The University Of Sheffield.

Electronic & Electrical Engineering.

EEE6220 ELECTRONIC COMMUNICATION TECHNOLOGIES

Credits: 15

Course Description including Aims

This module aims to provide students with a range of skills that are required when designing circuits at high frequencies covering topics such as circuit interference mechanisms and design techniques, circuit layout, filtering, screening, transmission lines, S-parameters, Smith charts, radio frequency (RF) device design, and measurement techniques..

1. To provide an introduction to the fields of electromagnetic interference, control and compatibility, including nomenclature and methodology.
2. To review the relevant legislation, in particular the EU emc directive.
3. To provide an appreciation of the causes and potential remedies for emi through good design practice and case studies.
4. To introduce the concept of a distributed system and how to handle and model it using high frequency transmission line theory. This will involve vital concepts such as reflection coefficient, insertion loss, transferred impedances and impedance matching.
5. To show how parasitic elements dominate the behaviour of devices at high frequency and to introduce the idea of "S" parameters, used by manufacturers to specify component behaviour, and how to use them in the design process.
6. To introduce an awareness of the various RF devices available and their relative merits, and of the impact that circuit layout and substrate dielectric quality have on circuit performance including the idea of skin depth and its significance for conduction losses in interconnects.
7. To discuss importance of linearity and the related issues of intermodulation in RF power devices and the way these parameters are specified and also to discuss noise and noise figure and ways of minimising both.
8. To introduce the specialist measurement equipment - network analysers, spectrum analysers, signal sources, power meters etc - commonly used in a high frequency design/test environment and outline the principles behind their operation.

Outline Syllabus

The need for emc. engineering. Basic model for emi. Radiated and conducted coupling. Filters and shields. Emc. legislation and compliance. High frequency transmission lines. Device characteristics at high frequency. High power amplifies. Measurement techniques.

Time Allocation

36 lectures in weeks 1 to 18.

Recommended Previous Courses

Second year modules or equivalent.

Assessment

Examination 3 out of 4 questions (75%) plus a written piece of coursework relating to interference in electronic systems (12.5%) and short tests covering objectives 5-12(12.5%)

Recommended Books

Keiser, B.	*Principles of Electromagnetic Compatibility*	Artech House
Marshman, C.	*The Guide to the EMC. Directive*	E.P.A.Press
Williams, T.	*EMC for Product Designers*	Newnes
Ott, H	*Noise reduction techniques in electronic systems*	Wiley
Reinhold Ludwig, Pavel Bretchko	*RF Circuit Design; Theory and Applications*	Prentice-Hall
Vincent F. Fusco	*Microwave Circuits; Analysis and Design*	Prentice-Hall
Jeremy Everard	*Fundamentals of RF Circuit Design*	Wiley

Objectives

By the end of the unit a successful student will be able to

1. Understand the nature and scope of electromagnetic interference (emi) in modern electronic and electrical systems and the need for electromagnetic compatibility (emc).
2. Understand the broad principles of combating emi both at the equipment design stage and during its testing, commissioning and use.
3. Design circuits to minimise electromagnetic emissions
4. Use filtering, screening and appropriate circuit design to minimise sensitivity to emi
5. Display a working knowledge of basic high frequency transmission line behaviour by solving quantitative problems based on reflection coefficient and insertion loss.
6. Use a Smith chart to design RF circuits.
7. Recognise the different forms in which a transmission line may appear.
8. Describe the various forms of active device and subsystems available for RF designs and their relative advantages and disadvantages.
9. Demonstrate knowledge of the high frequency equivalent circuit of both passive and active devices and the ability to use passive device equivalent circuits to predict performance.
10. Use "S" parameters to design simple RF circuits.
11. Use noise specifications to make quantitative estimates of the noise performance of simple RF systems.
12. Understand the terms used to specify linearity in power amplifiers