Course Type	Course Code	Name of Course	L	T	P	Credit
DE	ECD408	EMI/EMC	3	0	0	9

Course Objective

Any product that emits frequency components above 9 kHz, whether intentionally or unintentionally, is called a RF device. Such devices must satisfy some regulatory limits before marketing. The course objective is to familiar the students about these regulatory limits, different causes of such emissions, and different techniques to overcome them.

Learning Outcomes

Upon successful completion of this course, students will:

- Be familiarized about EMI, EMC, and different regulatory limits.
- Have knowledge about the non-ideal behaviors of wires and circuit components.
- Learn how to analyze and design a clock for digital devices, how to design a system to reduce radiated emission, and how to design a system to reduce conducted emission.
- Familiarized about ESD events and different techniques to mitigate it.
- Gain knowledge on the analysis and design of shields for RF systems.
- Learn to analyse the system crosstalk and different techniques to reduce it.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to EMI/EMC: Introduction, to EMI and EMC, EMC Units.	02	Familiarized about EMI and EMC and their importance.
2	EMC Requirements for Electronic Systems: Governmental Requirement, Measurement of Radiated and Conducted Emission, Additional product Requirement.	04	Introduced to different regulatory limits that a RF device must satisfy to be marked for home/ commercial/ military applications.
3	Non-Ideal Behaviour of Components: Wires and PCB Lands, Effect of Component Leads, Resistor, Capacitor, Inductors.	04	Have knowledge about the non-ideal behaviors of wires and different circuit components.
4	Signal Spectra: Spectrum of clock waveforms, Effect of clock parameters, Ringing.	04	Learn how to analyse and design a clock for digital devices.
5	Radiated Emission and Susceptibility: Differential and Common Mode Current Emission Model, Simple Susceptibility Models.	04	Learn how to design a system to reduce radiated emission.

6	Conducted Emission and Susceptibility: Common and Difference Mode Current, Power Supply Filter, Power Supplies, Power Supply, Conducted Susceptibility.	04	Learn how to design a system to reduce conducted emission.
7	Electrostatic Discharge: Effects of the ESD Events, Mitigation Design Technique.	04	Familiarized about ESD events and different techniques to mitigate it.
8	Shielding: Introduction, Shielding Effectiveness – Far Field and Near-Field Sources, Low Frequency Magnetic Field Shielding, Effects of Aperture.	04	Gain knowledge on the analysis and design of shields for RF systems.
9	Crosstalk: Three Conductor Transmission Line and Per-Unit-Length Parameters, Frequency and Time Domain Crosstalk, Shielded Wires, Twisted WiresEffect of incident field	08	Learn to analyse the system crosstalk and different techniques to reduce it.
10	System Design for EMC: Grounding, System Configuration, PCB Design,	04	Gain how to design an EMC system.

Textbook:

1. C. R. Paul, Introduction to Electromagnetic Compatibility, 2nd Ed., (John Wiley and Sons, 2006).

Reference Books:

1. S. H. Hall and H. L. Heck, Advanced Signal Integrity for High-Speed Digital Designs, (Wiley-IEEE, 2009).
2. K. L. Kaiser, Electromagnetic Compatibility Handbook, (CRC Press, Florida, 2004).
3. C. R. Paul, Analysis of Multiconductor Transmission Lines, 2nd Ed., (Wiley-IEEE, 2007).
4. C. R. Paul, Transmission Lines in Digital Systems for EMC Practitioners, (Wiley-IEEE).
5. C. R. Paul, Transmission Lines in Digital and Analog Electronic Systems: Signal Integrity and Crosstalk, (Wiley, 2010).