EEE119 DIGITAL SYSTEM ENGINEERING

Credits: 20

Course Description including Aims

This module introduces the basic principles underlying the design of electronic systems. The ideas are discussed mainly in the context of digital design which cannot be undertaken realistically without some level of system thinking and planning. Other areas of system design will be used to illustrate and reinforce the idea that system design ideas apply to many fields beside digital design. The module will also introduce some of the computer based tools used by system designers for simulation and verification.

The module aims to:

1. provide students with an understanding of the design of modern electronic hardware and software systems. Modern electronic systems are now so complicated that unmanaged and unstructured approaches to their design leads to ineffective, poor and costly systems. This module introduces students to structured and managed methods that support design and implementation processes and which will enable students to carry out projects successfully.
2. Provide students with an understanding of modern digital systems.
3. Develop the fundamental skills required for the analysis and design of digital systems.

Outline Syllabus

Introduction and motivation. Design flows and the management of processes. Requirements capture. Introduction to design notations. Introduction to implementation and hardware/software co-design. Examples of hardware and software implementation. Introduction to verification, validation and test. Modelling of systems. Reliability. Regulation and legislation. **Boolean Algebra:** basic principles, fundamental theorems. **Logic Expressions:** analysis and synthesis techniques with examples. **Combinational Logic:** simple gates and derived combinational circuits. **Number Systems:** bases, coding, simple binary arithmetic, arithmetic logic circuits. **Sequential Logic:** flip-flops and registers. **Synchronous Sequential Design:** state diagrams, state transition tables, counters, finite state machines (Mealy/Moore). **Hardware Description Languages**: Verilog descriptions of combinational and sequential circuits, algorithmic state machines. **Memory**: ROM, RAM, FLASH. **Timing issues:** delays, set-up/hold time, metastability. **Electrical Properties:** input and output behavior, board level design issues.

Time Allocation

48 lectures, 24 problem classes and 124 hours of independent study

Recommended Previous Courses

entry qualifications

Assessment

mid term test (January) - 10%, exam (June) answer 4 questions from 6 in 3 hours - 90%

Recommended Books

J. Crowe & B. Hayes-Gill	*Introduction to Digital Electronics*	Newnes
T. L. Floyd	*Digital Fundamentals*	Prentice Hall
D. D. Gajski	*Principles of Digital Design*	Prentice Hall
M Morris Mano	*Digital Design 3rd ed.*	Prentice Hall
I. Sommerville	*Software Engineering*	Addison Wesley
A. Sage	*Systems Engineering*	John Wiley
B. Blanchard & W. Fabrycky	*Systems Engineering & Analysis*	Prentice Hall
E. Aslaken & R. Belcher	*Systems Engineering*	Prentice Hall

Objectives

By the end of the unit, a candidate will be able to

1. understand the need to use a structured and well managed approach for the design of electronic systems.
2. demonstrate knowledge and understanding of the design and implementation process from requirements capture through to verification, validation and test.
3. model a simple system and will be able to design and implement a digital simulation of a simple hardware or software system.
4. show awareness of legislation governing the development, deployment and disposal of electronic systems
5. demonstrate an elementary grasp of quality standards such as ISO9000 and their place in the design process.
6. exploit Boolean algebra theorems and manipulation techniques, and use the techniques to analyse or generate simple combinational networks.
7. analyse and design simple sequential circuits using state diagrams and state tables.
8. understand binary number representations and to be able to design simple arithmetic circuits.
9. appreciate the relevance of hardware description languages in the design process and to understand simple digital systems described in Verilog.
10. anticipate the problems in practical circuit implementations stemming from the limitations of devices and the chosen technology.