2nd Semester

EMBEDDED SYSTEMS
VED 551

Introduction Review of Embedded Hardware
Terminology gates- timing diagram – memory microprocessors buses-direct memory access-interrupts- bulit-ins on the microprocessor-conventions used on schematic-schematic, interrupts microprocessor architecture – interrupts basics- share data problem-interrupt latency.

PIC Micro-controller and Interfacing
Introduction, CPU architecture, registers, instruction sets addressing modes loop timing, timers interrupts, interrupts, timing I/o expansion, I 2 C bus operation serial EPROM, analog to digital converter, UART-Baud Rate-Data Handling-initialization, special features- serial programming – parallel slave port.

Embedded Microcomputer Systems
Motorola MC68H11 family architecture registers, addressing modes programs, interfacing methods parallel i/o interface, parallel port interface, memory interfacing. High speed i/o interfacing, interrupts – interrupt service routine-features of interrupts – interrupt vector and priority, timing generation and measurements, input capture, output compare, frequency measurement, serial i/o devices Rs232, Rs485. Analog interfacing, applications.

Software Development and Tools
Embedded system evolution trends, round-robin, robin with interrupts, function – one scheduling architecture, algorithms, introduction to- assembler - compiler-cross compilers and integrated development environment (IDE). Object oriented interfacing, recursion, debugging strategies, simulators.

Real Time Operating Systems
Task and Task States, tasks and data, semaphores and shared Data Operating system services- message questimer function- events - memory management, interrupt routines in an RTOS environment, basic design using RTOS.

Books:

1. David E Simon, "An embedded software primer", Pearson education Asia, 2001.
2. John B Peat man, "Design with micro-controller", Pearson education Asia, 1998.
3. Jonarthan W Valvano Brooks/code, "Embedded micro computer systems, Real time interfacing", Thomson learning 2001.

4.Burns, Alan and Welling, Andy, "real – time systems and programming languages", Second edition. Harlow: Addison-Wesley-Longman, 1997.

5.Raymond J A Bhur and Donald L Bialey, "An introduction to real time systems: Design to networking with C/C++, Prentice hall Inc. New Jersey, 1999.

6. Grehan Moore, and Cyliax, "Real time programming: A guide to

32 bit embedded development reading" Addison- Wesley-
Longman, 1998.
7. Health, Steve, "Embedded Systems Design" , Newnes 1997.

CAD OF DIGITAL SYSTEMS
VED 552

Introduction to VLSI Methodologies – VLSI Physical Design Automation – Design and Fabrication of VLSI Devices – Fabrication process and its impact on Physical Design.

A Quick Tour of VLSI design automation tools – Data structures and basic algorithms – algorithms graph theory and computational complexity – tractable and intractable problems.

General purpose methods for combinational optimization – partitioning- floor planning and pin assignment – placement – routing.

Simulation – logic synthesis- verification – high level synthesis – compaction.

Physical design automation of FPGAs, MCMS-VHDL-Verilog-implementation of simple circuits using VHDL and verilog.

Books:

1. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", 1999.
2. S.H. Gerez, "Algorithms for VLSI Design Automation, 1998.

VLSI SIGNAL PROCESSING
VED 553

Introduction to DSP systems – Iteration Bound – Pipelined and parallel processing.

Retiming – unfolding – algorithmic strength reduction in filters and transforms.

Systolic architecture design – fast convolution – pipelined and parallel recursive and adaptive filters.

Scaling and round off noise – digital lattice filter structures – bit level arithmetic architecture – redundant arithmetic.

Numerical strength reduction – synchronous, wave and asynchronous pipe lines – low power design – programmable digit signal processors.

Book:

1. Keshab K. Parthi, "VLSI Digital signal processing systems, design and implementaion", Wiley, Inter Science, 1999.
2. Mohammad Isamail and Terri Fiez, "Analog VLSI signal and information processing", Mc Graw – Hill

3. S.Y. Kung, H.J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.

VLSI PHYSICAL DESIGN AUTOMATION
VED 554

VLSI Physical Design Automation: VLSI design cycle, physical design cycle, design styles and system packaging styles.

Design and Fabrication of VLSI device: Fabrication materials, transistor fundamentals, fabrication of VLSI circuits, design rules, layout of basic devices, and additional fabrication factors.

Data structure and basic algorithms: Basic terminology, complexity issues and NP-hard problems, basic algorithms (Graph and computational geometry), Basic data structures and graph algorithms for physical design.

Partitioning: Problem formulation, classification of partitioning algorithms, group migration algorithms, simulated annealing and evolution, other partitioning algorithms and performance driven partitioning.

Placement, floor planning and pin assignment: Placement, floorplanning, pin assignment, integrated approach.

Global Routing: Problem formulation classification of global routing algorithms, maze routing algorithms, line - probe algorithms, shortest path based algorithms, steiner tree based algorithms, and integer programming based approach.

Books:

1. Naveed Sherwani, "Algorithms for VLSI physical design automation", Kluwer academic publisher – 1993.

Elective – II: (i) ASIC DESIGN
VED 561

Introduction to ASICS, CMOS LOGIC and ASIC Library Design

Types of ASICs – design flow- CMOS transistors CMOS design rules – combinational logic cell – sequential logic cell- Data path logic cell – transistors and resistors – transistor parasitic capacitance – logical effort – library cell design – library architecture.

Programmable ASICS, Programmable ASIC Logic cells and Programmable ASIC I/o cells

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

Programmable ASIC Interconnect, Programmable ASIC design software and Low level design entry

Actel ACT-Xilinx LCA – Xilinx EPLD – Altera MAX 5000 and 7000 – Altera MAX 9000 – Altera FLEX- Design systems – Logic synthesis – half gate ASIC schematic entry – low level design language – PLA tools – ENDIF-CFI design representation.

Logic Synthesis, Simulation and Testing

Verilog and logic synthesis – VHDL and logic synthesis – types of simulation – boundary scan test- fault simulation automatic test pattern generation.

ASIC construction, Floor Planning, Placement and routing

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

Books:

1. M.J.S. Smith, "Application – specific integrated circuits" – Addison – Wesley Longman Inc. 1997.
2. Andrew Brown, - "VLSI circuits and systems in silicon", Mc Graw Hill, 1991.
3. S.D. Brown, R.J. Francis, J.Rox, Z.G. Uranesic, "Field Programmable gate arrays", Khuever academic publisher, 1992.
4. S.Y.Kung, H.J. Whilo House, T.Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.

Elective – II: (ii) ADVANCED MICROPROCESSORS & MICROCONTROLLERS

VED 562

Microprocessor organization: CPU, memory i/o, operating system, multiprogramming, multithreading, MS-Windows.

Microprocessor Systems: Overview of 8086/8088, IBM PC Architecture, MASM-assembler directive, exe files, con files, real mode, protected mode, DPMI services.

80386 Processor architecture, instruction set, SRAM interfacing, DRAM interfacing, interrupt controllers, DMI controllers, interfacing and communication with 80387.

Memory management: Virtual memory concepts, memory management unit.

Differences between 80386 and 80486, Pentium processor architectural enhancements.

Microcontrollers: overview of 8051 (8-bit) and 80196 (16-bit) microcontroller architectures, architectural features of DSP microcontrollers such as ADSP21XX/TMS320 XX applications.

Books:

1. "Intel Microprocessors, architecture programming and interfacing – 8086/8088/80186,80286/80386 and 80486", by Barry B.Brey, PHI, 1995

2. AD/TMS data books.

Elective – II: (iii) RELIABILITY ENGINEERING
VED 563

Introduction
Reliability fundamentals and bath tub curve, reliability measures and parameters, electronic system reliability, hazard rate model, probability concepts and failure time distribution.

System reliability
System reliability modeling, v-out of 'n' system, analysis of complex reliability structures, system reliability estimation.

Device Reliability
Accelerated life testing, early life reliability, long term device reliability, electrostatic discharge, electrical stress, steady state hazard rate.

Reliability Techniques
Reliability prediction, cut set, tie set, FME set, PTA, Markov, Monte Carlo Simulation, application to electronic systems.

Maintainability and availability concepts
Guidelines for design for maintainability, MITR, BIT/BITE facility, spares provisioning, electronics system packaging and interconnections.

Books:

1. Lewis, "Introduction to reliability engineering", 2nd edition, Wiley international 1996.
2. O'Connor, P.D.T., "Practical reliability engineering", Hayden book company, New Jersey, 1981.

Elective – II: (iv) MEMS AND IC INTEGRATION
VED 564

Overview of CMOS process in IC fabrication, MEMS system-level design methodology, Equivalent Circuit representation of MEMS, signal-conditioning circuits, and sensor noise calculation.
Pressure sensors with embedded electronics (Analog/Mixed signal): Accelerometer with transducer,Gyroscope,RF MEMS switch with electronics,Bolo meter design.
RF MEMS, and Optical MEMS.

Books:

1. Gregory T.A. Kovacs, Micromachined Transducers Sourecbook, The McGraw-Hill, Inc. 1998
2. Stephen D. Senturia, Microsystem Design, Kluar Publishers, 2001

3. Nadim Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House, 2000.
4. M.H. Bao, Micro Mechanical Transducers, Volume 8, Handbook of Sensors and Actuators, Elsevier, 2000.
5. Masood Tabib-Azar, Microactuators, Kluwer, 1998.
6. Ljubisa Ristic, Editor, Sensor Technology and Devices, Artech House, 1994
7. D. S. Ballantine, et. al., Acoustic Wave Sensors, Academic Press, 1997
8. H. J. De Los Santos, Introduction to Micro electro- mechanical (MEM) Microwave Systems, Artech, 1999.
9. James M.Gere and Stephen P. Timoshenko, Mechanics of Materials, 2nd Edition, Brooks/Cole Engineering Division, 1984