23SC808 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY (3-0-1-4)

The programme In-depth exposure of unintentional electromagnetic energy generation, propagation, and reception—which may result in undesirable effects like electromagnetic interference or even physical damage to the operational or impaired function of equipment—is provided by electromagnetic interference and compatibility. The purpose of EMC is to incorporate the capacity for various pieces of equipment to operate in a shared electromagnetic environment. The learner will leave this course with a thorough understanding of EMI sources and victims. The suppression procedures like shielding, bonding, grounding, and earthing are also covered in the course. Learners should be able to investigate and use EMI/EMC measurement methodologies, assessment techniques, and different EMI/EMC standards like ANSI, FCC, CISPR, and CENELEC.

CO1 - Identify the various types and mechanisms of Electromagnetic Interference

CO2 - Find solution to EMI Sources, EMI problems

CO3 - To measure emission immunity level from different systems to couple with the prescribed EMC standards

CO4 - Understand the different types of EMI/EMC measurement techniques.

Module I BASIC THEORY: Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Case Histories, Radiation hazards to humans, Various issues of EMC, EMC Testing categories, EMC Engineering Application.

Module II COUPLING MECHANISM: Electromagnetic field sources and Coupling paths, Coupling via the supply network, Common mode coupling, Differential mode coupling, Impedance coupling, Inductive and Capacitive coupling, Radiative coupling, Ground loop coupling, Cable related emissions and coupling, Cross talk in transmission lines, Transient sources, Automotive transients, Cable routing and connection, Component selection and mounting, PCB design, Trace routing, Impedance control, decoupling.

Module III PRINCIPLES OF SHIELDING: Working principle of Shielding, LF Magnetic shielding, Apertures and shielding effectiveness, Choice of Materials for H, E, and free space fields, Gasketing and sealing, PCB Level shielding, Principle of Grounding, Isolated grounds, Grounding strategies for Large systems, Grounding for mixed signal systems, Electrical bonding, Filter types and operation, Surge protection devices, Transient protection.

Module IV STANDARDS AND REGULATION: Need for Standards, Generic/General Standards for Residential and Industrial environment, Basic Standards, Product Standards, National and International EMI Standardizing Organizations; IEC, ANSI, FCC, CISPR,

CENELEC, Electro Magnetic Emission and susceptibility standards and specifications, MIL461E Standards.

Module V EMI TEST METHODS AND INSTRUMENTATION: Fundamental considerations, Basic principles of RE, CE, RS and CS measurements, EMI Shielding effectiveness tests, TEM cell for immunity test, Shielded chamber, Shielded anechoic chamber, EMI test receivers, Spectrum analyzer, EMI test wave simulators, EMI coupling networks, Line impedance stabilization networks, Feed through capacitors, Antennas, Current probes, MIL -STD test methods, Civilian STD test methods.

Reference

1. Clayton Paul, “Introduction to Electromagnetic Compatibility”, Wiley Interscience, 2006.
2. V Prasad Kodali, “Engineering Electromagnetic Compatibility”, IEEE Press, Newyork, 2001.
3. Henry W. Ott, “Electromagnetic Compatibility Engineering”, John Wiley & Sons Inc, Newyork, 2009.
4. Daryl Gerke and William Kimmel, “EDN’s Designer’s Guide to Electromagnetic Compatibility”, Elsevier Science & Technology Books, 2002.
5. W Scott Bennett, “Control and Measurement of Unintentional Electromagnetic Radiation”, John Wiley & Sons Inc., (Wiley Interscience Series) 1997.
6. Dr Kenneth L Kaiser, “The Electromagnetic Compatibility Handbook”, CRC Press 2005.