Electromagnetic Compatibility (EMC) and Printed Circuit Board (PCB) Design

Programme course

6 credits

Elektromagnetisk kompatibilitet och mönsterkortdesign

TNE089

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Electrical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Electronics Design Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Circuit Theory, Analog Electronics, Analog/digital System Design, RF electronics

Intended learning outcomes
This course intends to provide the knowledge of printed circuit board processing and design considerations, design rules and EMC. After this course the student should:

- Understand how and why phenomenon like cross-talk occurs.
- Learn the principles of the printed circuit board process.
- Implement design guides, and design rules for printed circuit board production-lines, e.g., practical limitations such as feature sizes etc.
- Learn the EMC requirements for electronic systems, legal aspects and key arguments for EMC.
- Design high frequency PCB, using computer aided design (CAD), and simulate electromagnetic (EM) radiation.
- Evaluate critical disturbers, coupling and susceptibility and EM-compatibility.

Course content

The primary focus of the course is EMC theory and techniques, but it also addresses design and production of printed circuit boards. In printed circuit board design for modern electronics a number of requirements need to be fulfilled; a substrate stack that have the desired electrical and physical parameters must be chosen, which affects design-rules with respect to minimum detail, track spacing, layer connectivity options (VIAs). Moreover, considerations for an environmental friendly production process are taken. EMC theory: Conducted emissions, radiated emissions, and emission susceptibility. Non ideal behaviour of components. Crosstalk and Signal integrity. Regulations and product certifications makes electromagnetic compatibility a modern electronics key issue. Robustness against EM-interferers and emission level control are important properties. In this course the student learn, PCB design rules, substrate stacks, track spacing, track width, production requirements such as panel size, minimum/ maximum feature size, environmental aspects of the production, waste, material selections etc. Regarding EMC, the student learns the cross-talk phenomenon, EM emissions, radiated and conducted conduction-paths. Furthermore, the student will learn how to implement the knowledge from EMC to design a PCB with source, coupling and susceptibility considered.

Teaching and working methods

Lectures, laborations and project

Examination

PRA1	Project work and oral examination	3 credits	U, G
LAB1	Laboratory work	1 credits	U, G
TEN1	Written exam	2 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

Supplementary courses: Antenna Theory

Department

Institutionen för teknik och naturvetenskap

Director of Studies or equivalent

Adriana Serban

Examiner

Magnus Karlsson

Course website and other links

www.itn.liu.se/utbildning/kurs/

Education components

Preliminary scheduled hours: 34 h
Recommended self-study hours: 126 h

Course literature

Additional literature

Books

Paul R. Clayton, *Introduction to Electromagnetic Compatibility* 2
The second edition is the preferred version, but the first edition is also ok.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.