SECOND SEMESTER 2019-20
COURSE HANDOUT

Date: 06.01.2020

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course No	**: EEE F436**
Course Title	**: ELECTROMAGNETIC COMPATIBILITY**
Instructor-in-Charge	**: Dr. Praveen Kumar A.V.**
Instructor(s)	**: None**
Practical Instructors	**: None**

1. Course Description:

Electromagnetic compatibility (EMC) is the engineering of electrical systems to ensure the overall functioning in a complex electromagnetic environment. With the advancements in high speed communication, switching techniques, and integrated circuit technologies, devices affect one another through the phenomenon called the electromagnetic interference (EMI). A system that is designed for EMC doesn't interfere with the operation of other systems, immune from the emissions of other systems and doesn't interfere with its own operation. An electronic product that is not compliant with the respective EMC standards doesn't qualify to be marketed. It is recommended to take the EMC into account starting from the design stage of a system, as discovering it at a later stage, especially during the product testing will cost both time and money. The course addresses the issues, requirements, regulatory obligations, propagation and solutions to EMI/EMC issues faced in electrical systems. The course is mostly built upon undergraduate level Electromagnetic theory.

2. Scope and Objective of the Course:

- Understand the effects of EMI/EMC in electrical systems
- Be aware of EMC related units, regulations and legislations
- Identify possible EMI sources
- Study the temporal and spectral behavior of electrical signals
- Learn the non-idealities of circuit elements
- Analyze emissions and susceptibility of circuits
- Analyze various types of coupling mechanisms between electrical circuits
- Understand methods of measuring EMC
- Learn about methods to control the EMI
- Use research articles effectively in analyzing practical EMI situations, and propose solutions.
- Effectively present the students' ideas and works in written and oral form

3. Text Book:

- Paul, C.R., "Introduction to Electromagnetic Compatibility", 2nd ed., Wiley (2010)

4. Reference Material:

- **R1.** David K. Cheng, "Field and Wave Electromagnetics", 2nd ed. Pearson Education, 2009.
- **R2.** Course notes on Electromagnetic compatibility, Michigan State University. Available at : https://www.egr.msu.edu/emrg/electromagnetic-compatibility-emc-course-notes.
- **R3.** V. Prasad Kodali, "Engineering Electromagnetic Compatibility: Principles, Measurements, Technologies, and Computer Models", 2nd ed., Wiley-IEEE Press, 2001

5. Course Plan:

Module	Lecture No.	Topics to be covered	Reference
Introduction	1–4	Electromagnetic compatibility - aspects and history, Sources – external/ internal, unintentional / intentional, Electrical dimensions, Units, Regulations (brief), Emissions, Product design, Review topics from electromagnetic theory	Ch.1-2 (TB), For review Appendix A-B, (TB), R1
Signals and spectra	5–9	Signals and spectral content, Digital waveforms – clock and data, Trapezoidal signals – characteristics, Spectrum analyzer	Ch.3 (TB), R2
Non-ideal behavior of circuit elements	10–14	Internal and external impedances, Equivalent circuits – Wires, Resistors, Capacitors and Inductors, PCB lands, Frequency dependence	Ch.5(TB), R2
Emission, susceptibility and measurement	15–22	Emissions / susceptibility - Conducted / radiated, Simple emission models – differential and common mode, Measurement of EMI	Ch. 6 & 8, ch. 7 (brief), R2
Near-field and far-field coupling	23–30	Cross-talk – Capacitive coupling, Inductive coupling, LC coupling, Common impedance coupling, Coupling to shielded cables, Electromagnetic coupling	Ch. 9-10 (TB),R2
Solutions to EMC problems	31–40	Grounding, Cable shielding, Electromagnetic shielding, Filtering, Surge protection, Decoupling, Lightening protection, Printed circuit boards – design considerations, EMC simulators	Ch.11 (TB), R2
Lab component	Lab demonstrations on practical EMI/EMC		

6. Evaluation Scheme:

Component	Weightage (%)	Duration	Date & Time	Nature of component (Close Book/ Open Book)
Quiz	20	10–15 min	Surprise	Closed book
Assignment	10	1–2 Week	Take home	Open book
Mid semester examination	30	90 Min	02/03 AN	Closed book
Comprehensive examination	40	3 h	02/05 FN	Closed + Open book

7. Chamber Consultation Hour: To be announced

8. Notices: Notices will be displayed in *Nalanda* ONLY (https://nalanda.bits-pilani.ac.in/).

9. Make-up Policy: Make-up will be granted ONLY in genuine cases such as health issues or urgency of going out of campus. If a student is likely to be absent in an evaluation, he/she MUST write an email application to the IC. In medical cases, proper proof must be produced.

10. Important: Students must keep all the answer sheets (quiz, assignment, test etc) safe and secure till the end of the semester. Students should produce them whenever asked by the IC.

Instructor-in-charge
Course No. EEE F436