EE6303 ELECTROMAGNETIC COMPATIBILITY DESIGN

Acad Unit: 3
Prerequisite: Nil
Effective: AY2014-15
Last update: October 2013

LEARNING OBJECTIVE

With higher operating speeds and more compact packaging in electronics systems, electromagnetic compatibility (EMC) design of electronic systems is crucial due to mandatory international EMC regulations. Most electrical and electronic engineers are well trained in system design for a specific application but lack the necessary knowledge in designing that system to meet the EMC requirements. The objective of this course is to fill this missing gap. The course starts with the cause of electromagnetic interference (EMI) occurrence and the historical development of worldwide EMC regulatory standards. At the circuit design level, it covers non-ideal behaviors of passive components at high frequencies and their impacts on EMI, EMI filter design for switching mode power supplies, printed circuit board layouts to minimize crosstalk and radiation and electrostatic discharge (ESD) protections. At the system integration level, it covers radio frequency interference (RFI) analysis, grounding and shielding design. Finally, it discusses test methods and procedures for both emission and immunity tests to verify EMC performance of a system.

CONTENT

EMC Regulatory Requirements. Non-Ideal Behaviors of Passive Components. Conducted EMI and Filter Design. Electromagnetic Shielding. Basic Grounding Concept. Crosstalk. Printed Circuit Board Layout and Radiated EMI. Electrostatic Discharge. Radio Frequency Interference. Emission and Susceptibility Measurement Methods.

LEARNING OUTCOME

Through this course, students are expected to:

1. Understand the EMC regulatory requirements in North America, European Community and Asia Pacific region;
2. Select proper passive components for circuits operating at high frequencies without unwanted EMI behaviors;
3. Design an EMI filter for a switching-mode power supply to comply with conducted EMI emission limit;
4. Apply the correct printed circuit board layout techniques to resolve EMI problems arising from crosstalk and to comply with radiated EMI emission limit;

5. Apply the correct printed circuit board layout techniques to resolve EMI problems arising from crosstalk and to comply with radiated EMI emission limit;
6. Apply the correct protection techniques to minimize damages to active components due to ESD;
7. Apply the correct grounding and shielding methods for EMC purposes;
8. Compute antenna-to-antenna coupling for RFI analysis;
9. Familiar with the basic measurement methodologies for electromagnetic emission and susceptibility requirements.

OTHER RELEVANT INFORMATION

This course is intended for graduate students. The prerequisite for understanding the course is a bachelor degree in Electrical and/or Electronic engineering.

ASSESSMENT SCHEME

Continuous Assessment	20%
Final Examination	80%

TEXTBOOKS

1. Henry W. Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons, 2009.

REFERENCES

1. Clayton R. Paul, "Introduction to Electromagnetic Compatibility", 2nd Edition, Wiley Interscience, 2006.
2. Elya B. Joffe and Kai-Sang Lock, "Grounds for Grounding – A Circuit-to-System Handbook", John Wiley & Sons and IEEE Press, 2010.