLDFIRE Processor.
9. ADC Programming using COLDFIRE Processor.
10. Interfacing of Switch and LED using COLDFIRE Processor

Softwares: Codewarrier tool

11ES011 SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEMS

3 0 0 3

Objective:

- To know the concepts of embedded C and object oriented programming.
- To acquire knowledge on HTML and web security.
- To write simple programs using files and exception handling for embedded systems.

MODULE - I **15**

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 – Memory testing – Flash Memory.

Overview of Embedded C - Compilers and Optimization - Programming and Assembly – Register usage conventions – Typical use of addressing options – Instruction sequencing – Procedure call and return – Parameter passing – Retrieving parameters – Everything in pass by value – Temporary variables

MODULE - II **15**

Embedded Program and Software Development Process: Program Elements – Queues – Stack-List and ordered lists-Embedded programming in C++ - Inline Functions and Inline Assembly - Portability Issues - Embedded Java- Software Development process: Analysis – Design-Implementation – Testing – Validation- Debugging - Software maintenance

MODULE - III **15**

Unified Modelling Language and Web Architectural Framework: Object State Behaviour – UML State charts – Role of Scenarios in the Definition of Behaviour – Timing Diagrams – Sequence Diagrams – Event Hierarchies – Types and Strategies of Operations – Architectural Design in UML Concurrency Design – Representing Tasks – System Task Diagram – Concurrent State Diagrams – Threads. Mechanistic Design – Simple Patterns-Basics – Client/sever model- Domain Names and IP address – Internet Infrastructure and Routing – URL – TCP/IP protocols - Embedded as Web Client - Embedded Web servers - HTML - Web security - Case study : Web-based Home Automation system

TOTAL : 45

REFERENCE BOOKS

1. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003
2. Michael Barr, "Programming Embedded Systems in C and C++", Oreilly, 2003
3. H.M. Deitel ,P.J.Deitel, A.B. Golldberg " Internet and World Wide Web – How to Program" Third Edition , Pearson Education , 2001.
4. Bruce Powel Douglas, "Real-Time UML, Second Edition: Developing Efficient Object for Embedded Systems, 2nd Edition ,1999, Addison-Wesley
5. Daniel W.lewis "Fundamentals of Embedded Software where C and Assembly meet", PHI, 2002.
6. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006.

11ES012 ADVANCED SOFT COMPUTING TECHNIQUES

3 0 0 3

Objective:

- To learn and design different types of neural networks.
- To understand various optimization techniques.
- To understand various real time applications using neuro fuzzy systems.

MODULE– I **15**

Neural Networks: Introduction to soft Computing-Neural Networks -Supervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Support Vector Machine – Extreme Learning Machine

Case Study: Performance enhancement in GPS/INS integration -sliding controller in ac servo systems -Facial expression recognition.

MODULE– II **15**

Fuzzy Logic: Fuzzy Sets – Basic Definition and Terminology – Set-theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning

Extension principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models-Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

Neuro-Fuzzy Modelling: Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm –Hybrid Neuro Fuzzy System – Fuzzy BPN, Fuzzy Associative Memory

Case Study: Sensorless Control for robot manipulator position tracking- Sensorless Control of switched reluctance Machine .

MODULE– III **15**

Genetic Algorithm: Derivative-based Optimization – Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

ACO-Ant Colony Optimization, PSO-Particle Swarm Optimization techniques, Bee Colony Optimization

Case Study: Pattern extraction- Inverse Kinematics Problems – Automobile Fuel Efficiency prediction –CANFIS modeling for color recipe prediction

TOTAL: 45

REFERENCE BOOKS

1. S.N.Sivanandam, Sumathi & Deepa "Introduction to Neural Networks Using Matlab 6.0", Tata McGraw-Hill Education 2006.
2. S.N.Sivanandam, Sumathi & Deepa "Introduction to Fuzzy Logic using MATLAB",Springer 2006
3. Jang, J.S.R., C.T.Sun and E.Mizutani., "Neuro-Fuzzy and Soft Computing", PHI, Pearson Education, 2004.
4. Eberhart, R., simpson, P. and Dobbins, R., "Computational Intelligence PC Tools", AP Professional, Boston 1996.
5. Goldberg, Davis E., "Genetic Algorithms: Search, Optimization and Machine Learning" Addison Wesley, New York, 1989.
6. S.Rajasekaran and Pai, G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India, New Delhi, 2003.

11ES013 DESIGN OF EMBEDDED CONTROL SYSTEMS

3 0 0 3

Objective:

- To develop applications using communication buses for embedded processors.
- To interface peripherals using RTOS.
- To implement control design using RTOS.

MODULE – I **15**

Interface With Communication Protocol: Design methodologies and tools – Design flows – Designing hardware and software Interface– System integration- SPI- High speed data acquisition and interface-SPI read/write protocol- RTC interfacing and programming.

MODULE - II **15**

Embedded System Organization: Embedded computing – Characteristics of embedded computing applications–Embedded system design challenges- Build process of Realtime Embedded system– Selection of processor- Memory- I/O devices-Rs-485- MODEM-Bus Communication system using I^2C- CAN- USB buses-8bit–ISA- EISA bus-Introduction to RTOS- RTOS- Inter Process communication- Interrupt driven Input and Output-Nonmaskable interrupt-Software interrupt-Thread–Single-Multithread concept-Multitasking Semaphores.

MODULE – III **15**

Design of Software For Embedded Control: Software abstraction using Mealy-Moore FSM controller-Layered software development-Basic concepts of developing device driver – SCI – Software - interfacing & porting using standard C & C++ - Functional and performance Debugging with benchmarking- Real-time system software – Survey on basics of contemporary RTOS – VXWorks- UC/OS-II

Case Studies With Embedded Controller-Programmable interface with A/D & D/A interface- Digital voltmeter- Control- Robot system - PWM motor speed controller-Serial communication interface.

TOTAL : 45

REFERENCE BOOKS

1. Steven F. Barrett, Daniel J. Pack, “Embedded Systems – Design and Applications with the 68HC 12 and HCS12”, Pearson Education, 2008.
2. Raj Kamal, “Embedded Systems- Architecture, Programming and Design”, Tata McGraw Hill, 2006.
3. MichealKhevi, “The M68HC11 Microcontroller application in Control, Instrumentation & Communication”, PH New Jersey, 1997.
4. Muhammad Ali Mazidi, Rolin D. Mckinlay, and Danny Causey, “PIC Microcontroller and Embedded Systems- Using Assembly and C for PIC18”, Pearson Education, 2008.
5. Steven F.Barrett, and Daniel J. Pack, “Embedded Systems-Design & Application with the 68HC12 & HCS12”, Pearson Education, 2008.

11ES014 WIRELESS EMBEDDED SYSTEMS

3 0 0 3

Objective:

- To study the concepts of wireless embedded system and its use in real time system.
- To learn the protocol architectures of different wireless networks and its applications in embedded systems.
- To learn about different sensor technologies.

MODULE - I **15**

Wireless Embedded Systems for Real-Time Applications: Introduction - Definition of embedded system -Constraints on embedded systems vs.standalone systems- Concept of real-time design -Time scales for real-time system –Applications Software environments-HLL -Assembly coding, DSP - general purpose computer-microprocessor

Wireless PAN- Blue tooth-Over all architecture-Protocol Stack-Physical Connection-MAC Mechanism-Connection Management-Security-Zigbee- Protocol Architecture-Physical layer-MAC Layer-Zigbee Layer-Applications-Home RF_Wi Fi.

MODULE - II **15**

CDMA, GSM, GPRS and Smart Sensors: OFDM Channel-GSM:Services-System Architecture-Radio Sub system-Channel Types-Frame structure-Signal Processing- GPRS-Reference Architecture-Protocol Layers-Short Messaging Services. Primary sensors- filters- converter – compensation – Non-linearity- Noise and interference – Drift – Information coding – Data coding – Data Communication

MODULE –III **15**

Recent Trends in Sensor Technologies and Applications: Standards for smart sensor interface – Film sensors – Semiconductor IC technology –MEMS – Nano sensors. Product-Bands and Standards-Wireless Geo location: System Architecture-Technologies- Standard for E-911 Service- Wireless Home Networking-Need-Technologies- Home Access Networks-Embedded Wireless Control using GSM-RFID.

TOTAL: 45

REFERENCE BOOKS

1. Pahalavan, Kaveh and Krishnamoorthy, Prasanth., “Principles of Wireless Networks”, Prentice Hall of India, New Delhi, 2005.
2. Iyer S. V. and Gupta P., “Embedded Real-time System Programming”, Tata McGraw-Hill, New Delhi, 2006
3. Rappaport, Theodore S., “Wireless Communications: Principles and Practice”, Prentice Hall of India, New Delhi, 2007.
4. Patranabis, D., “Sensors and Transducers”, Wheeler Publishing, Allahabad, 1997.
5. Michel Banatre, Pedro Jose Marron, and Anibal Ollero, “Cooperating Embedded Systems and Wireless Sensor Networks”, John Wiley & Sons Inc, 2008.

11ES015 EMBEDDED BUSES AND DATA ACQUISITION TECHNIQUES

3 0 0 3

Objective

- To design and analyze various circuits for digital devices.
- To study the standard bus for digital instrumentation system.
- To design real time applications using instrumentation buses.

MODULE – I **15**

Data Acquisition Systems: Overview of A/D converter, types and characteristics – Sampling, Errors. Objective – Building blocks of Automation systems –Counters – Modes of operation- Frequency, Period, Time interval measurements, Prescaler, Heterodyne converter for frequency measurement, Single and Multi channel Data Acquisition systems.

Interfacing and Data Transmission: Data transmission systems – 8086 Microprocessor based system design – Peripheral Interfaces – Time Division Multiplexing (TDM) – Digital Modulation – Pulse Modulation – Pulse Code Format – Interface systems and standards – Communications.

MODULE – II **15**

Instrumentation Bus: Introduction-Modem standards, Basic requirements of Instrument Bus standards, Bus communication, Interrupt and data handshaking , Interoperability, Interchangeability for RS-232, USB, RS-422, RS-485.

Parallel Port Buses: Field bus, Mod bus, GPIB, IEEE-488, VME, VXI, Network buses – Ethernet – TCP/IP protocols; CAN bus- basics, Message transfer, Fault confinement.

MODULE - III **15**

Case Studies: PC based DAS, Data loggers, PC based industrial process measurements like flow, temperature, pressure and level development system, CRT interface and controller with monochrome and colour video display

TOTAL : 45

REFERENCE BOOKS

1. A.J. Bouwens, “Digital Instrumentation”, Tata McGraw-Hill Edition, 1998.
2. N. Mathivanan, “Microprocessors, PC Hardware and Interfacing”, Prentice-Hall India, 2005.
3. H S Kalsi, “Electronic Instrumentation” Second Edition, Tata McGraw-Hill, 2006.
4. Joseph J. Carr, “Elements of Electronic Instrumentation and Measurement” 3rd Edition, Pearson Education, 2003.
5. Buchanan, “Computer buses”, Arnold, London, 2000.
6. Jonathan W Valvano, “Embedded Microcomputer Systems”, Asia Pvt. Ltd., Brooks/Cole, Thomson, 2001.

11ES016 RISC PROCESSOR ARCHITECTURE AND PROGRAMMING

3 0 0 3

Objective

- To study the architecture of AVR, ARM Processor.
- To attain programming knowledge in ARM & AVR applications.
- To design an ARM based System.

MODULE - I **15**

AVR Microcontroller Architecture: Architecture – memory organization – addressing modes – instruction set – programming techniques –Assembly language & C programming- Development Tools – Cross Compilers – Hardware Design Issues .

Peripheral of AVR Microcontroller: I/O Memory – EEPROM – I/O Ports –SRAM –Timer –UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing .

MODULE - II **15**

Architecture and Programming: Arcon RISC Machine – Architectural Inheritance – Core & Architectures -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors. Instruction set – Thumb instruction set – Instruction cycle timings - The ARM Programmer's model – ARM Development tools – ARM Assembly Language Programming and 'C'compiler programming.

MODULE - III **15**

ARM Application Development: Introduction to DSP on ARM –FIR Filter – IIR Filter – Discrete fourier transform – Exception Handling – Interrupts – Interrupt handling schemes- Firmware and boot loader – Example: Standalone - Embedded Operating Systems – Fundamental Components - Example Simple little Operating System

Design With ARM Microcontrollers: Integrated development environment - STDIO Libraries - User Peripheral Devices – Application of ARM processor: Wireless Sensor Networks, Robotics.

TOTAL : 45

REFERENCE BOOKS

1. Steve Furber, "ARM System on chip Architecture", Addision Wesley,2009
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield "ARM System Developer"s Guide Designing and Optimizing System Software", Elsevier 2007
3. Dananjay V. Gadre "Programming and Customizing the AVR microcontroller", McGraw Hill 2001
4. Trevor Martin, "The Insider's Guide To The Philips ARM7-Based microcontrollers,An Engineer's Introduction To The LPC2100 Series", Hitex (UK) Ltd
5. ARM Architecture Reference Manual
6. LPC213x User Manual
7. www.nxp.com
8. www.arm.com

11ES017 ADVANCED EMBEDDED SYSTEMS

3 0 0 3

Objective:

- To study the design attributes of functional units of a processor.
- To understand Intra & Inter processor communications.
- To study the system modeling with embedded co-design.

MODULE-I **15**

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 – Interrup 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.

MODULE-II **15**

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.

MODULE-III **15**

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.

TOTAL: 45

REFERENCE BOOKS

1. David. E. Simon, "An Embedded Software Primer", Pearson Education, 2001.
2. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", Tata McGraw Hill, 2006.
4. Tammy Noergaard, "Embedded System Architecture: A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
5. Steve Heath, "Embedded System Design", Elsevier, 2nd Edition, 2004.
6. Ralf Niemann, "Hardware/Software Co-Design for Data Flow Dominated Embedded Systems", Kluwer Academic Pub, 1998.
7. Jorgen Staunstrup, Wayne Wolf, "Hardware/Software Co-Design: Principles and Practice", Kluwer Academic Pub, 1997.
8. Giovanni De Micheli, and Rolf Ernst Morgon, "Reading in Hardware/Software Co-Design" Kaufmann Publishers, 2001.

11ES018 HDL FOR EMBEDDED FPGA PROCESSOR

3 0 0 3

Objective:

- To understand and learn the hardware description language.
- To implement practical, digital functional blocks using HDL.
- To learn the concepts of RTL system design.

MODULE – I **15**

System Verilog: Introduction- Design Hierarchy- Data types- Operators and language constructs. Functional coverage- assertion- Interfaces and test bench structures.

MODULE- II **15**

Modeling and Logic Synthesis with Verilog HDL: Overview of digital design using Verilog-HDL-Hierarchical Modeling concepts-Basic Concepts-Gate level Modeling-Dataflow Modeling-Behaviour Modeling-Tasks and Functions-Switch level modeling-Verilog HDL Synthesis-Synthesis Design Flow-Verification of the gate level net list-Modeling for logic synthesis-Example of sequential circuit synthesis.

MODULE -III **15**

Embedded FPGA Processor: An overview of advanced FPGAs and programmable SOCs - Architecture and configuration of Spartan II and Virtex II FPGAs- Apex and Cyclone FPGAs- Virtex II PRO kits and Nios kits- OMAP- ASIC physical design issues- system partitioning- interconnect delay models and measurement of delay.

TOTAL : 45

REFERENCE BOOKS

1. Stuart Sutherland, Simon Davidmann, and Peter Flake, "System Verilog for Design: "A Guide to Using SystemVerilog for Hardware Design and Modeling", 2nd Edition, Springer, 2010
2. Janick Bergeron, Eduard Cerny, Alan Hunter, Andy Nightingale "Verification Methodology Manual for SystemVerilog", Springer, 2005
3. Chris Spear SystemVerilog for Verification: "A Guide to Learning the Testbench Language Features", 3rd Edition, Springer, 2012
4. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, New Delhi, 2003.
5. Perry Douglas L., "VHDL: Programming by Example", Fourth Edition, Tata McGraw-Hill, New Delhi, 2002.

11ES019 COMPUTERS IN NETWORKING AND DIGITAL CONTROL

3 0 0 3

Objective:

- To get familiarized with the concepts of virtual instrumentation and network layer protocol.
- To understand the various layers and their functionality of network models.
- To measure and control various parameters using VI.

MODULE-I **15**

Network Fundamentals: Data communication networking – Data transmission concepts – Communication networking - Overview of OSI- TCP/IP layers – IP addressing - DNS – Packet Switching – Routing –Fundamental concepts in SMTP- POP- FTP- Telnet- HTML- HTTP- URL- SNMP-ICMP.

Data Communication: Sensor data acquisition- Sampling- Quantization- Filtering -Data Storage- Analysis using compression techniques- Data encoding – Data link control – Framing- Flow and Error control- Point to point protocol- Routers- Switches - Bridges – MODEMs- Network layer – Congestion control - Transport layer- Congestion control- Connection establishment.

MODULE-II **15**

Virtual Instrumentation: Block diagram and Architecture – Data flow techniques – Graphical programming using GUI – Real time system – Embedded controller – Instrument drivers – Software and hardware simulation of I/O communication blocks – ADC/DAC – Digital I/O – Counter - Timer- Data communication ports.

MODULE-III **15**

Measurement and control through internet: Web enabled measurement and control-data acquisition for Monitoring of plant parameters through Internet – Calibration of measuring instruments through Internet- Web based control – Tuning of controllers through Internet.

VI Based Measurement and Control: Simulation of signal analysis & controller logic modules for Virtual Instrument control – Case study of systems using VI for data acquisition- Signal analysis- controller design- Drives control.

TOTAL: 45

REFERENCE BOOKS

1. Wayne Tomasi, "Introduction to Data communications and Networking" Pearson Education, 2007.
2. Al Williams, "Embedded Internet Design", 2nd Edition, TMH, 2007.
3. Douglas E.Comer, "Internetworking with TCP/IP", Vol. 1, 3rd Edition, Prentice Hall, 1999.
4. Cory L. Clark, "LabVIEW Digital Signal Processing and Digital Communication", TMH edition 2005.
5. Behrouza A Forouzan, "Data Communications and Networking" 4th Edition, TMH, 2007.
6. Krishna Kant, "Computer based Industrial control",PHI, 2002.
7. Gary Johnson, "LabVIEW Graphical Programming", 2nd Edition, McGraw Hill, Newyork, 1997.
8. Kevin James, "PC Interfacing and Data Acquisition: Techniques for measurement, Instrumentation and control", Newnes, 2000.
9. Cory L. Clark, "LabVIEW Digital Signal processing and Digital Communications" Tata McGraw-Hill, 2005.

11ES020 DISTRIBUTED EMBEDDED COMPUTING

3 0 0 3

Objective:

- To design applications using web technology.
- To enrich knowledge in embedded computing architecture and its design.
- To learn about embedded agent and distributed computing.

MODULE-I **15**

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 - use of active components.

MODULE-II **15**

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.

MODULE-III **15**

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.

TOTAL: 45

REFERENCE BOOKS

1. Sape Mullender, "Distributed Systems", Addison-Wesley, 1993.
2. George Coulouris and Jean Dollimore, "Distributed Systems – concepts and design", Addison – Wesley 1988.
3. Bernd Kleinjohann, "Architecture and Design of Distributed Embedded Systems", C-lab, University at Paderborn, Germany, Kluwer Academic Publishers, Boston, April 2001, 248 pp.
4. Dietel and Dietel, "JAVA How to Program", Prentice Hall 1999.

11ES021 ROBOTICS

3 0 0 3

Objective:

- To understand the concepts of robotics power transmission systems.
- To know the characteristics and various types of sensors used in robotics.
- To learn the concept of the vision systems for robotics and various standards.

MODULE - I **15**

Robotics and Robotics Drives: History- Present status and future trends in Robotics and automation – Application Laws of Robotics - Robot definitions - Robotics systems and robot anatomy - Specification of Robots - Resolution- Repeatability and accuracy of a manipulator. Robotics applications Robot drive mechanisms- Hydraulic – Electric – Servomotor- Stepper motor - Pneumatic drives.

Robotics Power Transmission Systems: Mechanical transmission method - Gear transmission- Belt drives- cables- Roller chains- Link - Rod systems - Rotary-to-Rotary motion conversion- Rotary-to-Linear motion conversion- Rack and Pinion drives- Lead screws- Ball Bearing screws- Harmonic drives.

MODULE - II **15**

End effectors: Types of End Effector- Mechanical gripper- Types of Mechanisms- Magnetic gripper- Vacuum gripper- other types of gripper.

Rigid Transformation: Rigid motions and Homogeneous transformations- Kinematic chaim- Denavit – Harten berg representation- Forward and Inverse Kinematics- Velocity Kinematics- Manipulator Dynamics-End effectors – Types.

MODULE- III **15**

Sensors: Sensor characteristics- Position sensors – Potentiometers – Encoders – Resolvers – LVDT- Velocity sensors – Tacho generators - Encoders - Proximity sensors- Limit switches – Tactile sensors - Touch sensors - Force and torque sensors.

Vision Systems for Robotics: Robot vision systems- Image capture- Cameras – Vidicon and solid state- Image representation - Gray scale and colour images- Image sampling and quantization - Image processing and analysis - Image data reduction - Segmentation - Feature extraction - Object Recognition- Image capturing and communication - JPEG- MPEGs and H.26x standards- Packet video- Error concealment.- Image texture analysis.

TOTAL: 45

REFERENCE BOOKS

1. Klafter, Richard D., Chmielewski, Thomas A, and Negin, Michael., “Robotics Engineering: An Integrated Approach”, Prentice Hall of India, New Delhi, 1989.
2. Fu, K.S., Gomalez, R.C., and Lee C.S.G., “Robotics: Control, Sensing, Vision and Intelligence”, McGraw Hill, New York, 1987.
3. Spong W, Vidyasagar. M, “Robot Dynamics and control matrix” Wiley Publication.2008

11ES022 CRYPTOGRAPHY AND NETWORK SECURITY

3 0 0 3

Objective:

- To understand the concepts of public key encryption and number theory
- To realize authentication and Hash functions.
- To know the network security tools and applications.

MODULE– I **15**

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

MODULE– II **15**

Network Security Practice: Authentication Applications – Kerbors – X.509 Authentication Service – Electronic mail Security – Pretty Good Privacy – S/MIME – IP Security architecture – Authentication Header – Encapsulating Security Payload – Key Management.

MODULE– III **15**

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.

TOTAL: 45

REFERENCE BOOKS

1. William Stallings, "Cryptography And Network Security – Principles and Practices", Pearson Education, 4th Edition, 2004.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2006.
3. Bruce Schneier, "Applied Cryptography", John Wiley and Sons Inc, 2nd Edition 2006.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security In Computing", 3rd Edition, Pearson Education, 2003.
5. Mai, "Modern Cryptography: Theory and Practice", 1st Edition, Pearson Education, 2003.

11ES023 EMBEDDED AUTOMOTIVE NETWORKING

3 0 0 3

Objective:

- To develop applications using CAN bus for PIC microcontrollers
- To understand network communication protocols.
- To obtain knowledge on CAN protocol controller

MODULE– I **15**

Data Communication basics: Data communication basics - Network communication protocol – Medium access control – Error checking & control – Requirements & applications of field bus systems- Characteristics of CAN

CAN Data link layer : CAN data link layer – Principles of bus arbitration – Frame formats – Error detection & error handling – Extended frame format – Time triggered multiplexing.

MODULE– II **15**

CAN Physical layer: Physical signaling – Transmission media – Network topology – Bus medium access – Physical layer standards

CAN protocol controllers: CAN protocol controllers – Functions of a CAN controller – Message filtering – Message handling - Standalone CAN controllers – Integrated CAN controllers – CAN transceivers

MODULE– III **15**

CAN higher layer protocols: CAN application layer – Protocol architecture – CAN message specification – Allocation of message identifiers – Network management – Layer management – Higher layer protocols - CAN open - DeviceNet – SAEJ1939 – Time triggered CAN

TOTAL: 45

REFERENCE BOOKS

1. Glaf P.Feiffer, Andrew Ayre and Christian Keyold "Embedded Networking with CAN and CAN open". Embedded System Academy, 2005.
2. Wolfhard Lawrenz, "CAN System Engineering: From Theory to Practical Applications", Springer,1997.
3. Konrad Etschberger, "Controller Area Network" , IXXAT Automation GmbH,2001.
4. Francoise Simonot-Lion, " Handbook of Automotive Embedded Systems" ,CRC Press,2007.
5. http://www.can-cia.org/can/
6. http://www.can-cia.org/can/

11ES024 REAL TIME SYSTEMS

3 0 0 3

Objective:

- To learn the programming tools and data bases for real time systems.
- To study the scheduling algorithms of hard real-time systems.
- To understand different kinds of evaluation techniques.

MODULE– I **15**

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.

MODULE– II **15**

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.

MODULE– III **15**

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

TOTAL: 45

REFERENCE BOOKS

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, 2010.
2. Stuart Bennett, “Real Time Computer Control – An Introduction”, Prentice Hall of India, 1998.
3. Peter D.Lawrence, “Real Time Micro Computer System Design – An Introduction”, McGraw Hill, 1988.
4. S.T. Allworth and R.N.Zobel, “Introduction to real time software design”, Macmillan, 2nd Edition, 1987
5. R.J.A Buhur, D.L Bailey, “An Introduction to Real – Time Systems”, Prentice – Hall International, 1999.
6. Philip. A. Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd Edition, April 2004.

11ES025 NETWORK ON CHIP

3 0 0 3

Objective:

- To learn the architecture and switching techniques of ICN.
- To analyse the performance of combinational and sequential network on chip design.
- To analyse the performance , issues and challenges of NOC.
- To obtain knowledge of various routing algorithms and topologies.

MODULE- I **15**

ICN Architectures and Switching Techniques: Introduction – Classification of ICNs - Topologies - Direct Networks - Indirect Networks. Basic switching techniques - Virtual channels – Hybrid switching techniques Optimizing switching techniques - Comparison of switching techniques – Deadlock- Live lock and Starvation Issues

MODULE– II **15**

Routing Algorithms: Taxonomy of routing algorithms - deterministic routing algorithms - Partially adaptive algorithms - Fully adaptive algorithms - Routing in MINs - Routing in switch-based networks with irregular topologies - Resource allocation policies.

MODULE– III **15**

Network-On-Chip and Performance Analysis: NoC Architectures - Area, energy and reliability constraints - NoC design alternatives - Quality-of Service (QoS) issues in NoC architectures. Performance issues – Analytical and Simulation approaches – Fault-tolerance issues –Case studies.

TOTAL : 45

REFERENCE BOOKS

1. William J. Dally and Brian Towels, “Principles and Practices of Interconnection Networks”, Morgan Kaufmann Publishers, 2003
2. Giovanni Deicheli, Luca Benini, “Networks on Chips: Technology and Tools”, Morgan Kaufmann Publishers, 2006
3. J.Duato, S.Yalamanchili, and Li, “Interconnection Networks: An Engineering Approach”, Morgan Kaufmann Publishers, 2004.

11ES026 MEDICAL IMAGING SYSTEMS

3 0 0 3

Objective:

To understand radiographic interpretations from various images.
To learn about medical imaging techniques.

MODULE I **15**

Principles of Radiographic Equipments: X-Ray tubes- Cooling systems- Removal of scatters- Construction of image Intensifier tubes- Angiographic setup- Digital radiology.

Computer Aided Tomography: Need for sectional images- Principles of sectional scanning- Method of convolution and Back-Propagation- Methods of reconstruction- Artifacts- Principle of 3D imaging-Case Study: Camera Augmented Mobile C-Arm (CAMC)- CT Lung Cancer Screening

MODULE II **15**

Radio Isotopic Imaging: Radiation detectors- Radio isotopic imaging equipments- scanners- Principle of semiconductor detectors- Gamma ray camera- Positron Emission tomography.SPECT.

Ultrasonic Systems: Wave propagation and interaction in Biological tissues- Acoustic radiation- Continuous and pulsed excitation- Transducers and imaging systems- Scanning methods- Principle of image generation. Case Study- Radio guided Surgery to detect Glioma- Control of Traveling-Wave Ultrasonic Motor System

MODULE III **15**

Magnetic Resonance Imaging: Principles of MRI- Relaxation processes and their measurements- Pulse sequencing and MR image acquisition. Case Study-Measurement of Cerebral Blood Flow by Phase Contrast Magnetic Resonance Imaging- Spline-Based Cardiac Motion Tracking

TOTAL:45

REFERENCE BOOKS

1 D.N.Chesney and M.O.Chesney "Radio Graphic Imaging", CBS Publications, New Delhi, 1987.
2 Peggy, W., Roger D.Ferimarch, "MRI for Technologists", McGraw Hill, New York, 1995.
3 Steve Webb, "The Physics of Medical Imaging", Taylor & Francis, New York.1988.

11VL019 ADVANCED COMPUTER ARCHITECTURE

(Common to M.E VLSI Design and Embedded Systems)

3 0 0 3

Objective:

- To introduce the Parallel processing and vector processors.
- To know about the Multiprocessors.
- To understand the Multicore Processors.

PREREQUISITE: Computer Architecture

MODULE - I **15**

Principles of Parallel Processing and Vector Processors: Introduction-Trends towards Parallel Processing- Uniprocessor Architecture Overview–Basic Uniprocessor Architecture- Parallel Processing Mechanism- Balancing of subsystems- Bandwidth- Multiprogramming and Time sharing – Styles of Architecture -Multiplicity of Instruction – Data Structures- Serial versus Parallel Processing- Parallelism versus Pipelining- Parallel Processing Applications. Principles of Vector Processing- Pipelined Vector Processing methods- The Architecture of CRAY-1-the Architecture of CYBER-205- Vector Processing in CYBER-205.

MODULE - II **15**

Array Processors and Multiprocessor Systems: SIMD Computer Organizations- Masking and Data Routing mechanisms- Statics versus Dynamic Networks- Mesh-connected- Iliac Networks- Cube Interconnection Networks- SIMD Matrix Multiplication. Loosely Coupled Multiprocessors- Tightly Coupled Multiprocessors- Processor characteristics for Multiprocessing- Time Shared or Common Buses- Crossbar switch and Multi-port memories- Classification of Multiprocessor Operating Systems- Software Requirements for Multiprocessors- Operating System Requirements.

MODULE - III **15**

Data Flow Computer Architectures and Multi Core Processors: Control-Flow versus Data Flow Computers- Data Flow Graphs and Languages Advantages and Potential Problems- Static Data Flow Computers- Dynamic Data Flow Computers- Data Flow Design Alternates - Introduction to Multi core processor – Components of multi core processors.-Applications

TOTAL: 45

REFERENCE BOOKS

1 Hwang, Kai, and Briggs, Faye A., "Computer Architecture and Parallel Processing," McGraw Hill Inc., New York, 1985.
2 Shiva, Sajjan G., "Pipelined and Parallel Computer Architecture", Prentice Hall Inc, New Jersey, 1996.
3 Stallings, William. "Computer Organization and Architecture", McMillan Publishing Company, London, 1990.
4 Hwang, Kai., "Advanced Computer Architecture", Tata McGraw-Hill, New Delhi, 2001.
5 www.intel.com/technology/advanced_comm/multicore.htm

11VL023 SYSTEM ON CHIP

(Common to M.E VLSI Design and Embedded Systems)

3 0 0 3

Objective:

- To learn combinational system on chip design
- To learn the sequential system on chip design
- To understand the design of subsystem and CAD systems

PREREQUISITE: VLSI Design Techniques.

MODULE- I **15**

Digital Systems: Digital system and VLSI-Transistors-Design rules-Layout design and tools-logic gates-static complementary gates-switch logic-alternative gate circuits-delay through resistive interconnect-delay through inductive interconnect.

MODULE– II **15**

Combinational and Sequential Network: Combinational logic network-standard cell based layout-Combinational network delay-logic and interconnect design-power optimization-switch logic network-combinational logic testing Sequential machines-Latches and Flipflops-Sequential systems and clocking disciplines-Sequential System Design- Power optimization-Design Validation-Sequential testing.

MODULE– III **15**

Subsystem Design: Subsystem Design-Principles of Shifters-Adders-ALU-Multiplier-High Density Memory-FPGA-PLA- Floor planning methods- off chip connections-Architectural Design –HDL-Register Transfer Design-High Level Synthesis-Architecture for low power-SoC and embedded CPUs-Architecture testing.- Chip Design-methodologies-Kitchen Timer Chip-Microprocessor Data Path CAD systems and algorithms-Switch level simulation-layout synthesis-analysis-timing analysis and optimization-logic synthesis-test generation-Sequential machine optimization-scheduling and binding- Hardware/Software co design.

TOTAL : 45

REFERENCE BOOKS

1. Wolf, Wayne “Modern VLSI Design: System-on-Chip Design”, 3rd Edition, Pearson Edition, New Delhi, 2004.
2. Reis, Ricardo. “Design of System on a Chip: Devices and Components”, Springer, 2004.
3. Rashinkar P., Paterson and Singh L., “System on a Chip Verification – Methodologies and Techniques”, Kluwer Academic Publishers, 2001.
4. Wang, Laung – Terng, Stroud, Charles.E., Touba, Nur.A, “System–on–Chip Test Architectures: Nanometer Design for Testability”, Elsevier Inc,2007.
5. www.elsevier.com

11VL025 DIGITAL IMAGE PROCESSING

(Common to M.E. Mechatronics, Applied Electronics , Embedded Systems and Computer Science and Engg.)

3 0 0 3

PREREQUISITE: Digital Signal Processing

Objectives:

- To introduce the fundamentals and techniques of digital image processing.
- To understand the various 2D image transformations.
- To study the concepts of image processing techniques like image enhancement and restoration.
- To study the various techniques in image segmentation and representation.
  To understand the various techniques of Image compression and its standards

MODULE– I **15**

Introduction: Elements of Digital Image processing – Elements of visual perception: light - luminance – brightness, contrast, hue, saturation – Mach band effect – simultaneous contrast. Color image fundamentals – RGB model and HIS model – converting colors from HIS to RGB. Two dimensional sampling theory – practical limits in sampling and reconstruction.

Image Transforms: Two dimensional systems - Block matrices and Kronecker products. Two dimensional orthogonal and unitary transforms – DFT, cosine, sine, Walsh, problems

MODULE– II **15**

2D Transforms: Hadamad, Haar and KL transforms, Radon transforms, problems

Image Enhancement and Restoration: Image enhancement - Point operations - contrast stretching - clipping and thresholding - digital negative intensity level slicing - bit extraction. Histogram processing - histogram equalisation -modification. Spatial operations – smoothing spatial filters, sharpening spatial filters. Transform operations. Color image enhancement. Image Restoration – degradation model, Noise models, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering.

Image Segmentation: Point, line and edge detection –Image segmentation based on thresholding– Region based segmentation – region growing – region splitting and merging.

MODULE– III **15**

Image Representation: Representation: chain codes – polynomial approximations – signatures – boundary descriptors – Regional descriptors: Texture regional descriptor.

Image Compression: Image Compression – Need for data compression – Run length encoding – Huffman coding – Arithmetic coding – predictive coding- transform based compression, Image compression standards – JPEG 2000, MPEG 4. - vector quantization – block truncation coding, Wavelet based image compression.

TOTAL: 45

REFERENCE BOOKS

1. Gonzalez, Rafel C. and Woods, Richard E., "Digital Image Processing", 2nd Edition, Prentice Hall, New York, 2006.
2. Jain, Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi, 2003.
3. Rosenfield, Azriel and Kak, Avinash C., “Digital Picture Processing”, Academic Press Inc, New York, 1982.
4. Jayaraman. S, Esakkirajan. S, and Veerakumar. T, “Digital Image Processing” Tata McGraw-Hill, New Delhi, 2009

11AE020 MICRO SENSORS AND MEMS

(Common to M.E.Applied Electronics, Embedded Systems and Control and Instrumentation Engineering)

3 0 0 3

Objective:

- To gain a fundamental knowledge of standard Microsystems design fabrication and manufacturing techniques.
- Understanding the working principles of micro sensors and actuators
- The materials used for MEMS system design and its properties.
- Know the major classes, components and application of MEMS systems.

MODULE-I **15**

Introduction: Introduction to Microsystems and Micro Electronics working principles of different types of Micro sensors and Micro actuators scaling laws for Micro system design – Mechanics for MEMS design: Bending of thin plates, Vibration and fracture mechanics

MODULE-II **15**

Materials for MEMS: Si, Silicon compounds: Sio_2, Si_3N_4, SIC, Poly silicon, Silicon Piezo resistors – GAS, Quartz, polymers – Piezo Electric crystals. Fabrication: Photolithography, Ion implantation, diffusion, oxidation, CVD, Sputtering, etching.

MODULE-III **15**

Microsystem manufacturing and packaging: Bulk micro machining, surface micro machining, LIGA Technique – Die level, device level and system level practices– Application ;of Microsystems in automotive industry, biomedical and consumer products.

TOTAL: 45

REFERENCE BOOKS

1. Doebelin, E.O., "Measurement Systems: Application & Design", 5th Edition McGraw-Hill Book Co., New Delhi, 2004.
2. Sheingold, D.H., "Transducer Interfacing Handbook: The guide to analog signal conditioning", Analog devices Inc, 1993.
3. Tai – Ran Hsu, "MEMS and Microsystems design and manufactures" Tata McGraw Hill, New Delhi, 2008.
4. Mohamed Gad –el-Hak, "The MEMS Hand Book", CRC press, 2002.
5. Fatilcow. S and Rembold U, "Microsystem Technology and Microrobotics, Springer – verlog Berlin, 1997.
6. Garden, J.W. Varadan.V.K., Osama and Awadelkarim.O., "Microsensors MEMS and Smart Devices", John Wiley & sons Ltd., New York, 2001.