AFFILIATED INSTITUTIONS

ANNA UNIVERSITY, CHENNAI

REGULATIONS – 2013

M.E. EMBEDDED SYSTEM TECHNOLOGIES

I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

SEMESTER I

Sl.No	CODE	COURSE TITILE	L	T	P	C
THEORY						
1	MA7163	Applied Mathematics for Electrical Engineers	3	1	0	4
2	ET7101	Advanced Digital System Design	3	0	0	3
3	ET7102	Microcontroller Based System Design	3	0	0	3
4	ET7103	Real Time Systems	3	0	0	3
5	ET7104	Design of Embedded Systems	3	0	0	3
6		Elective - I	3	0	0	3
PRACTICAL						
7	ET7111	Embedded System Laboratory I	0	0	3	2
		TOTAL	**18**	**1**	**3**	**21**

SEMESTER II

Sl.No	CODE	COURSE TITILE	L	T	P	C
THEORY						
1	ET7201	VLSI Architecture and Design Methodologies	3	0	0	3
2	ET7202	Embedded Networking	3	1	0	4
3	ET7203	Wireless and Mobile Communication	3	0	0	3
4	ET7204	Software for Embedded Systems	3	0	0	3
5		Elective - II	3	0	0	3
6		Elective - III	3	0	0	3
PRACTICAL						
7	ET7211	Embedded System Laboratory II	0	0	3	2
		TOTAL	**18**	**1**	**3**	**21**

SEMESTER III

Sl.No	CODE	COURSE TITILE	L	T	P	C
THEORY						
1		Elective – IV	3	0	0	3
2		Elective – V	3	0	0	3
3		Elective – VI	3	0	0	3
PRACTICAL						
4	ET7311	Project Work (Phase I)	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV						
Sl.No	**CODE**	**COURSE TITILE**	L	T	P	C
THEORY						
1	ET7411	Project Work (Phase II)	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NUMBER OF CREDITS = 69

ELECTIVES FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES

ELECTIVE I

Sl. No	**CODE**	**COURSE TITILE**	L	T	P	C
THEORY						
1	ET7001	Digital Instrumentation	3	0	0	3
2	ET7002	Real Time Operating Systems	3	0	0	3
3	ET7016	Parallel Processing Architecture	3	0	0	3

ELECTIVE II & III

4	ET7003	Design of Embedded Control Systems	3	0	0	3
5	ET7004	Programming with VHDL	3	0	0	3
6	ET7005	Adhoc Networks	3	0	0	3
7	ET7006	Advanced Digital Signal Processing	3	0	0	3
8	CL7204	Soft Computing Techniques	3	0	0	3
9	ET7007	RISC Processor Architecture and Programming	3	0	0	3

ELECTIVE IV ,V & VI

10	ET7008	Advanced Embedded Systems	3	0	0	3
11	ET7009	Pervasive Devices and Technology	3	0	0	3
12	ET7010	Cryptography and Network Security	3	0	0	3
13	ET7011	Smart Meter and Smart Grid Communication	3	0	0	3
14	ET7012	Computer in Networking and Digital Control	3	0	0	3
15	ET7013	Distributed Embedded Computing	3	0	0	3
16	CL7004	Robotics and Control	3	0	0	3
17	ET7014	Application of MEMS Technology	3	0	0	3
18	ET7015	Digital Image Processing and Applications	3	0	0	3

MA7163 APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS LT P C
3 1 0 4

OBJECTIVES:

- To develop the ability to apply the concepts of Matrix theory and Linear programming in Electrical Engineering problems.
- To achieve an understanding of the basic concepts of one dimensional random variables and apply in electrical engineering problems.
- To familiarize the students in calculus of variations and solve problems using Fourier transforms associated with engineering applications.

UNIT I MATRIX THEORY (9+3)

The Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT II CALCULUS OF VARIATIONS (9+3)

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – problems with constraints - Direct methods: Ritz and Kantorovich methods.

UNIT III ONE DIMENSIONAL RANDOM VARIABLES (9+3)

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT IV LINEAR PROGRAMMING (9+3)

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT V FOURIER SERIES (9+3)

Fourier Trigonometric series: Periodic function as power signals – Convergence of series – Even and odd function: cosine and sine series – Non-periodic function: Extension to other intervals - Power signals: Exponential Fourier series – Parseval's theorem and power spectrum – Eigen value problems and orthogonal functions – Regular Sturm-Liouville systems – Generalized Fourier series.

L:45 +T: 15 TOTAL: 60 PERIODS

REFERENCES:

1. Richard Bronson, "Matrix Operation", Schaum's outline series, 2nd Edition, McGraw Hill, 2011.
2. Gupta, A.S., Calculus of Variations with Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
3. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes, Academic Press, (An imprint of Elsevier), 2010.
4. Taha, H.A., "Operations Research, An introduction", 10th edition, Pearson education, New Delhi, 2010.
5. Andrews L.C. and Phillips R.L., Mathematical Techniques for Engineers and Scientists, Prentice Hall of India Pvt.Ltd., New Delhi, 2005.
6. Elsgolts, L., Differential Equations and the Calculus of Variations, MIR Publishers, Moscow, 1973.
7. Grewal, B.S., Higher Engineering Mathematics, 42nd edition, Khanna Publishers, 2012.
8. O'Neil, P.V., Advanced Engineering Mathematics, Thomson Asia Pvt. Ltd., Singapore, 2003.

9. Johnson R. A. and Gupta C. B., “Miller & Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 7th Edition, 2007.

ET7101 ADVANCED DIGITAL SYSTEM DESIGN LT P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of sequential system design, modelling
- To teach the fundamentals of Asynchronous circuits, switching errors
- To study on Fault identification in digital switching circuits
- To introduce logics for design of Programmable Devices
- To comparatively study the classification of commercial family of Programmable Devices

UNIT I SEQUENTIAL CIRCUIT DESIGN 9

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

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 9

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.

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS 9

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.

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES 9

Programming Techniques -Re-Programmable Devices Architecture- Function blocks, I/Oblocks, Interconnects, Realize combinational, Arithmetic, Sequential Circuit with Programmable Array Logic; Architecture and application of Field Programmable Logic Sequence.

UNIT V ARCHITECTURES AND PROGRAMMING PROGRAMMABLE LOGIC DEVICES 9

Architecture with EPLD, PEEL – Realization State machine using PLD – FPGA-Aptix Field Programmable Interconnect – Xilinx FPGA – Xilinx 2000 - Xilinx 4000 family.VHDL based Designing with PLD-ROM,PAL,PLA,Sequential PLDs,Case study –Keypad Scanner.

TOTAL : 45 PERIODS

REFERENCES:

1. Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.
2. Stephen Brown and Zvonk Vranesic, "Fundamentals of Digital Logic with VHDL Deisgn", Tata McGraw Hill, 2002
3. Charles H. Roth Jr., "Digital Systems design using VHDL", Cengage Learning, 2010.
4. Mark Zwolinski, "Digital System Design with VHDL", Pearson Education, 2004
5. Parag K Lala, "Digital System design using PLD", BS Publications, 2003
6. John M Yarbrough, "Digital Logic applications and Design", Thomson Learning,2001
7. Nripendra N Biswas, "Logic Design Theory", Prentice Hall of India, 2001
8. Charles H. Roth Jr., "Fundamentals of Logic design", Thomson Learning, 2004.
9. John V.Oldfeild,Richard C.Dorf,"Field Programmable Gate Arrays",Wiley India Edition,2008

ET7102 MICROCONTROLLER BASED SYSTEM DESIGN L T P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of microcontroller based system design.
- To teach I/O and RTOS role on microcontroller.
- To impart knowledge on PIC Microcontroller based system design.
- To introduce Microchip PIC 8 bit peripheral system Design
- To give case study experiences for microcontroller based applications.

UNIT I 8051 ARCHITECTURE 9

Architecture – memory organization – addressing modes – instruction set –Timers - Interrupts - I/O ports, Interfacing I/O Devices – Serial Communication.

UNIT II 8051 PROGRAMMING 9

Assembly language programming – Arithmetic Instructions – Logical Instructions –Single bit Instructions – Timer Counter Programming – Serial Communication Programming Interrupt Programming – RTOS for 8051 – RTOSLite – FullRTOS – Task creation and run – LCD digital clock/thermometer using FullRTOS

UNIT III PIC MICROCONTROLLER 9

Architecture – memory organization – addressing modes – instruction set – PIC progrmming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, MP-LAB.

UNIT IV PERIPHERAL OF PIC MICROCONTROLLER 9

Timers – Interrupts, I/O ports- I2C bus-A/D converter-UART- CCP modules -ADC, DAC and Sensor Interfacing –Flash and EEPROM memories.

UNIT V SYSTEM DESIGN – CASE STUDY 9

Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand alone Data Acquisition System.

TOTAL : 45 PERIODS

REFERENCES:

1. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ‘ PIC Microcontroller and Embedded Systems using Assembly and C for PIC18’, Pearson Education 2008
2. John Iovine, ‘PIC Microcontroller Project Book ’, McGraw Hill 2000
3. Myke Predko, “Programming and customizing the 8051 microcontroller”, Tata McGraw Hill 2001.
4. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, ‘The 8051 Microcontroller and Embedded Systems’ Prentice Hall, 2005.
5. Rajkamal,”.Microcontrollers-Architecture,Programming,Interfacing & System Design”,2ed,Pearson,2012.
6. I Scott Mackenzie and Raphael C.W. Phan, “The Micro controller”, Pearson, Fourth edition 2012

ET7103 **REAL TIME SYSTEMS** **LT P C**
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of Real Time systems
- To teach the fundamentals of Scheduling and features of programming languages
- To study the data management system for real time
- To introduce the fundamentals of real time communication
- To teach the different algrorithms and techniques used for real time systems

UNIT I INTRODUCTION **9**

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.

UNIT II PROGRAMMING LANGUAGES AND TOOLS **9**

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

UNIT III REAL TIME DATABASES **9**

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

UNIT IV COMMUNICATION **9**

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.

UNIT V . EVALUATION TECHNIQUES **9**

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

TOTAL : 45 PERIODS

REFERENCES

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, 1997.
2. Rajib Mall, ”Real-time systems: theory and practice”, Pearson Education, 2007
3. Peter D.Lawrence, “Real Time Micro Computer System Design – An Introduction”, McGraw Hill, 1988.
4. Stuart Bennett, “Real Time Computer Control – An Introduction”, Prentice Hall of India, 1998.
5. S.T. Allworth and R.N.Zobel, “Introduction to real time software design”, Macmillan,

2nd Edition, 1987.
6. R.J.A Buhur, D.L Bailey, “An Introduction to Real – Time Systems”, Prentice – Hall International, 1999.
7. Philip.A.Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd Edition, April 2004

ET7104 DESIGN OF EMBEDDED SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To provide a clear understanding on the basic concepts, Building Blocks for Embedded System
- To teach the fundamentals of System design with Partioning
- To introduce on Embedded Process development Environment
- To study on Basic tool features for target configuration
- To introduce different EDLC Phases &Testing of embedded system

UNIT I EMBEDDED DESIGN WITH MICROCONTROLLERS 9

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Micro Controller – Performance tools – Bench marking – RTOS Micro Controller -issues in selection of processors.

UNIT II PARTITIONING DECISION 9

Hardware / Software duality – Hardware-Software portioning- coding for Hardware- software development – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization –memory enhancement – Firmware-speed and code density -System startup

UNIT III FUNCTIONALITIES FOR SYSTEM DESIGN 9

Timers,Watch dog timers – RAM, Flash Memory basic toolset – Integration of Hardware & Firmware- InSystem Programming, InApplication Programming,,IDE-Target Configuration- Host based debugging – Remote debugging – ROM emulators – Logic analyser

UNIT IV IN CIRCUIT EMULATORS 9

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

UNIT V EMBEDDED DESIGN LIFE CYCLE & TESTING 9

Objective, Need, different Phases & Modelling of the EDLC.choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems- Software &Hardware Design,PCB Design, Manufacturing & PCB Assembly-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 PERIODS

REFERENCES

1. James K.Peckol, “Embedded system Design”,JohnWiley&Sons,2010
2. Elicia White,”Making Embedded Systems”,O’Reilly Series,SPD,2011
3. Rajkamal,”Embedded Systems”,TMH,2009.
4. Lyla B Das,” Embedded Systems-An Integrated Approach”,Pearson2013
5. Arnold S. Berger – “Embedded System Design”, CMP books, USA 2002.
6. ARKIN, R.C., Behaviour-based Robotics, The MIT Press, 1998.

ET7111 EMBEDDED SYSTEM LABORATORY I L T P C
0 0 3 2

Sl.No.	Title	Requirement	Quantity
1	Programming with 8 bit Microcontrollers Both Assembly and C programming	8 bit Microcontrollers with peripherals;Board Support Software Tools	5 set
2	Programming with 8 bit Microcontrollers I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	8 bit Microcpontrollers with peripherals;Board Support Software Tools, peripherals with interface DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	2 set
3	Programming with 8 bit PIC/AVR Microcontrollers Both Assembly and C programming	8 bit PIC/AVR Microcpontrollers with peripherals;Board Support Software Tools	5 set
4	Programming with PIC /AVR Microcontrollers I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	PIC /AVR Microcpontrollers with peripherals;Board Support Software Tools, peripherals with interface DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	2 set
5	Programming with 16 bit processors Both Assembly and C programming	16 bit processors with peripherals;Board Support Software Tools	2 set
6	Programming with 16 bit processors I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	16 bit Microcpontrollers with peripherals;Board Support Software Tools with interface DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	2 set
7	Design with CAD tools Design and Implementation of Combinational , Sequential Circuits in CAD simulators	Simulation Tools as SPICE/others	Multiple user
8	Study on incircuit Emulators, crosscompilers, debuggers	Microcpontrollers with peripherals;IDE, Board Support Software Tools /Uc/OS-II/C Compiler/others	Multiple user
9	Simulation & Programming of sensor interface & measurement with using programming environments (MATLAB/LabVIEW/Simulation Tools)	Simulation Tools as MATLAB/ LABVIEW /others	Multiple user

10	Programming of TCP/IP protocol stack	Simulation & Experimenting set with IAR C/C++ Compiler,Assembler, peripherals;Board Support Software Tools	1 set

TOTAL: 45 PERIODS

ET7201 VLSI ARCHITECTURE AND DESIGN METHODOLOGIES LT P C
3 0 0 3

OBJECTIVES

- To give an insight to the students about the significance of CMOS technology and fabrication process.
- To teach the importance and architectural features of programmable logic devices.
- To introduce the ASIC construction and design algorithms
- To teach the basic analog VLSI design techniques.
- To study the Logic synthesis and simulation of digital system with Verilog HDL.

UNIT I CMOS DESIGN 9

Overview of digital VLSI design Methodologies- Logic design with CMOS-transmission gate circuits-Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- Layout diagram, Stick diagram-IC fabrications – Trends in IC technology.

UNIT II PROGRAMABLE LOGIC DEVICES 12

Programming Techniques-Anti fuse-SRAM-EPROM and EEPROM technology – Re-Programmable Devices Architecture- Function blocks, I/O blocks,Interconnects, Xilinx-XC9500,Cool Runner - XC-4000,XC5200, SPARTAN, Virtex - Altera MAX 7000-Flex 10K-Stratix.

UNIT III BASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING 6

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

UNIT IV ANALOG VLSI DESIGN 6

Introduction to analog VLSI- Design of CMOS 2stage-3 stage Op-Amp –High Speed and High frequency op-amps-Super MOS-Analog primitive cells-realization of neural networks.

UNIT V LOGIC SYNTHESIS AND SIMULATION 12

Overview of digital design with Verilog HDL, hierarchical modelling concepts, modules and port definitions, gate level modelling, data flow modelling, behavioural modelling, task & functions, Verilog and logic synthesis-simulation-Design examples,Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Multiplexer, Comparator, Test Bench.

TOTAL 45 PERIODS

REFERENCES:
1. M.J.S Smith, “Application Specific integrated circuits”,Addition Wesley Longman Inc.1997.
2.Kamran Eshraghian,Douglas A.pucknell and Sholeh Eshraghian,”Essentials of VLSI circuits and system”, Prentice Hall India,2005.
3. Wayne Wolf, “ Modern VLSI design “ Prentice Hall India,2006.
4. Mohamed Ismail ,Terri Fiez, “Analog VLSI Signal and information Processing”, McGraw Hill International Editions,1994.
5.Samir Palnitkar, “Veri Log HDL, A Design guide to Digital and Synthesis” 2nd Ed,Pearson,2005.
6. John P. Uyemera “Chip design for submicron VLSI cmos layout and simulation “, Cengage Learning India Edition”, 2011.

ET7202 EMBEDDED NETWORKING L T P C
3 1 0 4

OBJECTIVES

To impart knowledge on

- Serial and parallel communication protocols
- Application Development using USB and CAN bus for PIC microcontrollers
- Application development using Embedded Ethernet for Rabbit processors.
- Wireless sensor network communication protocols.

UNIT I EMBEDDED COMMUNICATION PROTOCOLS 8

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

UNIT II USB AND CAN BUS 10

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

UNIT III ETHERNET BASICS 9

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

UNIT IV EMBEDDED ETHERNET 9

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

UNIT V WIRELESS EMBEDDED NETWORKING 9

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

L = 45 T = 15 TOTAL = 60 PERIODS

REFERENCES

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

ET7203 WIRELESS AND MOBILE COMMUNICATION L T P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of wireless communication technologies.
- To teach the fundamentals of wireless mobile network protocols
- To study on wireless network topologies
- To introduce network routing protocols
- To study the basis for classification of commercial family of wireless communication technologies

UNIT I INTRODUCTION 9

Wireless Transmission – signal propagation – spread spectrum – Satellite Networks – Capacity Allocation – FAMA – DAMA – MAC

UNIT II MOBILE NETWORKS 9

Cellular Wireless Networks – GSM – Architecture – Protocols – Connection Etablishment – Frequency Allocation – Routing – Handover – Security – GPRA

UNIT III WIRELESS NETWORKS 9

Wireless LAN – IEEE 802.11 Standard-Architecture – Services – AdHoc Network - Hiper Lan – Blue Tooth.

UNIT IV ROUTING 9

Mobile IP – DHCP – AdHoc Networks – Proactive and Reactive Routing Protocols – Multicast Routing

UNIT V TRANSPORT AND APPLICATION LAYERS 9

TCP over Adhoc Networks – WAP – Architecture – WWW Programming Model – WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML – WML scripts.

TOTAL : 45 PERIODS

REFERENCES

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, " Principles of Mobile computing", Springer, New york, 2003.
3. C.K.Toh, " AdHoc mobile wireless networks", Prentice Hall, Inc, 2002.
4. Charles E. Perkins, " Adhoc Networking", Addison-Wesley, 2001.
5. Jochen Schiller, " Mobile communications", PHI/Pearson Education, Second Edition, 2003.
6. William Stallings, " Wireless communications and Networks", PHI/Pearson Education, 2002.

ET7204 SOFTWARE FOR EMBEDDED SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of embedded Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To study the basic concepts of embedded C and Embedded OS
- To introduce time driven architecture, Serial Interface with a case study.
- To introduce the concept of embedded Java for Web Enabling of systems.

UNIT I EMBEDDED PROGRAMMING 9

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

UNIT II C PROGRAMMING TOOLCHAIN IN LINUX 9

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using *gprof* - Memory Leak Detection with *valgrind* - Introduction to GNU C Library

UNIT III EMBEDDED C AND EMBEDDED OS 9

Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts. Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS.

UNIT IV TIME-DRIVEN MULTI-STATE ARCHITECTURE AND HARDWARE 9

Multi-State systems and function sequences: Implementing multi-state (Timed) system - Implementing a Multi-state (Input/Timed) system. Using the Serial Interface: RS232 - The Basic RS-232 Protocol - Asynchronous data transmission and baud rates - Flow control - Software architecture - Using on-chip UART for RS-232 communication - Memory requirements - The serial menu architecture - Examples. Case study: Intruder alarm system.

UNIT V EMBEDDED JAVA 9

Introduction to Embedded Java and J2ME – Smart Card basics – Java card technology overview – Java card objects – Java card applets – working with APDUs – Web Technology for Embedded Systems.

TOTAL : 45 PERIODS

REFERENCES

1. Steve Oualline, 'Practical C Programming 3rd Edition', O'Reilly Media, Inc, 2006.
2. Stephen Kochan, "Programming in C", 3rd Edition, Sams Publishing, 2009.
3. Michael J Pont, "Embedded C", Pearson Education, 2007.
4. Zhiqun Chen, 'Java Card Technology for Smart Cards: Architecture and Programmer's Guide', Addison-Wesley Professional, 2000.

ET7211 EMBEDDED SYSTEM LABORATORY II L T P C
0 0 3 2

Sl.No.	Title	Requirement	Quantity
1	Programming with ARM Processors Both Assembly and C programming, I/O Programming/Timers/Interrupts, /ADC/DAC/ LCD /RTC Interfacing/ Sensor Interfacing/i/o device control	ARM family Processors With IDE, Board Support Packages & Peripherals DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	Multiple user
2	Programming with Fixed Point & Floating Point DSP Processors Both Assembly /C programming/CCS Compilers- Programming with DSP processors for Correlation, Convolution, Arithmetic adder, Multiplier, Design of Filters - FIR based , IIR based	Fixed Point & Floating Point DSP Processors With IDE, Board Support Packages & Peripherals	2 set each

3	Design using Xilinx/Altera CPLD Design and Implementation of simple Combinational/Sequential Circuits	Xilinx/Altera CPLD Processor	Multiple set
4	Design using Xilinx/Altera FPGA Design and Implementation of simple Combinational/Sequential Circuits	Xilinx/Altera FPGA Processor	Multiple user
3	Interfacing: Motor Control/ADC/DAC/LCD / RTC Interfacing/ Sensor Interfacing	DSP/ARM/FPGA Processors With IDE, Board Support Packages & P DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each) eripherals for interface	2 set
6	Study of one type of Real Time Operating Systems (RTOS) with ARM Processor/Microcontroller	ARMProcessor/Microcontroller	Multiple user
7	Network Simulators Communication Topology of network using NS2/simulators	NS2/simulators	Multiple user
8	Study on Embedded wireless network Topology	NS2/simulators	Multiple user
9	Simulation of digital controllers using programming environments	(MATLAB/LabVIEW/Simulators)	Multiple user
10	Simulation & Programming on DSP /Image Processing using programming environments	(MATLAB/LabVIEW/Simulators)	Multiple user

TOTAL= 45 PERIODS

REFERENCES :

1. Mohamammad Ali Mazidi & Mazidi ' 8051 Microcontroller and Embedded Systems', Pearson Education
2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, 'PIC Microcontroller and Embedded Systems' Pearson Education
3. UdayaShankara, "Modern Digital Signal Processing Includes Signals and Systems-MATLAB Programs, DSP Architecture with Assembly and C Programs", second edition, PHI Learning 2012.
4. Rashid," Introduction to PSPICE using Orcad for Circuits And Electronics"
5. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
6. Kraig Mitzner, 'Complete PCB Design using ORCAD Capture and Layout', Elsevier
7. Woon-Seng Gan, Sen M. Kuo, 'Embedded Signal Processing with the Micro Signal Architecture', John Wiley & Sons, Inc., Hoboken, New Jersey 2007
8. U. Meyer-Baese 'Digital Signal Processing using Field Programmable Gate Arrays', Springer
9. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008

ET7311	**PROJECT WORK (PHASE I)**	**L T P C** **0 0 12 6**

ET7411	**PROJECT WORK (PHASE II)**	**L T P C** **0 0 24 12**

ET7001	**DIGITAL INSTRUMENTATION**	**L T P C** **3 0 0 3**

OBJECTIVES

- To discuss to the students on the fundamentals building blocks of a digital instrument
- To teach the digital data communication techniques
- To study on bus communication standards and working principles
- To teach Graphical programming using GUI for instrument building
- The case studies to be developed/ discussed

UNIT I DATA ACQUISITION SYSTEMS 9

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.

UNIT II INTERFACING AND DATA TRANSMISSION 9

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.

UNIT III INSTRUMENTATION BUS 9

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.

UNIT IV VIRTUAL INSTRUMENTATION 9

Block diagram and Architecture – Data flow techniques – Graphical programming using GUI – Real time Embedded system –Intelligent controller – Software and hardware simulation of I/O communication blocks-peripheral interface – ADC/DAC – Digital I/O – Counter , Timer.

UNIT V CASE STUDIES 9

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 PERIODS

REFERENCES:

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” Third Edition, Pearson Education, 2003.
5. Buchanan, “Computer busses”, Arnold, London,2000.
6. Jonathan W Valvano, “Embedded Microcomputer systems”, Asia Pvt. Ltd., Brooks/Cole, Thomson, 2001.

ET7002 REAL TIME OPERATING SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of interaction of OS with a computer and User computation.
- To teach the fundamental concepts of how process are created and controlled with OS.
- To study on programming logic of modeling Process based on range of OS features
- To compare types and Functionalities in commercial OS
- To discuss the application development using RTOS

UNIT I REVIEW OF OPERATING SYSTEMS 15

Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – issues in distributed system:states,events,clocks-Distributed scheduling-Fault &recovery.

UNIT II OVERVIEW OF RTOS 9

RTOS Task and Task state –Multithreaded Premptive scheduler- Process Synchronisation-Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronisation problem – Deadlocks

UNIT III REAL TIME MODELS AND LANGUAGES 6

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

UNIT IV REAL TIME KERNEL 6

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.

UNIT V RTOS APPLICATION DOMAINS **9**

Case studies-RTOS for Image Processing – Embedded RTOS for Network communication – RTOS for fault-Tolerant Applications – RTOS for Control Systems.

TOTAL : 45 PERIODS

REFERENCES:

1. Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003
2. D.M.Dhamdhere," Operating Systems,A Concept-Based Approch,TMH,2008
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006.
4. Herma K., "Real Time Systems – Design for distributed Embedded Applications", Kluwer Academic, 1997.
5. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill 1997.
6. C.M. Krishna, Kang, G.Shin, "Real Time Systems", McGraw Hill, 1997.
7. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI 1999.
8. Mukesh Sighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill 2000.

ET7016 PARALLEL PROCESSING ARCHITECTURE **L T P C**
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of interaction of OS with a computer and User computation.
- To teach the fundamental Parallel Processing.
- To study on networking for memory
- To compare types and Functionalities in commercial OS
- To discuss the parallel models development using software

UNIT I THEORY OF PARALLELISM **9**

Parallel Computer models – the state of computing, Multiprocessors and Multicomputers and Multivectors and SIMD computers, PRAM and VLSI models, Architectural development tracks, Program and network properties – Conditions of parallelism.

UNIT II PARTITIONING AND SCHEDULING **9**

Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures, Principles of scalable performance – performance matrices and measures, Parallel processing applications, speedup performance laws, scalability analysis and approaches.

UNIT III HARDWARE TECHNOLGIES **9**

Processor and memory hierarchy advanced processor technology, superscalar and vector processors, memory hierarchy technology, virtual memory technology, bus cache and shared

memory – backplane bus systems, cache memory organizations, shared memory organizations, sequential and weak consistency models.

UNIT IV PIPELINING AND SUPERSCALAR TECHNOLOGIES 9

Parallel and scalable architectures, Multiprocessor and Multicomputers, Multivector and SIMD computers, Scalable, Multithreaded and data flow architectures.

UNIT V SOFTWARE AND PARALLEL PROCESSING 9

Parallel models, Languages and compilers, Parallel program development and environments, UNIX, MACH and OSF/1 for parallel computers.

TOTAL : 45 PERIODS

REFERENCES:

1. Kai Hwang “Advanced Computer Architecture”. McGraw Hill International 2001.
2. Dezso Sima, Terence Fountain, Peter Kacsuk, “Advanced computer Architecture – A design Space Approach”. Pearson Education,2003.
3. Carl Homacher, Zvonko Vranesic, Sefwat Zaky, “Computer Organisation”, 5th Edition, TMH, 2002.
4. David E. Culler, Jaswinder Pal Singh with Anoop Gupta “Parallel Computer Architecture” ,Elsevier, 2004.
5. John P. Shen. “Modern processor design Fundamentals of super scalar processors”, Tata McGraw Hill 2003.
6. Sajjan G. Shiva “Advanced Computer Architecture”, Taylor & Francis, 2008.
7. V.Rajaraman, C.Siva Ram Murthy, “Parallel Computers- Architecture and Programming”, Prentice Hall India, 2008.
8. John L. Hennessy, David A. Petterson, “Computer Architecture: A Quantitative Approach”, 4th Edition, Elsevier, 2007.
9. Harry F. Jordan Gita Alaghaband, “Fundamentals of Parallel Processing”. Pearson Education, 2003.
10. Richard Y. Kain, “Advanced computer architecture – A system Design Approach”, PHI, 2003.

ET7003 DESIGN OF EMBEDDED CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of Embedded System Blocks
- To teach the fundamental RTOS.
- To study on interfacing for processor communication
- To compare types and Functionalities in commercial software tools
- To discuss the Applications development using interfacing

UNIT I EMBEDDED SYSTEM ORGANIZATION 9

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, 8 bit –ISA, EISA bus;

UNIT II REAL-TIME OPERATING SYSTEM 9

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

UNIT III INTERFACE WITH COMMUNICATION PROTOCOL 9

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

UNIT IV DESIGN OF SOFTWARE FOR EMBEDDED CONTROL 9

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

UNIT V CASE STUDIES WITH EMBEDDED CONTROLLER 9

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

TOTAL : 45 PERIODS

REFERENCES:

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. Micheal Khevi, “The M68HC11 Microcontroller application in control,Instrumentation & Communication”, PH NewJersy, 1997.
4. Chattopadhyay, “Embedded System Design”,PHI Learning, 2011.

5. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey, “PIC Microcontroller and Embedded Systems- Using Assembly and C for PIC18”, Pearson Education,2008.
6. Steven F.Barrett,Daniel J.Pack,”Embedded Systems-Design & Application with the 68HC12 & HCS12”, Pearson Education,2008.
7. Daniel W. Lewis, “Fundamentals of Embedded Software”, Prentice Hall India, 2004.
8. Jack R Smith “Programming the PIC microcontroller with MBasic” Elsevier, 2007.
Keneth J.Ayala, “The 8086 Microprocessor: Programming & Interfacing the PC”, Thomson India edition,

ET7004 PROGRAMMING WITH VHDL L T P C
3 0 0 3

OBJECTIVES

- To give an insight to the students about the significance of VHDL Programming
- To teach the importance and architectural modelling of programmable logic devices.
- To introduce the construction and design programming
- To teach the basic VLSI design configurations
- To study the Logic synthesis and simulation of digital system with PLD.

UNIT I VHDL FUNDAMENTALS 9

Fundamental concepts- Modeling digital system-Domain and levels of modeling-modeling languages-VHDL modeling concepts-Scalar Data types and operations- constants and Variable-Scalar Types- Type Classification-Attributes and scalar types-expression and operators-Sequential statements.

UNIT II DATA TYPES AND BASIC MODELING CONSTRUCTS 9

Arrays- unconstrained array types-array operations and referencing- records - Access Types-Abstract Date types- -basic modeling constructs-entity declarations-Architecture bodies-behavioral description-structural descriptions- design Processing, case study: A pipelined Multiplier accumulator.

UNIT III SUBPROGRAMS , PACKAGES AND FILES 9

Procedures-Procedure parameters- Concurrent procedure call statements –Functions – Overloading –visibility of Declarations-packages and use clauses- Package declarations-package bodies-use clauses-Predefined aliases-Aliases for Data objects-Aliases for Non-Data items-Files- I/O-Files. Case study: A bit vector arithmetic Package.

UNIT IV SIGNALS, COMPONENTS, CONFIGURATIONS. 9

Basic Resolved Signals-IEEE std_Logic_1164 resolved subtypes- resolved Signal Parameters - Generic Constants- Parameterizing behavior- Parameterizing structure-components and configurations-Generate Statements-Generating Iterative structure-Conditionally generating structure-Configuration of generate statements-case study: DLX computer Systems.

UNIT V DESIGN WITH PROGRAMMABLE LOGIC DEVICES 9

Realization of -Micro controller CPU.- Memories- I/O devices-MAC-Design,synthesis,simulation and testing.

TOTAL : 45 PERIODS

REFERENCES

1. Peter J.Ashenden, "The Designer's guide to VHDL", Morgan Kaufmann publishers,San Francisco,Second Edition, May 2001.
2. Zainalabedin navabi, "VHDL Analysis ans modeling of Digital Systems", McGraw Hill international Editions, Second Editions, 1998.
3. Charles H Roth, Jr. "Digital system Design using VHDL", Thomson ,2006.
4. Douglas Perry, "VHDL Programming by Example", Tata McGraw Hill,4th Edition 2002.
5. Navabi.Z., "VHDL Analysis and Modeling of Digital Systems", McGraw International, 1998.
6. Peter J Ashendem, "The Designers Guide to VHDL", Harcourt India Pvt Ltd, 2002
7. Skahill. K, "VHDL for Programmable Logic", Pearson education, 1996.

ET7005 ADHOC NETWORKS L T P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of wireless communication technologies.
- To teach the fundamentals of wireless network routing protocols
- To study on wireless issues in network layers topologies
- To introduce energy management in network routing protocols
- To study the basis of performance metrics for N/W communication technologies

UNIT I WIRELESS LAN, PAN, WAN AND MAN 9

Characteristics of wireless channel, Fundamentals of WLANs, IEEE 802.11 standard, HIPERLAN Standard, First-, Second-, and third- generation cellular systems, WLL, Wireless ATM, IEEE 802.16 standard, HIPERACCESS, AdHoc Wireless Internet.

UNIT II MAC, ROUTING AND MULTICAST ROUTING PROTOCOLS 9

MAC Protocols: Design issues, goals and classification, Contention –based protocols with reservation and scheduling mechanisms, Protocols using directional antennas. Routing protocols: Design issues and classification, Table-driven, On-demand and Hybrid routing protocols, Routing protocols with efficient flooding mechanisms, Hierarchical and power-aware routing protocols. Multicast Routing Protocols: Design issues and operation, Architecture reference model, classification, Tree-based and Mesh-based protocols, Energy-efficient multicasting.

UNIT III TRANSPORT LAYER AND SECURITY PROTOCOLS 9

Transport layer Protocol: Design issues, goals and classification, TCP over AdHoc wireless Networks, Security, Security requirements, Issues and challenges in security provisioning, Network security attacks, Security routing.

Quality of Service: Issues and challenges in providing QoS, Classification of QoS solutions, MAC layer solutions, Network layer solutions, QoS frameworks.

UNIT IV ENERGY MANAGEMENT 9

Need, classification of battery management schemes, Transmission power management schemes, System power management schemes.

Wireless Sensor Networks: Architecture, Data dissemination, Date gathering, MAC protocols, location discovery, Quality of a sensor network.

UNIT V PERFORMANCE ANALYSIS 9

ABR beaconing, Performance parameters, Route-discovery time, End-to-end delay performance, Communication throughput performance, Packet loss performance, Route reconfiguration/repair time, TCP/IP based applications.

TOTAL : 45 PERIODS

REFERENCES

1. C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2004
2. C.-K.Toh, AdHoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR, 2001
3. Mohammad Ilyas, The Handbook of AdHoc Wireless Networks, CRC press, 2002
4. Charles E. Perkins, AdHoc Networking, Addison – Wesley, 2000
5. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, Mobile AdHoc Networking, Wiley – IEEE press, 2004.

ET7006 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of digital signal processing in frequency domain& its application
- To teach the fundamentals of digital signal processing in time-frequency domain& its application
- To compare Architectures & features of Programmable DSprocessors
- To discuss on Application development with commercial family of DS Processors
- To design & develop logical functions of DSProcessors with Re-Programmable logics &Devices

UNIT I INTRODUCTION TO DIGITAL SIGNAL PROCESSING 12

Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Decimation and Interpolation, Digital Filters, FIR Filters, IIR Filters.

UNIT II WAVELET TRANSFORM 6

Introduction to continuous wavelet transform- discrete wavelet transform -orthogonal wavelet decomposition- Multiresolution Analysis-Wavelet function-DWT,bases,orthogonal Basis-Scaling function, Wavelet coefficients- ortho normal wavelets and their relationship to filter banks- Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal- Example MRA- Haar & Daubechies wavelet.

UNIT III ARCHITECTURES OF COMMERCIAL DIGITAL SIGNAL PROCESSORS 12

Introduction, catogorisation of DSP Processors, Fixed Point (Blackfin),Floating Point (SHARC),TI TMS 320c6xxx & OMAP processors TMS320C54X & 54xx on Basic Architecture – comparison : of functional variations of Computational building blocks, MAC, Bus Architecture and memory, Data Addressing, Parallelism and pipelining, Parallel I/O interface,Memory Interface, Interrupt, DMA (one example Architecture in each of these case studies).

UNIT IV INTERFACING I/O PERIPHERALS FOR DSP BASED APPLICATIONS 6

Introduction, External Bus Interfacing Signals, Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).**-**Introduction, Design of Decimation and Interpolation Filter, FFT Algorithm, PID Controller ,Application for Serial Interfacing, DSP based Power Meter, Position control , CODEC Interface .

UNIT V VLSI IMPLEMENTATION 9

Low power Design-need for Low power VLSI chips-Basics of DSP system architecture design using VHDL programming, Mapping of DSP algorithm onto hardware, Realisation of MAC & Filter structure.

TOTAL : 45 PERIODS

REFERENCES:

1. John G. Proaks, Dimitris G. Manolakis, “Digital Signal Processing”, Pearson Education 2002.
2. Avatar Sing, S. Srinivasan, “Digital Signal Processing- Implementation using DSP Microprocessors with Examples from TMS320C54xx”, Thomson India,2004.
3. Lars Wanhammer, “DSP Integrated Circuits”, Academic press, 1999,NewYork.
4. Lyla B Das,” Embedded Systems-An Integrated Approach”,Pearson2013
5. Ashok Ambardar,”Digital Signal Processing: A Modern Introduction”,Thomson India edition, 2007.
6. Raghuveer M.Rao and Ajit S. Bapardikar, Wavelet transforms- Introduction to theory and applications, Pearson Education, 2000.
7. K.P. Soman and K.L. Ramchandran,Insight into WAVELETS from theory to practice, Eastern Economy Edition, 2008
8. Ifeachor E. C., Jervis B. W ,”Digital Signal Processing: A practical approach, Pearson-Education, PHI/ 2002
9. B Venkataramani and M Bhaskar **“**Digital Signal Processors**”**, TMH, 2nd, 2010
10. Peter Pirsch **“**Architectures for Digital Signal Processing”, John Weily, 2007

11. Vinay K.Ingle,John G.Proakis,"DSP-A Matlab Based Approach",Cengage Learning,2010
12. Taan S.Elali,"Discrete Systems and Digital Signal Processing with Matlab",CRC Press2009.

CL7204 SOFT COMPUTING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

Introduction of soft computing - soft computing vs. hard computing- various types of soft computing techniques- applications of soft computing-Neuron- Nerve structure and synapse-Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- McCullochPitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training-applications.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Counter propagation network- architecture- functioning & characteristics of counter- Propagation network-Hopfield/ Recurrent network- configuration- stability constraints-associative memory-and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications-Implementation and training-Associative Memory.

UNIT III FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification- inferencingand defuzzification-Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9

Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters-Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

UNIT V APPLICATIONS 9

GA application to power system optimization problem- Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural Network interconnection systems- Implementation of fuzzy logic controller using Matlab fuzzy logic toolbox-Stability analysis of fuzzy control systems.

TOTAL : 45 PERIODS

REFERENCES

1.. Laurene V. Fausett, Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson Education,
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
3. Zimmermann H.J. "Fuzzy set theoryand its Applications" Springer international edition, 2011.
4. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control”, MIT Press, 1996.

ET7007 RISC PROCESSOR ARCHITECTURE AND PROGRAMMING L T P C
3 0 0 3

OBJECTIVES

- To teach the architecture of 8 bit RISC processor
- To teach the architecture and programming of 16 bit RISC processor
- To teach the implementation of DSP in ARM processor
- To discuss on memeroy management in RISC processor
- To teach the application development with ARM processor

UNIT I AVR MICROCONTROLLER ARCHITECTURE 9

Architecture – memory organization – addressing modes – I/O Memory – EEPROM – I/O Ports –SRAM –Timer –UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing.

UNIT II ARM ARCHITECTURE AND PROGRAMMING ` 9

Arcon RISC Machine – Architectural Inheritance – Core & Architectures -- The ARM Programmer’s model -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors. Instruction set – Thumb instruction set – Instruction cycle timings

UNIT III ARM APPLICATION DEVELOPMENT 9

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

UNIT IV MEMORY PROTECTION AND MANAGEMENT 9

Protected Regions-Initializing MPU, Cache and Write Buffer-MPU to MMU-Virtual Memory-Page Tables-TLB-Domain and Memory Access Permission-Fast Context Switch Extension.

UNIT V DESIGN WITH ARM MICROCONTROLLERS 9

Assembler Rules and Directives- Simple ASM/C programs- Hamming Code- Division-Negation-Simple Loops –Look up table- Block copy- subroutines.

TOTAL : 45 PERIODS

REFERENCES

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
3. Trevor Martin, 'The Insider's Guide To The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd.,
4. Dananjay V. Gadre 'Programming and Customizing the AVR microcontroller', McGraw Hill 2001
5. William Hohl, ' ARM Assebly Language' Fundamentals and Techniques.
5. ARM Architecture Reference Manual
6. LPC213x User Manual
7. R. Barnett , L. O' CULL and S. Cox " Embedded C Programming and Atmel AVR", Delmar Cengage Learning, India Edition , 2009.

ET7008 ADVANCED EMBEDDED SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- *To teach the* Fundamentals on design attributes of functional units of a Processor
- To discuss on Hardware software partioning in system design
- To teach intra & Inter processor Communications
- To discuss strategies for processor Communications
- To discuss on Co-Designs

UNIT I INTRODUCTION TO EMBEDDED HARDWARE AND SOFTWARE 9

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

UNIT II SYSTEM MODELLING WITH HARDWARE/SOFTWARE PARTITIONING 9

Embedded systems, Hardware/Software Co-Design, Co-Design for System Specification and modelling- Single-processor Architectures&,Multi-ProcessorArchitectures, 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.

UNIT III HARDWARE/SOFTWARE CO-SYNTHESIS 9

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

UNIT IV MEMORY AND INTERFACING 9

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

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

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 PERIODS

REFERENCES

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

ET7009 PERVASIVE DEVICES AND TECHNOLOGY LT P C
3 0 0 3

OBJECTIVES

- To expose the students to the fundamentals of wireless sensor technology
- To teach the infrastructure of WSN processor and its functions
- To study on challenges in Network communication
- To discuss on interconnectivity of networks
- To study the classification of commercial family of wireless technology

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 12

Challenges for Wireless Sensor Networks- Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, TelosB,-Physical layer and transceiver design considerations in WSNs, introduction to fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols -the IEEE 802.15.4 MAC protocol- Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations-Applications of sensor networks

UNIT II ISSUES IN PERVASIVE SENSOR NETWORK 9

Single-Node Architecture - Hardware Components, constraints & challenges in resources- Energy Consumption of Sensor Nodes, Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Data Dissemination-Flooding and Gossiping-Data gathering Sensor Network Scenarios –Optimization, Goals and Figures of Merit – Design Principles for WSNs- Gateway Concepts – Need for gateway

UNIT III PERVASIVE NETWORKING & COMPUTING 12

Introduction, Networking Infrastructure and Architecture of PERV NET, Mobility management, service discovery, disconnected operation, Dynamic configuration, auto registration, content based routing, Backbone Technology: Electrical Backbone Networks – Optical Backbone Networks – Wireless Backbone Networks – Wireless Access Technology - Pervasive Web Application architecture- Access from PCs and PDAs - Access via WAP

UNIT IV PERVASIVE DEVICES 6

Introduction with Case study of - PDA - Mobile Phone:Elements – Mobile Information Architecture - Mobile Phone Design - Android Overview – The Stack – Android User Interface – Preferences, the File System, the Options Menu and Intents.

UNIT V EMERGING WIRELESS TECHNOLOGIES 6

Evolution and Deployment of Cellular Telephone Systems – 1G, 2G, 2.5G, 3G, 4G. Introduction to wireless LAN, Wireless PAN, Wireless MAN, Broadband Satellite and Microware Systems – Emerging Wireless Technologies – IEEE 802.20 Mobile Broadband Wireless Access.

TOTAL : 45 PERIODS

REFERENCES
1. Debashis saha, Amitava mukherjee ,"Networking Infrastructure for Pervasive Computing, Springer International edition, 2011 (unit 3)
2. Mullet,"Introduction to wireless telecommunications systems and networks", cengage learning, 2010 (unit 5)
3. Frank Adelstein, Sandeep K S Gupta, Golden G Richard III, Loren Schwiebert, "Fundamentals of mobile and pervasive computing, TMH, 2007.
4. Brian Fling,"Mobile Design & Development,O'Reilly,2011 (unit 4)
5. Marko Gargenta,"Learning Android", O'Reilly,2011 (unit 4)
6. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks" , John Wiley, 2005.
7. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
8. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.'
9. C.Britton Rorabaugh,"Simulating Wireless Communication Systems-Practical Models in C++",Pearson Edu,2006.
10. Mohammad Ilyas And Imad Mahgaob,"Handbook Of Sensor Networks: Compact Wireless And Wired Sensing Systems", CRC Press,2005
11. K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349, 2005.
12. Philip Levis, " TinyOS Programming",2006 – www.tinyos.net
13. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd, 2003.

ET7010 CRYPTOGRAPHY AND NETWORK SECURITY L T P C
3 0 0 3

Pre-requisites:Basics of Signal Processing, Mathematics of Transforms, microcontroller

OBJECTIVES
- To expose the students to the fundamentals of data security.
- To teach the fundamentals of mathematical aspects in creating Encryption keys
- To teach the fundamentals of Security in data communication.
- To teach the fundamentals of Secured system operation.
- To teach the fundamentals of Security in wireless communication.

UNIT I SYMMETRIC CIPHERS 9

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.

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 9

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.

UNIT III NETWORK SECURITY PRACTICE 9

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.

UNIT IV SYSTEM SECURITY **9**

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

UNIT V WIRELESS SECURITY **9**

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. William Stallings, "Cryptography And Network Security – Principles And Practices", Pearson Education, 3rd Edition, 2003.

REFERENCES

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", 3rd Edition, Pearson Education, 2003.
5. Mai, "Modern Cryptography: Theory and Practice", First Edition, Pearson Education, 2003.

ET7011 SMART METER AND SMART GRID COMMUNICATION **L T P C**
3 0 0 3

Pre-requisites: Basics in Instrumentation, Power system and communication

OBJECTIVES

- To teach the fundamentals of automated meters and Grids.
- To teach on functional components of Smart meters
- To discuss on need of smart grid for power systems
- To teach the significance of microgrid and its needs
- To teach the communication and protocols for power system

UNIT I INTRODUCTION **9**

Introduction to Smart grid and metering technology- Smart energy management technical architecture-Functions of Smart Grid and smart meters, Opportunities and challenges-Difference between conventional and smart grid-meters, Concept of Resilient and Self Healing Grid, recent developments and International policies in Smart Grid. IEC 61850 protocol standards.

UNIT II SMART METERS **9**

Smart metering-Smart Meters types- hardware architecture- software architecture-requirements- communication protocols- Real Time Prizing, Smart Appliances, Automatic Meter Reading- MEMS, Smart Sensors- Smart actuators- Advanced metering infrastructure- spectrum analyzer.

UNIT III SMART GRID AND APPLICATIONS 9

Outage Management System, Plug in Hybrid Electric Vehicles, Vehicle to Grid, Home and Building Automation- Smart Substations, Substation Automation, Feeder Automation- Geographic Information System(GIS), Intelligent Electronic Devices and their application for monitoring and protection- -Smart city- Wide Area Measurement System, Phase Measurement Unit- Power Quality and EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring and Power Quality Audit.

UNIT IV MICROGRIDS 9

Concept of microgrid, need and applications of microgrid, formation of microgrid, Issues of interconnection, protection and control of microgrid. Plastic and Organic solar cells, Thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.

UNIT V INFORMATION AND COMMUNICATION TECHNOLOGY FOR SMART GRID AND METERS 9

Home Area Networks for smart grid - IEEE802.15.4- ITU G.hn-IEEE 802.11, Field Area Networks -power-line communications- IEEE P1901 /HomePlug, RF mesh, Wide-area Networks for Smart Grid- Fiber Optics, WiMAX, sensor networks, Information Management in Smart Grid - SCADA, CIM. Networking Issues in Smart Grid -Wireless Mesh Network- CLOUD Computing - Security and Privacy in Smart Grid and smart meters -Broadband over Power line.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai “Integration of Green and Renewable Energy in Electric Power Systems”, Wiley
2. Stuart Borlase, “ Smart Grid: infrastructure, technology and Solutions”.2012 CRC Press
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley
4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, “Smart Grids”, Wiley Blackwell
5. Peter S. Fox Penner, “Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities”, Island Press; 1 edition 8 Jun 2010
6. S. Chowdhury, S. P. Chowdhury, P. Crossley, “Microgrids and Active Distribution Networks.” Institution of Engineering and Technology, 30 Jun 2009
7. Stuart Borlase, “Smart Grids (Power Engineering)”, CRC Press

REFERENCES:

1. Andres Carvallo, John Cooper, “The Advanced Smart Grid: Edge Power Driving Sustainability: 1”, Artech House Publishers July 2011
2. James Northcote, Green, Robert G. Wilson “Control and Automation of Electric Power Distribution Systems (Power Engineering)”, CRC Press
3. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert “Substation Automation (Power Electronics and Power Systems)”, Springer
4. R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, “Electrical Power System Quality”, 2nd Edition, McGraw Hill Publication
5. Yang Xiao, “Communication and Networking in Smart Grids”, CRC Press.

ET7012 COMPUTER IN NETWORKING AND DIGITAL CONTROL L T P C
3 0 0 3

Pre-requisites: Digital Circuits, Computer Technology, Basic in Measurement & Instrumentation

OBJECTIVES

- To discuss on the fundamentals of Network Layers for Data Communications
- To teach the digital data communication techniques
- To teach Graphical programming using GUI for instrument building
- To study on internet based communication standards and working principles
- The case studies to be developed/ discussed in Virtual Environment Tools

UNIT I NETWORK FUNDAMENTALS 9

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

UNIT II DATA COMMUNICATION 9

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

UNIT III VIRTUAL INSTRUMENTATION 9

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

UNIT IV MEASUREMENT AND CONTROL THROUGH INTERNET 9

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

UNIT V VI BASED MEASUREMENT AND CONTROL 9

Simulation of signal analysis & controller logic modules for Virtual Instrument control – Case study of systems using VI for data acquisition, Signal analysis, controller design, Drives control.

TOTAL : 45 PERIODS

REFERENCES:

1. Wayne Tomasi, “Introduction to Data communications and Networking” Pearson Education, 2007.
2. Al Williams, “Embedded Internet Design”, Second Edition, TMH, 2007.
3. Douglas E.Comer, “Internetworking with TCP/IP, Vol. 1”, Third 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” Fourth edition, TMH, 2007.

6. Krishna Kant,"Computer based Industrial control",PHI,2002.
7. Gary Johnson, "LabVIEW Graphical Programming", Second 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 edition, 2005.

ET7013 DISTRIBUTED EMBEDDED COMPUTING **L T P C**
3 0 0 3

Pre-requisites: *Basics* in Programming, Embedded System & operating systems

OBJECTIVES

- To expose the students to the fundamentals of Network communication technologies.
- To teach the fundamentals of Internet
- To study on Java based Networking
- To introduce network routing Agents
- To study the basis for network on-chip technologies

UNIT I THE HARDWARE INFRASTRUCTURE **9**

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

UNIT II INTERNET CONCEPTS **9**

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

UNIT III DISTRIBUTED COMPUTING USING JAVA **9**

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

UNIT IV EMBEDDED AGENT **9**

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.

UNIT V EMBEDDED COMPUTING ARCHITECTURE **9**

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.

TOTAL : 45 PERIODS

REFERENCES:

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

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

CL7004 ROBOTICS AND CONTROL L T P C
3 0 0 3

OBJECTIVES

- To introduce robot terminologies and robotic sensors
- To educate direct and inverse kinematic relations
- To educate on formulation of manipulator Jacobians and introduce path planning techniques
- To educate on robot dynamics
- To introduce robot control techniques

UNIT I INTRODUCTION AND TERMINOLOGIES: **9**

Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates- Reference frames-workspace-Robot languages-actuators-sensors- Position, velocity and acceleration sensors-Torque sensors-tactile and touch sensors-proximity and range sensors- vision system-social issues

UNIT II KINEMATICS 9

Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematics-solution and programming-degeneracy and dexterity

UNIT III DIFFERENTIAL MOTION AND PATH PLANNING 9

Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian- Robot Path planning

UNIT IV DYNAMIC MODELLING 9

Lagrangian mechanics- Two-DOF manipulator- Lagrange-Euler formulation – Newton-Euler formulation – Inverse dynamics

UNIT V ROBOT CONTROL SYSTEM 9

Linear control schemes- joint actuators- decentralized PID control- computed torque control – force control- hybrid position force control- Impedance/ Torque control.

TOTAL : 45 PERIODS

REFERENCES

1. R.K. Mittal and I J Nagrath, “ Robotics and Control”, Tata MacGrawHill, Fourth Reprint 2003.
2. Saeed B. Niku ,''Introduction to Robotics '', Pearson Education, 2002
3. Fu, Gonzalez and Lee Mcgrahill ,''Robotics '', international
4. R.D. Klafter, TA Chmielewski and Michael Negin, ''Robotic Engineering, An Integrated approach'', Prentice Hall of India, 2003.
5. Reza N.Jazar, Theory of Applied Robotics Kinematics, Dynamics and Control, Springer, Fist Indian Reprint 2010.

ET7014 APPLICATION OF MEMS TECHNOLOGY LT P C
3 0 0 3

PRE-REQUISITES: Basic Instrumentation ,Material Science, Programming

OBJECTIVES

- To teach the students properties of materials, microstructure and fabrication methods.
- To teach the design and modeling of Electrostatic sensors and actuators.
- To teach the characterizing thermal sensors and actuators through design and modeling
- To teach the fundamentals of piezoelectric sensors and actuators
- To give exposure to different MEMS and NEMS devices.

UNIT I MEMS:MICRO-FABRICATION, MATERIALS AND ELECTRO-MECHANICAL CONEPTS 9

Overview of micro fabrication – Silicon and other material based fabrication processes – Concepts: Conductivity of semiconductors-Crystal planes and orientation-stress and strain-flexural beam bending analysis-torsional deflections-Intrinsic stress- resonant frequency and quality factor.

UNIT II ELECTROSTATIC SENSORS AND ACTUATION 9

Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators-Applications

UNIT III THERMAL SENSING AND ACTUATION 9

Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications.

UNIT IV PIEZOELECTRIC SENSING AND ACTUATION 9

Piezoelectric effect-cantilever piezo electric actuator model-properties of piezoelectric materials-Applications.

UNIT V CASE STUDIES 9

Piezoresistive sensors, Magnetic actuation, Micro fluidics applications, Medical applications, Optical MEMS.-NEMS Devices

TOTAL : 45 PERIODS

REFERENCES

1. Chang Liu, “Foundations of MEMS”, Pearson International Edition, 2006.
2. Marc Madou , “Fundamentals of microfabrication”,CRC Press, 1997.
3. Boston , “Micromachined Transducers Sourcebook”,WCB McGraw Hill, 1998.
4. M.H.Bao “Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes”, Elsevier, Newyork, 2000.
5. P. RaiChoudry“ MEMS and MOEMS Technology and Applications”, PHI, 2012.
6. Stephen D. Senturia, “ Microsystem Design”, Springer International Edition, 2011.

ET7015 DIGITAL IMAGE PROCESSING AND APPLICATIONS **LT P C**
3 0 0 3

Pre-requisites: Signal Processing, Programming Techniques

OBJECTIVES

- To teach the students on fundamentals of image analysis.
- To teach the methods to improve image qualities.
- To teach the characterizing parameters for improve image qualities
- To teach the fundamentals of image size reduction
- To give exposure to different processing applications

UNIT I FUNDAMENTALS OF IMAGE PROCESSING **9**

Introduction – Steps in image processing systems – Image acquisition – Sampling and Quantization – Pixel relationships – Color fundamentals and models, File formats, Image operations – Arithmetic, Geometric and Morphological.

UNIT II IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level Transformations – Histogram processing – Spatial filtering smoothing and sharpening. Frequency Domain: Filtering in frequency domain – DFT, FFT, DCT – Smoothing and sharpening filters – Homomorphic Filtering.

UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS **9**

Detection of Discontinuities – Edge operators – Edge linking and Boundary Detection – Thresholding – Region based segmentation – Morphological Watersheds – Motion Segmentation, Feature Analysis and Extraction.

UNIT IV MULTI RESOLUTION ANALYSIS AND COMPRESSIONS **9**

Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms, Image compression: Fundamentals – Models – Elements of Information Theory – Error free compression – Lossy Compression – Compression Standards.

UNIT V APPLICATION OF IMAGE PROCESSING **9**

Image classification – Image recognition – Image understanding – Video motion analysis – Image fusion – Steganography – Digital compositing Mosaics – Colour Image Processing.

TOTAL : 45 PERIODS

REFERENCES :

1. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, 2nd Edition, Pearson Education, 2003.
2. Milan Sonka, Valclav Halavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, 2nd Edition, Thomson Learning, 2001.
3. Anil K.Jain, “Fundamentals of Digital Image Processing”. Pearson Education, 2003.