

2nd Semester

EMBEDDED SYSTEM DESIGN

MODULE I

Introduction to Embedded Computing: Terms and scope, Application areas, Growing importance of embedded systems. Specifications: Requirements, Models of computation, State Charts: Modelling of hierarchy, Timers, Edge labels and State Charts semantics, Evaluation and extensions, General language characteristics: Synchronous and asynchronous languages, Process concepts, Synchronization and communication, Specifying timing, Using non-standard I/O devices, SDL, Petri nets: Introduction, Condition/event nets, Place/transition nets, Predicate/transition nets, Evaluation, Message Sequence Charts, UML, Process networks: Task graphs, Asynchronous message passing, Synchronous message passing.

MODULE II

Embedded System Hardware: Introduction, Input: Sensors, Sample-and-hold circuits, A/D-converters, Communication: Requirements, Electrical robustness, Guaranteeing real-time behaviour, Examples, Processing units: Application-Specific Circuits (ASICs), Processors, Reconfigurable Logic, Memories, Output: D/A-converters, Actuators. Standard Software: Embedded Operating Systems, Middleware, and Scheduling: Prediction of execution times, Scheduling in real-time systems: Classification of scheduling algorithms, Aperiodic scheduling, Periodic scheduling, Resource access protocols, Embedded operating systems: General requirements, Real-time operating systems, Middleware: Real-time data bases, Access to remote objects

MODULE III

Implementing Embedded Systems: Hardware/Software Co-design, COOL, Actual design flows and tools: SpecC methodology, IMEC tool flow, The COSYMA design flow, Ptolemy II, The OCTOPUS design flow. Embedded Product Development Life Cycle (EDLC): What is EDLC, Why EDLC, Different Phases of EDLC. Overview of PIC and AVR Family of Microcontrollers and ARM Processors .Introduction to PIC and AVR Family of Microcontrollers and ARM Processors

MODULE IV

Basic Features of VHDL: Major Language Constructs, Lexical Description, VHDL Source File, Data Types, Data Objects, Language Statements, Advanced Features of VHDL. Basic VHDL Modelling Techniques: Modelling Delay in VHDL, The VHDL Scheduling Algorithm, Modelling Combinational and

2nd Semester

Sequential Logic.HDL-Based Design Techniques: Design of Combinational Logic Circuits, Design of Sequential Logic Circuits; Modelling for Synthesis: Behavioral Model Development, The Semantics of Simulation and Synthesis, Modelling Sequential Behaviour, Modelling Combinational Circuits for Synthesis, Inferred Latches and Don't Cares, Tristate Circuits

Textbooks:

1. Peter Marwedel, Embedded System Design, Springer, 2006 <http://ls12-www.cs.unidortmund.de/~marwedel/kluwer-es-book/>

Reference Book:

1. Wayne Wolf, Computers as Components, Morgan Kaufmann, 2001 <http://www.ee.princeton.edu/~wolf/embedded-book>
2. G. De Micheli, Rolf Ernst and Wayne Wolf, eds, Readings in Hardware/Software CoDesign, Morgan Kaufmann, Systems-on-Silicon Series Embedded
3. Frank Vahid and Tony D. Givargis, System Design: A Unified Hardware/Software Introduction, Addison Wesley, 2002.
4. Michael Barr, Programming Embedded Systems in C and C++, O'Reilly, 1999.
5. David E. Simon, An Embedded Software Primer, Addison Wesley, 1999.
6. Jack Ganssle, The Art of Designing Embedded Systems, Newnes, 2000.
7. K. Short, Embedded Microprocessor System Design, Prentice Hall, 1998. C. Baron, J. Geffroy and G. Motet, Embedded System Applications, Kluwer, 1997.