

SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 19AUB204 – AUTOMOTIVE ELECTRICAL AND ELECTRONICS ENGINEERING

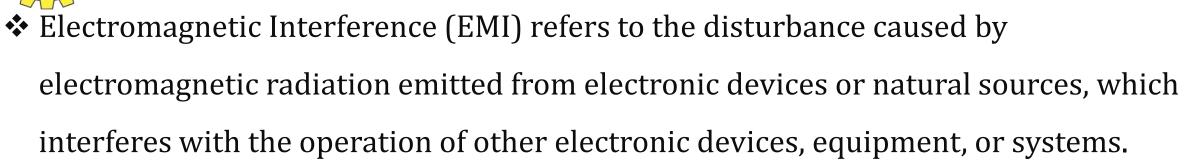
II YEAR / IV SEMESTER

Unit 5 – Electronics Systems

Topic : Electromagnetic interference Suppression and Electromagnetic Compatibility



ELECTROMAGNETIC INTERFERENCE SUPPRESSION



- EMI can manifest in various forms, including electromagnetic fields, radio frequency interference (RFI), or conducted interference through electrical wiring.
- Electromagnetic Interference (EMI) suppression is crucial in maintaining the proper functioning of electronic systems by preventing unwanted electromagnetic disturbances.



SHIELDING



- Enclosures: Use metal cases or covers around electronic devices to block external electromagnetic fields.
- Cable Shielding: Employ shielded cables with conductive layers to protect the internal wires from external interferenc



FILTERING



- Low-pass Filters: Allow low-frequency signals to pass while blocking highfrequency noise.
- High-pass Filters: Permit high-frequency signals to pass and block low-frequency noise.
- *** Band-pass Filters**: Allow a specific range of frequencies to pass and block others.
- Common-mode Chokes: Used in power lines to filter common-mode noise by providing high impedance to unwanted signals.



GROUNDING



Single-point Grounding: Use a single grounding point to avoid ground loops that can introduce noise.

* Multi-point Grounding: Connect multiple points to the ground to reduce the path for EMI.



PCB Design Techniques



- Proper Layout: Arrange components to minimize loop areas that can pick up or emit EMI.
- *** Trace Routing**: Use short and straight traces to reduce the chances of EMI.
- Ground Planes: Implement continuous ground planes to provide a return path for signals and reduce EMI.



TWISTED PAIR CABLES



Twisting Wires: Pair and twist wires together to cancel out electromagnetic fields and reduce interference.

FERRITE BEADS AND CORES

*** Ferrite Beads**: Attach beads to cables to suppress high-frequency noise.

Ferrite Cores: Encircle cables with ferrite cores to absorb EMI and prevent it from propagating.



ELECTROMAGNETIC COMPATIBILITY



- Electromagnetic Compatibility (EMC) is the ability of electronic devices and systems to function properly in their electromagnetic environment without causing or experiencing unacceptable levels of electromagnetic interference (EMI).
- Achieving EMC involves both controlling emissions and ensuring immunity to interference.



EMISSION CONTROL



Conducted Emissions: These are electromagnetic disturbances conducted through

electrical connections, such as power lines and signal cables.

Radiated Emissions: These are electromagnetic disturbances emitted through the air from the device.

IMMUNITY

- Conducted Immunity: The ability of a device to withstand conducted disturbances on its power and signal lines.
- Radiated Immunity: The ability of a device to withstand electromagnetic fields present in its environmenT



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Design Techniques

- Proper PCB Layout: Minimize loop areas, use ground planes, and separate highspeed and low-speed circuits.
- Component Placement: Keep noisy and sensitive components apart, and use shielded components where necessary.
- Trace Routing: Use short, direct traces, and avoid parallel runs of high-speed signals to minimize crosstalk.





Shielding

- Enclosures: Use metal enclosures to block electromagnetic fields from entering or leaving the device.
- Cable Shielding: Employ shielded cables to protect against external EMI and prevent internal emissions from escaping.





Power Line Filters: Use filters on power lines to suppress conducted emissions and improve immunity.

- Signal Line Filters: Apply filters on signal lines to reduce noise and prevent interference.
- ***** Grounding

25/05/2024

- Single-Point Grounding: Use a single ground point to avoid ground loops that can cause interference.
- Multi-Point Grounding: In some designs, multiple grounding points might be used to improve EMC, especially in large or complex systems.

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- * Decoupling and Bypass Capacitors
 - Decoupling Capacitors: Place capacitors near power pins of ICs to filter out high-frequency noise.
 - Bypass Capacitors: Provide low impedance paths to ground for high-frequency signals, reducing potential interference.
- ***** EMI Suppression Components
 - Ferrite Beads and Cores: Attach ferrite beads to cables and use ferrite cores around cables to absorb EMI.
 - Chokes: Use common-mode and differential-mode chokes to suppress noise on
 - power and signal lines. 25/05/2024 19AUB204 - Automotive Electrica

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Circuit Design Techniques

- **Balanced Circuits**: Use differential signaling to reduce noise susceptibility.
- Ground Planes: Implement continuous ground planes to provide a stable reference and reduce EMI.
- * Environmental Considerations
 - Cabling and Routing: Properly route cables to minimize EMI. Use twisted pair cables to cancel out noise.
 - Environmental Shielding: In environments with high EMI, additional shielding might be necessary.





THANK YOU !!!