INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Electromagnetic Interference and Compatibility</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ECE/Dr. Sundeep Kumar</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">UG/PG</td><td>Type</td><td colspan="2">Core ☐</td><td colspan="2">Elective ▬</td></tr>
<tr><td>Status</td><td colspan="2">New ☐</td><td colspan="2">Modification ▬</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td><td colspan="3">Submitted for approval</td><td colspan="2">Senate # 63</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• Provide a strong foundation in the principles, sources, and coupling mechanisms of EMI/EMC.
• Develop practical design skills in grounding, shielding, filtering, and PCB layout for EMC compliance.
• Train students in EMI/EMC measurement, testing, and troubleshooting techniques.
• Prepare graduates to address EMI/EMC challenges in electronics, IoT, automotive, aerospace, and communication systems.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">By the end of this course, students will be able to:
• Identify sources and coupling mechanisms of EMI.
• Apply grounding, shielding, filtering, and PCB layout techniques for EMC compliance.
• Interpret international EMC standards and apply them to product design.
• Conduct and analyze EMI/EMC tests in simulated or lab environments.
• Troubleshoot EMI issues in real-world systems.
• Design IoT, wireless, and digital systems considering EMI/EMC effects.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Electronic Equipment and System EMI Concepts - EMC Requirements for Electronic Systems, Equipment Emissions and Susceptibilities; EMC Specifications; EMC Standards; EMC Measurements; EMC Documentation - Historical Summary, The Rationale, Review of MIL-Std, FCC and CISPR Requirements. (3L+1T)

Introduction of Electromagnetic Compatibility; Communications System EMI-Typical modes of system interactions - antennas, Transmitters, receivers, and Receiver Responses; Elements of Interference - antennas, transmitters, receivers, and propagation; EMC in low-power sensor/IoT nodes. (6L+2T)

Common-Mode and Differential-Mode Coupling Mechanisms, Including Field to Cable, Ground Impedance, Ground Loop, and Coupling Reduction Techniques, Other Coupling Mechanisms, Arcing at Switches and Its Suppression. (6L+2T)

Non-Ideal behavior of components - Resistance, Capacitance, and Inductance of wires; Equivalent circuits - Resistors, Capacitors, Inductors; Effect of component leads; Digital circuit devices; Effect of component variability. (3L+1T)

EMI Mitigation Techniques - I.E. Safety, Lightning Control, EMC, etc; Grounding Schemes - Single Point, Multi-Point, and Hybrid; Shield Grounding and Bonding; shielding materials; shielding apertures; shielding effectiveness calculation; Filtering - line filters, ferrite beads, EMI chokes; Shielding- Shielding</td></tr>
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	Effectiveness, Shielding Considerations, Shielding Design, Shielding Compromises. (9L+3T) EMI Measurement and Test environments - OATS, semi-anechoic chambers, reverberation chambers; EMI Testing Techniques - conducted emissions testing, radiated emissions testing, Immunity testing. (6L+2T) PCB design for EMC – stack up, planes, decoupling, routing, return paths, differential signaling, Cabling, and connector design. (9L+3T).
Text Books	1. Clayton R. Paul – Introduction to Electromagnetic Compatibility, 3rd Ed. Wiley, ISBN 978-1119404347, 2002. 2. Bogdan Adamczyk – PCB Design and Layout Fundamentals for EMC, 1st Ed., Artech House, ISBN 978-1630819470, 2021.
Reference Books	1. Henry W. Ott – Electromagnetic Compatibility Engineering, 1st Ed., Wiley, ISBN 978-0470189306, 2009. 2. Mark I. Montrose – Printed Circuit Board Design Techniques for EMC Compliance, 2nd Ed., Wiley-IEEE Press, ISBN 978-0780360327, 2000. 3. Kenneth Wyatt & Patrick André – EMI Troubleshooting Cookbook for Product Designers, 1st Ed., Artech House, ISBN 978-1608077053, 2014. 4. Kenneth L. Kaiser – Electromagnetic Compatibility Handbook, 1st Ed., CRC Press, ISBN 978-0849320873, 2004. 5. L. Ashok Kumar & Y. Uma Maheswari – Electromagnetic Interference and Electromagnetic Compatibility: Principles, Design, Simulation, and Applications, 1st Ed., CRC Press/Taylor & Francis, ISBN 978-1003362951, 2023. 6. Tim Williams – EMC for Product Designers, 5th Ed., Elsevier/Newnes, ISBN 978-0081010167, 2016.