Course Title: Electronic Product Design

Course Code: EE3003

Units: 2

Level: B3

Course Aims & Objectives:
This course aims to introduce students with a clear understanding of the practical design problems of electronic products at an introductory level. The objective is for students to become familiar with the concept of product design, component tolerances, production constraints, safety requirements, and EMC standards are dealt with through a case study.

Intended Learning Outcomes:
On completion of this course, the students will be able to:

1. Identify and recognize the essential design and production procedures of electronic products.
2. Apply fundamental analysis methods and theorems to the solution of the case study.
3. Design and implement a prototype for meeting the case study requirements.
4. Acquire hands-on experience and problem-solving skills in electronic product design.
5. Acquire experience in presenting the design work.
6. Form the foundation for the Electronic Product Manufacturing Project, the penultimate part of the industrial training programme run in the summer semester.

Syllabus:

Modern Design Technology Manufacturability
Modular design, auto-insertion, surface mount technology, sources of design tips. Basic concepts of Design for Manufacture.

Electronic Circuit Testability Design
Testability: testing paradigms (in-circuit and functional); test points and accessibility of circuits for testing; principle of product partitioning.

Electronic Circuit Reliability
Design for circuit reliability: causes of component failure; reliability calculations and its prediction; means of improving circuit reliability. Environmental Stress Screening.

Tolerance Design
Tolerance analysis, Monte Carlo analysis, Design margins.

Noise and Interference
Introduction to EMI and EMC theory: conductive, static and magnetic interference coupling mechanisms; basic noise reduction techniques; EMI and EMC testing methods.

RFI and Safety Standards
RFI Standards and regulations applicable to the electronic product manufacturing industry. Safety standards for mains supplied electronic products.
Laboratory Experiment:

Part I

The laboratory session aims to provide students with an environment to learn about 1) what documentations are needed for a technical team, 2) how to build a working sample from the technical documents, and 3) how to test the working sample. Moreover, students have to report on the progress in each stage, thus, enabling them to improve their presentation skills.

Each student group, typically 5 students, will be expected to carry out the planning, design and construction of a working sample. The working sample is based on a given circuit and can perform all functions listed in the specifications. Students will also be required to complete a set of circuit diagrams and other necessary documentations. The latter must include detailed production instructions and a cost list of components for the manufacture of the product. The purpose of this exercise is to come up with all the necessary design and pre-production preparations to enable the product designed to go through the product design project in semester B.

Part II

The laboratory session aims to provide students with hands on experience in electronic product design techniques, and forms the foundation for the Electronic Product Manufacturing Project which forms part of the industrial training programme in the summer semester following semester B of Level 3.

Students are required to have a thorough involvement in the design of an electronic product. Each student group, typically 5 students, will be assigned functional specifications for an electronic product. The specifications will include constraints such as restrictions on the type of component that may be employed, mechanical dimensions, etc. This course will provide a training of computer-aided-design from simple drafting, surface, and solid modeling to the latest feature-based concept modeling, together with rapid prototyping techniques.

Each student group will be expected to carry out the planning, design and construction of a working sample that meets all the specifications. They will also be required to complete a set of circuit diagrams and other necessary documentation. The latter must include detailed production instructions and a cost list of components for the manufacture of the product. The document will be submitted to allow acquisition of the components in time for the scheduled starting of the manufacturing project in the summer. The purpose of this exercise is to come up with all the necessary design and pre-production preparations to enable the product designed to go through a small batch pilot production in the following summer. Test jigs for in-process testing and quality control will also be planned.

Through the above the students will gain experience in a complete design, prototype development, test and documentation sequence of a typical electronic product.

Products or equipment to be built will be regularly updated and may include:
- MP3 Player
- Electronic ballast for fluorescent lamp
- Remote switch
- Digital voice recorder

Teaching pattern:

*Duration of course: 2 semester*
Suggested lecture/tutorial/laboratory mix:
Laboratory: 3 hrs x 12 weeks (Sem A)
3 hrs x 11 weeks (Sem B)

Assessment pattern:
Examination duration: N/A
Percentage of coursework, examination, etc.: 100% CW

For a student to pass the course, at least 40% of the coursework and a laboratory attendance of at least 75% must be recorded.

The creativity of the final prototype will contribute to a significant portion of the final marks obtained.

Pre-requisites for Part I: (please quote course code & title)
EE2000 Logic Circuit Design
and
EE2003 Circuit Theory
and
(EE2106 Electronic Devices and Circuits
or
EE2202 (IT2201 old code) Microprocessor & Assembly Language Programming
or
EE3120 (IT3901 old code) Microprocessor & Assembly Language Programming)

Pre-requisites for Part II: (please quote course code & title)
EE3003 (Part I) Electronic Product Design

Pre-cursor: (please quote course code & title)
Nil

Exclusive Course: (please quote course code & title)
Nil

Equivalent Courses: (please quote course code & title)
Nil

Equivalent to the Old Course Code and Title: (please quote course code & title)
Nil

Textbook:
Weyerer M and Goldemund G: Testability of Electronic Circuits, (Prentice Hall, c1992)


Reference Book: