ANNA UNIVERSITY :: CHENNAI – 600 025

M.E. EMBEDDED SYSTEM TECHNOLOGIES

CURRICULUM 2002 FOR FULL TIME (4 SEMESTERS)

SEMESTER - I

Code No.	Course Title	L	T	P	M
ES131	Applied Mathematics for Embedded Systems	3	1	0	100
ES132	Advanced Digital System Design	3	0	0	100
ES133	Real Time Operating Systems	3	1	0	100
ES134	Design of Embedded Systems	3	0	0	100
ES135	Real Time Systems	3	0	0	100
E1***	Elective I	3	0	0	100
ES136	Embedded Systems Lab – I	0	0	3	100

SEMESTER – II

Code No.	Course Title	L	T	P	M
ES141	Computer Architecture	3	0	0	100
ES142	Digital Signal Processing	3	0	0	100
ES143	VLSI Architecture and Design methodologies	3	1	0	100
ES144	Software Technology for Embedded Systems	3	0	0	100
E2***	Elective II	3	0	0	100
E3***	Elective III	3	0	0	100
ES145	Embedded Systems Lab – II	0	0	3	100

SEMESTER - III

Code No.	Course Title	L	T	P	M
E4***	Elective IV	3	0	0	100
E5***	Elective V	3	0	0	100
E6***	Elective VI	3	0	0	100
ES233	Project Work (Phase – I)	0	0	12	200

SEMESTER - IV

Code No.	Course Title	L	T	P	M
ES233	Project Work (Phase – II)	0	0	24	400

LIST OF ELECTIVES FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES

Code No.	Course Title	L	T	P	M
ES031	Embedded Control Systems	3	0	0	100
ES032	Crypto Analytic Systems	3	0	0	100
ES033	Computer Vision and Image Understanding	3	0	0	100
ES034	Intelligent Embedded Systems	3	0	0	100
ES035	Distributed Embedded Computing	3	0	0	100
ES036	Mobile Computing	3	0	0	100
ES037	Design of Digital Control Systems	3	0	0	100
ES038	Micro Controller System Design and Applications	3	0	0	100
ES039	Data Communication and Networks	3	0	0	100

ES131 APPLIED MATHEMATICS FOR EMBEDDED SYSTEMS

3 1 0 100

1. THE WAVE EQUATIONS 10 + 3

Solution of initial and boundary value problems- Characteristics- D'Alembert's Solution- Significance of characteristic curves – Laplaceg transform solutions for displacement in a long string- a long string under its weight – a bar with prescribed force on one end- free vibrations of a string.

2. SPECIAL FUNCTIONS 10 + 3

Series solutions- Bessel's equation- Bessel Functions-Legendre's equation- Legendre polynomials- Rodrigue's formula- Recurrence relations- generating functions and orthogonal property for Bessel functions of the first kind- Legendre polynomials.

3. FOURIER ANALYSIS AND Z-TRANSFORMS 10 + 3

Discrete Fourier Transforms and its properties - Fourier series and its properties - Fourier representation of finite duration sequences - Z-Transform - Properties of the region of convergence. Inverse z-transforms - Z-Transform properties.

4. PROBABILITY AND RANDOM VARIABLES 10 + 3

Probability Concepts –Random Variables, Moment generating function – standard distributions- Two dimensional random variables- Transformation of Random Variables – Correlation – Regression system

5. QUEUING THEORY 5 + 3

Queuing applications - Single and Multiple server Markovian queuing models - M/G/1 queuing system - Priority queues – queuing applications

45 + 15

TOTAL = 60

REFERENCES:

1. Sankara Rao.K. "Introduction to Partial Differential Equation", PHI, 1995.
2. Taha. H.A., "Operations Research- An Introduction" 6th Edition, PHI, 1997.
3. Churchil. R.V., "Operational Mathematics", McGraw-Hill, 1972.
4. Richard A.Johnson, "Miller and Freund's Probability and Statistics for Engineers", 5th Edition, PHI, 1994.
5. S.Narayanan, T.K.Manickvachagam Pillay and G.Ramanaiah - Advanced Mathematics for Engineering Students Vol.II, S.Viswanathan Pvt. Ltd., 1986.

ES132 ADVANCED DIGITAL SYSTEM DESIGN 3 0 0 100

1. BASIC PRINCIPLES OF DIGITAL SYSTEMS 10

Digital Logic Levels - Binary and Hexadecimal Numbers - Digital Waveforms - Logic Functions - Enable and Inhibit Properties of Logic Gates - Integrated Circuit Logic Gates - Boolean Expressions- Logic Diagrams and Truth Tables - Sum-of-Products (SOP) and Product-of-Sums (POS) Forms - Theorems of Boolean Algebra -Simplifying SOP and POS Expressions - Simplification by the Karnaugh Map Method - Introduction to PLDs.

2. COMBINATIONAL LOGIC FUNCTIONS 10

Decoders – Encoder - Multiplexers - Demultiplexers - Magnitude Comparators - Parity Generators and Checkers - Digital Arithmetic and Arithmetic Circuits-Digital Arithmetic-Representing Signed Binary Numbers-Signed Binary Arithmetic - Hexadecimal Arithmetic - Numeric and Alphanumeric Codes - Binary Adders and subtractors - BCD Adders

3. INTRODUCTION TO SEQUENTIAL LOGIC 10

Latches - NAND/NOR Latches - Gated Latches - Edge-Triggered - D Flip-Flops-Edge-Triggered - JD Flip-Flops-Edge-Triggered - T Flip-Flops-Timing Parameters-Introduction to Programmable Logic Architectures - Programmable Sum-of-Products Arrays - PAL Fuse Matrix and Combinational Outputs- Memory Devices and Systems-Basic Memory Concepts - Random Access Read / Write Memory (RAM) - Read Only Memory (ROM) - Sequential Memory - FIFO and LIFO - Dynamic RAM Modules-Memory Systems.

4. COUNTERS AND SHIFT REGISTERS 10

Basic Concepts of Digital Counters - Synchronous Counters - Design of Synchronous Counters - Programming Binary Counters in VHDL - Control Options for Synchronous Counters - Programming Presettable and Bidirectional Counters in VHDL - Shift Registers - Programming Shift Registers in VHDL-Shift Register Counters.

5. STATE MACHINE DESIGN 5

State Machines-State Machines With No Control Inputs-State Machines With Control Inputs-Switch Debouncer for a Normally Open Pushbutton Switch-unused States in State Machines-Traffic Light Controller-Logic

TOTAL = 45

REFERENCES:

1. Robert K. Dueck “Digital Design with CPLD Applications and VHDL”
2. M. Morris Mano, “Digital Logic and Computer Design”, 1979 Prentice-Hall
3. John M Yarbrough, “Digital Logic: Applications And Design”
4. Alan B. Marcovitz, “ Introduction to Logic Design”, TMH publications, 2002

ES133 REAL TIME OPERATING SYSTEMS 3 0 0 100

1. REVIEW OF OPERATING SYSTEMS 9

Basic principles – system calls - files – processes – design and implementation of processes - communication between processes – operating system structures

2. DISTRIBUTED OPERATING SYSTEMS 9

Topology – network types – communication – RPC – Client server model – distributed file systems - design strategies

3. REAL TIME MODELS AND LANGUAGES 9

Event based – process based and graph based models – petrinet models – real time languages – RTOS tasks – RT scheduling – interrupt processing – synchronization control blocks – memory requirements

4. REAL TIME KERNEL 9

Principles – design issues – Polled loop systems - RTOS porting to a target – comparison and study of various RTOS like QNX – VX Works – PSOS – C Executive - case studies.

5. RTOS APPLICATION DOMAINS 9

RTOS for Image processing – Embedded RTOS for voice over IP – RTOS for fault tolerant applications – RTOS for control systems

TOTAL = 45

REFERENCES:

1. Herma K., "Real Time systems – Design for distributed Embedded Applications", Kluwer Academic, 1997.
2. Charles Crowley, "Operating System – A design oriented approach" McGraw-Hill, 1997.
3. R.J.A. Buhr, D.L.Bailey, "An Introduction to Real-Time Systems", PHI, 1999.
4. C.M.Krishna, Kang G. Shin, Real Time Systems, McGraw Hill, 1997
5. Raymond J.A.Buhr, Donald L. Bailey; "An Introduction to Real Time Systems", PHI 1999.

ES134 DESIGN OF EMBEDDED SYSTEMS 3 0 0 100

1. INTRODUCTION 9

Embedded computing – characteristics of embedded computing applications – embedded system design challenges – constraint-driven design – IP-based design – hardware - software co-design.

2. DEVELOPMENT ENVIRONMENT 9

The Execution Environment - Memory Organization - System Space - Code Space - Data Space - Unpopulated Memory Space - I/O Space - System Start-up - Interrupt Response Cycle - Function Calls and Stack Frames - Run-Time Environment - Object Placement.

3. EMBEDDED COMPUTING PLATFORM 9

CPU bus – memory devices – I/O devices – component interfacing – designing with microprocessors – development and debugging – design example – design patterns – dataflow graphs – assembly and linking – basic compilation techniques – analysis and optimization.

4. DISTRIBUTED EMBEDDED SYSTEM DESIGN 9

Inter-process communication – signals – signals in UML – shared memory communication – accelerated design – design for video accelerator – networks for embedded systems – networks based design – Internet enabled systems.

5. DESIGN TECHNIQUES 9

Design methodologies and tools – design flows – designing hardware and software components - requirement analysis and specification – system analysis and architecture design – system integration – structural and behavioural description - case studies.

TOTAL = 45

REFERENCES:

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer Systems Design”, Morgan Kaufman Publishers.
2. Jean J.Labrosse, “Embedded system Building blocks: complete and ready-to-use modules in C”.
3. Arnold S. Berger, “Embedded Systems Design: An Introduction to Processes, Tools and Techniques”

ES135 REAL TIME SYSTEMS 3 0 0 100

1. INTRODUCTION 5

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 - tasks assignment - mode changes - fault tolerant scheduling.

2. PROGRAMMING LANGUAGES AND TOOLS 8

Language features - desired language characteristics - data typing - control structures - facilitating hierarchical decomposition - package - run-time error handling - overloading and generics - multitasking - low level programming - task scheduling - timing specifications - programming environments - run-time support – code generation.

3. REAL TIME DATABASES 12

Real time database - basic definition - real time Vs general-purpose database - 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.

4. COMMUNICATION 10

Real time communication - communications media - network topologies - protocols – buffering data – synchronization – dead lock – mail boxes and semaphores - fault tolerance techniques - fault types - fault detection - fault error containment - redundancy -data diversity - reversal checks - integrated handling.

5. EVALUATION TECHNIQUES 10

Reliability evaluation techniques - reliability models for hardware redundancy - software error models – response time calculation – interrupt latency – time loading and its measurement – reducing response times – analysis of memory requirements – reducing memory loading

TOTAL = 45

TEXT BOOK:

1. C.M.Krishna, Kang G. Shin, Real - Time Systems, McGraw-Hill International Editions, 1997.

REFERENCES:

1. Stuart Bennett, Real Time Computer Control -An Introduction, PHI, 1988.
2. Peter D Lawrence, Real Time Micro Computer System Design -An Introduction, McGraw-Hill, 1988.
3. S.T.Allworth and R.N.Zobel, Introduction to real time software design, Macmillan, II Edition, 1987.

4. Real time systems design and analysis - An Engineers handbook 2nd edition - phillip A.Laplante, IEEE Press, IEEE Computer Society Press, 2001

ES136 EMBEDDED SYSTEMS LAB – I 0 0 3 100

1. Microcontroller 8051/8031
    a) Simple application programs with kit
    b) Sample programs through assembler

2. Flash controller programming
    a) Data flash with erase, verify, fusing through ATMEL/INTEL tools
    b) SRAM with erase, verify, fuse tools

3. Testing RTOS Environment and System Programming
    a) KEIL Tools

4. Mixed Signal Application Programming
    a) Telephone lines blending with controller

5. Complex Programmable Logical Devices
    a) Warp tools – Cypress - Active HDL, Simulator
    b) Galaxy – VHDL, FSM models

6. Device Programming with VHDL fitter and Cool runner
    a) Mixed single handling

7. RTOS System Solutions and Tools

8. Third party design tools
    a) Mentor Graphics
    b) Cadence

ES141 COMPUTER ARCHITECTURE 3 0 0 100

1. COMPUTER ARCHITECTURE INTRODUCTION 9

CPU organization – instruction sets – addressing modes - design of ALU for fixed and floating-point arithmetic – performance evaluation.

2. CONTROL UNIT 9

Basic concepts - Design of control unit – hardwired control – micro programmed control – pipelined control

3. MEMORY DESIGN 9

Virtual memory – cache design for different architectures and multiprocessor environments – evaluating memory performance.

4. INPUT / OUTPUT DESIGN 9

Speed limits – Interfacing to different types of I/O devices - RAID – Designing of I/O systems in five easy pieces – performance measures.

5. CPU ARCHITECTURES 9

Instruction sets of different machines - RISC Vs CISC – Pipelining issues – Superscalar architectures - Vector processors – EPIC - Case studies on parallel processors.

TOTAL = 45

REFERENCES:

1. John P.Hayes, "Computer Architecture and Organization", III edition, McGraw-Hill '1998.
2. D.A Patterson and J.L.Hennessy, Computer Architecture – A Quantitative Approach, Morgan Kaufmann Publishers, 2nd edition 1986.
3. Vincent.P.Heuring, Harry F.Jordan Computer Systems Design and Architecture, Addison Wesley, 1999.

ES142 DIGITAL SIGNAL PROCESSING 3 0 0 100

1. DISCRETE-TIME SIGNALS AND SYSTEMS 9

Discrete-Time Signals - Basic Definition - Some Elementary Discrete - Time Signals - representation of Signals - Discrete-Time Systems - Basic Operations on Sequences - Linear Systems - Time-Invariant Systems - Causal Systems - Stable Systems - Linear Time-Invariant (LTI) Systems - Properties of LTI Systems - Linear Constant-Coefficient Difference Equations - Fourier Transform of Discrete-Time Signals.

2. SAMPLING OF CONTINUOUS TIME SIGNALS 9

Z-Transform - Inverse Z-Transform - Periodic Sampling - Reconstruction of a Band limited signal from Its Samples - Sampling of Bandpass Signals - Sampling Rate Conversion - Decimation by an Integer Factor - Interpolation by an Integer Factor - Sampling Rate Conversion by a Rational Factor - Sampling Rate Conversion of Bandpass Signals - A/D Conversion – Quantization - Coding - D/A Conversion.

3. TRANSFORM ANALYSIS OF LTI SYSTEMS 9

Ideal filter characteristics – system function and frequency response of LTI systems – stability and causality - All-pass systems - Minimum phase systems – Discrete Fourier transform – relationship between DFT and Fourier transform of a discrete time signal – frequency analysis of signals using DFT – Fast Fourier Transform.

4. STRUCTURES FOR DISCRETE-TIME SYSTEMS AND DESIGN OF FILTERS 9

Block Diagram and signal Flow Graph Representation - Manipulation of Block Diagrams - Basic Structures of IIR Systems - Basic Structures of FIR Systems - Design of FIR Filters - Design of FIR Filters by Windowing - Design of Optimum Equiripple Linear-Phase FIR Filters - Design of IIR Filters - Classical Continuous-Time Low-Pass Filter Approximations - Conversion of Transfer Functions from Continuous to Discrete Time - Frequency Transformations of Lowpass Filters.

5. DIGITAL SIGNAL PROCESSORS 9

Fundamentals of Fixed-Point DSP Architecture -Fixed-Point Representation of Numbers - Arithmetic Computation - Memory Accessing - Pipelining of Instructions - Features of Example Processors - TMS320C25 - DSP16A and DSP56001 - Floating-Point DSPs - Floating-Point Representation of Numbers - TMS320C30 - Comparison of DSPs - Development Tools for DSP Programming - TMS320C30 Evaluation Module

TOTAL = 45

REFERENCES:

1. Rabiner and Gold – Theory and application of Digital Signal Processing, A comprehensive, industrial – strength DSP reference book

2. A.V. Oppenheim and R.W. Schafer, "Digital Signal Processing", Prentice-Hall, Inc., Englewood Cliffs, N.J., 1975.
3. John G. Proakis, Dimitris G. Manolakis, " Digital Signal Processing: Principles, Algorithms and Applications", PHI.
4. Monson H. Hayes, "Schaum's Outline of Theory and Problems of Digital Signal Processing", Schaum's outline series McGraw-Hill, 1999.

ES143 VLSI ARCHITECTURE AND DESIGN METHODOLOGIES

3 1 0 100

1. INTRODUCTION 9 + 0

Overview of digital VLSI design methodologies - Trends in IC technology – advanced Boolean algebra - Shannon's expansion theorem - consensus theorem - Octal designation - Run measure - Buffer gates - Gate Expander - Reed Muller expansion - Synthesis of multiple output combinational logic circuits by product map method - Design of static hazard free and dynamic hazard free logic circuits.

2. ANALOG VLSI AND HIGH SPEED VLSI 9 + 0

Introduction to analog VLSI - Realisation of Neural networks and switched capacitor filters - sub-micron technology and GaAs VLSI technology.

3. PROGRAMMABLE ASICS 9 + 5

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

4. PROGRAMMABLE ASIC DESIGN SOFTWARE 9 + 7

Actel ACT – Xilinx LCA – Xilinx EPLD – Altera MAX 5000 and 7000 - Altera MAX 9000 - Design systems – Logic synthesis – Half gate ASIC – schematic entry – Low level design language – PLA tools – EDIF – CFI design representation

5. LOGIC SYNTHESIS, SIMULATION AND TESTING 9 + 3

Basic features of VHDL language for behavioural modelling and simulation - Summary of VHDL data types – dataflow and structural modelling – VHDL and logic synthesis – types of simulation – boundary scan test-fault simulation – automatic test pattern generation

TOTAL = 60

REFERENCES:

1. William I. Fletcher "An Engineering approach to Digital Design" Prentice Hall of India 1996
2. Amar Mukherjee, Introduction to NMOS and CMOS VLSI system design, Prentice hall 1986
3. M.J.S Smith "Application – specific integrates circuits", Addison Wesley Longman Inc.1997
4. Frederick J. Hill and Gerald R. Peterson, "Computer Aided Logical Design with emphasis on VLSI".

ES144 SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEMS

3 0 0 100

1. LOW LEVEL PROGRAMMING IN C 9

Primitive data types – Functions – recursive functions – Pointers - Structures – Unions – Dynamic memory allocations – File handling – Linked lists

2. C AND ASSEMBLY 9

Programming in 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.

3. OBJECT-ORIENTED ANALYSIS AND DESIGN 9

Connecting the Object Model with the Use Case Model. Key Strategies for Object-Identification - Underline the Noun Strategy. Identify the Casual Objects - Identify Services (Passive Contributors) - Identify Real-World Items - Identify Physical Devices - Identify Key Concepts - Identify Transactions - Identify Persistent Information - Identify Visual Elements. Identify Control Elements - Apply Scenarios.

4. UNIFIED MODELLING LANGUAGE 9

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.

5. CASE STUDIES 9

Multi threaded applications – assembling embedded applications – polled waiting loop and interrupt driven I/O – preemptive kernels and shared resources - system timer – scheduling – client server computing.

TOTAL = 45

REFERENCES:

1. Bruce Powel Douglas, “Real-Time UML, Second Edition: Developing Efficient Objects for Embedded Systems (The Addison-Wesley Object Technology Series)”, 2 edition (October 29, 1999), Addison-Wesley.
2. Hassan Gomma, “Designing Concurrent, Distributed, and Real-Time applications with UML.
3. Daniel W. Lewis, “Fundamentals of Embedded Software where C and Assembly meet” PHI 2002.

ES145 EMBEDDED SYSTEMS LAB - II 0 0 3 100

1. ATMEL CPLDs – Prochip designer
   a) Schematic entry
   b) VHDL entry
2. AT40K FPGA series – synthesis – design – simulation of application programs
3. Xilinx EDA design tools – device programming –PROM programming
4. ALTERA and Mentor graphics – IC design tools
5. Code compressor studio for embedded DSP using Texas tool kit
6. Cell based ASICs – sample programs for risk and security plans
7. IPCORE usage in VOIP through SoC2 tools
8. FPSLIC synthesis testing and examples
9. Third party tools for embedded java and embedded C++ applications through cadence tools.

ES031 EMBEDDED CONTROL SYSTEMS 3 0 0 100

1. INTRODUCTION 6

Controlling the hardware with software – data lines – numbering systems – address lines - ports – schematic representation – bit masking – programmable peripheral interface – switch input detection.

2. INPUT-OUTPUT DEVICES 8

Keyboard basics – keyboard scanning algorithm – Multiplexed LED displays – character LCD modules – LCD module display – configuration – Time-of-day clock – Timer manager - interrupts - interrupt service routines – IRQ - ISR - interrupt vector or dispatch table multiple-point - interrupt-driven pulse width modulation.

3. D/A AND A/D CONVERSION 12

R 2R ladder - more on Op-Amps - virtual ground - resistor network analysis - port offsets - triangle waves analog vs digital values - ADC0809 – comparator - successive approximation - the ADC clock - ripple counter - D flip-flop - Q and NOT Q - aliasing – multiplexer - Auto port detect - recording and playing back voice - capturing analog information in the timer interrupt service routine - automatic, multiple channel analog to digital data acquisition.

4. ASYNCHRONOUS SERIAL COMMUNICATION 9

Asynchronous serial communication – RS-232 – RS-485 – sending and receiving data – serial ports on PC – low-level PC serial I/O module - buffered serial I/O.

5. CASE STUDIES 10

Multiple closure problems – basic outputs with PPI – controlling motors – bidirectional control of motors – H bridge – Telephonic systems – burglar alarms – fire alarms – inventory control systems.

TOTAL = 45

REFERENCES:

1. Jean J. Labrosse, “Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C”, The publisher, Paul Temme, 1999.
2. Ball S.R., Embedded microprocessor Systems – Real World Design, Prentice Hall, 1996.
3. Herma K, “ Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 1997
4. Daniel W. Lewis, “Fundamentals of Embedded Software where C and Assembly meet” PHI 2002.

ES032 CRYPTO ANALYTIC SYSTEMS 3 0 0 100

1. SECURITY PROBLEM 6

Security problem in computing - Characteristics of computers in intrusion - Kinds of security breaches - Points of security vulnerability - Methods of defense - Controls - Effectiveness of controls – Plan of attack encryption.

2. CRYPTOGRAPHY 12

Basic encryption and decryption - Mono alphabetic ciphers - Polyalphabetic substitution - transpositions - Fractional Morse - Stream and block ciphers - Characteristics of good ciphers - Secure encryption systems - Public key system - Single Key system -data encryption standard - Rivest-Shamir–Adelman (RSA) encryption.

3. ROLE OF OPERATING SYSTEM 10

Security involving programs and Operating systems - information access problems - program development controls -operating system controls - operating system controls in use of programs administration controls - Protection services for users of operating system - protected objects and method of protection - File protection mechanism - User authentication.

4. DATABASE AND NETWORK SECURITY 9

Data Base and Network security - Security requirements for data base - Reliability and integrity - Sensitive data - Inference problem - Multilevel data bases – Network security issues - Encryption in networking - Access control - User authentication - Local Area Networks - Multilevel security of network.

5. COMMUNICATION AND SYSTEM SECURITY 8

Communication and system security - Communication characteristics - Communication media - Loss of integrity - Wire tapping - Electronic mail security – IP Security - WEB security – Intruders – Viruses - Worms Firewalls - Standards.

TOTAL = 45

TEXT BOOK:

1. William Stallings Cryptography and Network Security Principles and Practice, PHI, 1998.
2. Charles, P. Pleeger, Security in Computing, PHI, 1989.

REFERENCES:

1. Hans, Information and communication Security, Springer Verlag, 1998.
2. Simonds, Network Security, McGraw-Hill, 1998.
3. Derek Atkins, Internet Security, Techmedia, 1998.
4. Kernel Texplan, Communication Network Management, PHI, 1992.

ES033 COMPUTER VISION AND IMAGE UNDERSTANDING

3 0 0 100

1. DIGITAL IMAGE FUNDAMENTALS 9

Image transforms – Walsh Hadamard transform - discrete cosine - Hotelling transforms - Image formation and file formats.

2. IMAGE ENHANCEMENT 9

Histogram modification techniques - Image smoothening – Image sharpening – Image restoration - degradation model - diagonalization of circulant and block circulant matrices - Algebraic approach to restoration.

3. IMAGE COMPRESSION AND SEGMENTATION 9

Compression models - Elements of Information Theory - Error free compression -Image segmentation - Detection of discontinuities - Edge linking and boundary detection – threshold - regions oriented segmentations – morphology.

4. FEATURE EXTRACTION 9

Image feature description - Interpretation of Line drawings - Image pattern recognition algorithms.

5. KNOWLEDGE REPRESENTATION AND USAGE 9

Knowledge representation and usage –Image analysis using knowledge about scenes- Image Understanding using two-dimensional methods.

TOTAL = 45

REFERENCES:

1. Gonzalez.R & woods B.E, “Digital Image processing”, Addison Wesley, 1993.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, Prentice Hall of India 1989.

ES034 INTELLIGENT EMBEDDED SYSTEMS 3 0 0 100

1. INTRODUCTION 9

Overview of agent based intelligent inhabited environments such as intelligent buildings - Introduction to the embedded-internet, embedded-agents and intelligent inhabited environments using examples from notable work - topologies for intelligent inhabited environments - brief review of control methods - behaviour based embedded-agents - Agent and system intelligence (eg reactivity versus and deliberation).

2. EMBEDDED-AGENT DESIGN 9

Embedded-agent design criteria & issues-consideration of various solutions, in particular behaviour based methods, which are the prime focus of this course behaviour based agent (BBA) mechanisms for implementing reactive functionality in embedded-agents - knowledge representation in embedded-agents - behaviour based agent (BBA) mechanisms for implementing deliberative functionality in embedded-agents.

3. MULTI EMBEDDED-AGENTS 9

Overview of multi embedded-agents infrastructures including network standards for intelligent buildings - embedded-agent co-ordination mechanisms and benchmarks embedded-agent

4. HUMAN-MACHINE ISSUES 9

HMI interfacing issues in intelligent inhabited environments and their relationship to cognitive disappearance - individuality commercial service issues - technical design consequences arising from social issues such as privacy and Asimov-like rules

5. HIGH – END APPLICATIONS 9

Case studies self-directed deep space probes - robotic soccer teams - underwater submarines - acrobatic helicopters and mobile robots.

TOTAL = 45

REFERENCES:

1. ARKIN, R.C., Behaviour-based Robotics, The MIT Press, 1998.
2. RZEVSKI, G., Mechatronics: Designing Intelligent Machines, Butterworth-Heinmann, 1995.
3. STEELS, L. and BROOKS, R., The Artificial Life Route to Artificial Intelligence: Building Embodied Situated Agents, Lawrence Erlbaum, 1995.

ES035 DISTRIBUTED EMBEDDED COMPUTING 3 0 0 100

1. THE HARDWARE INFRASTRUCTURE 9

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

2. SOFTWARE ARCHITECTURE 9

Client – server Architecture – challenges – Design methodology - intranets and group ware – Hardware and software for Intranet – Group and features - Network as a computer – the Internet – IP addressing – Internet security - Open systems - concepts and reliability.

3. 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.

4. DISTRIBUTED COMPUTING USING JAVA 9

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

5. 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

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, Universität Paderborn, Germany, Kluwer Academic Publishers, Boston, April 2001, 248 pp.

ES036 MOBILE COMPUTING 3 0 0 100

1. INTRODUCTION 9

Basics of mobile computing - Medium access control – Telecommunication systems – Satellite systems – Broadcast systems.

2. STANDARDS 9

Wireless LAN – IEEE 802.11 – Frequency Hopping spread spectrum – Direct sequence and spread spectrum - HIPERLAN – Bluetooth.

3. ADHOC NETWORKS 9

Characteristics – Performance issues – Routing in mobile hosts – Destination sequence distance vector – Dynamic source routing – Hierarchical Algorithms.

4. NETWORK ISSUES 9

Mobile IP – DHCP – Mobile transport layer – Indirect TCP – Snooping TCP – Transmission / time-out freezing – Selective retransmission – Transaction oriented TCP.

5. APPLICATION ISSUES 9

Wireless application protocol – Dynamic DNS - File systems – Synchronization protocol – Context-aware applications – Security – Analysis of existing wireless network.

TOTAL = 45

REFERENCES:

1. J. Schiller, Mobile Communications, Addison Wesley, 2000.
2. William C.Y.Lee, Mobile Communication Design Fundamentals, John Wiley, 1993.

ES037 DESIGN OF DIGITAL CONTROL SYSTEMS 3 0 0 100

1. INTRODUCTION 9

Effect of Sampling – Review of Continuous Control systems - modelling – control design using time and frequency domain techniques.

2. DISCRETE TIME SYSTEMS 9

Analysis of discrete time systems – difference equations – Z transform - time and frequency response – sample data systems – sample and hold – sampling and extrapolation – A/D and D/A conversion of systems.

3. DESIGN USING TRANSFORM AND STATE SPACE TECHNIQUES 9

Methods of discretisation – comparison - direct design – frequency response methods – state space design – controllers/estimator design – controllability and observability.

4. QUANTIZATION EFFECT AND SAMPLE RATE SELECTION 9

Analysis of round off error – parameter round off – limit cycles and dither – sampling theorem limit – time response and smoothness – sensitivity to parameter variations – measurement noise and antialising filter – multi-rate sampling.

5. COMPUTER BASED CONTROL 9

Selection of processors – mechanization of Control algorithms – PID control laws – merits and demerits of various algorithms – applications to temperature control- Design of DD systems - Stepper motors and motor controllers and stepper motor control systems.

TOTAL = 45

REFERENCES:

1. Gopal M. “Digital Control Engineering”, Wiley Eastern Ltd. 1989
2. K.Ogata, “Discrete Time Control Systems”, PHI 1987
3. Forsytheand W.Goodall R.N. “Digital Control” McMillan, 1991

ES038 MICROCONTROLLER SYSTEM DESIGN AND APPLICATIONS

3 0 0 100

1. PROGRAMMING FRAME WORK 9

Assembly language – Instruction set - 8051 CPU structure – Register File - Interfacing application using PWM mode – Simple program and applications.

2. REAL TIME CONTROL 9

8096 CPU structure-8096 interrupts structure – Interrupt control-priorities - critical register - Programmable timers - Interrupt Density and Interval Considerations – Real Time Clock.

3. INPUT/OUTPUT PORTS 9

High Speed Inputs – Modes - interrupt and status – High speed Outputs - HSO CAM – software Timers – Input ports – Output Ports – I/O control and status registers.

4. 8096 EXPANSION MODES 9

Bus control – Memory timing - External RAM and ROM expansion – PWM control- A/D interface - Serial Port.

5. SOFTWARE BLOCKS AND APPLICATIONS 9

Queues - Tables and Strings – Stack memoirs – Key switch – parsing – Application of 8096 controllers to generate gating signal for converter and inverters.

TOTAL = 45

REFERENCES:

1. John B. Peatman, “Design with Micro controllers”, McGraw-Hill international Limited Singapore, 1989.
2. Michael Slater, “Microprocessor based design .A comprehensive guide to effective hardware design”, Prentice Hall, New Jersey, 1989.
3. Ayala, Kenneth, “The 8051 Microcontroller Upper Saddle River”, New Jersey, Prentice Hall, 2000.
4. James W. Stewart, Kai X. Miao, “8051 Microcontroller, The: Hardware, Software, and Interfacing”, Prentice-Hall Career & Technology, 1993.

ES039 DATA COMMUNICATION AND NETWORKS 3 0 0 100

1. INTRODUCTION 9

Introduction to Data Communication - Network- Protocols and standards Organizations - Line Configuration - Topology - Transmission Mode - Classification of Network- OSI Model - Layers of OSI Model.

2. TRANSMISSION TECHNIQUES 9

Parallel and Serial Transmission - DTE/DCE/such as EIA -449, EIA-530, EIA-202 and x.21 interface - Interface standards - Modems - Guided Media - Unguided Media - performance - Types of Error - Error detection - Error Corrections.

3. SWITCHING TECHNIQUES 9

Multiplexing - Types of Multiplexing - Multiplexing Application - Telephone system - Project 802. - Ethernet - Token Bus - Token Ring - FDDI - IEEE 802.6 - SMDS - Circuit Switching - Packet Switching - Message Switching - Connection Oriented and Connectionless Services.

4. COMMUNICATION LAYERS 9

Analog and Digital Network - Access to ISDN - ISDN Layers - Broadband ISDN - X.25 Layers - Packet Layer Protocol - ATM - ATM Topology - ATM Protocol.

5. NETWORK DEVICES 9

Repeaters - Bridges - Routers - Gateway - Routing algorithms - TCP/IP Network Transport and application Layers of TCP/IP Word Wide Web

TOTAL = 45

REFERENCES

1. Behrouz., Forouzan, Data Communication and Networking TMH 1999.
2. Jean Walrand - Communication Networks (A first Course) WCB/McGraw-Hill 1996.
3. Stallings W.Data and Computer Communications. PHI.