

### UNIT III EMI Mitigation Techniques Part A with answer

#### 1. Define – Grounding

**Grounding** is a technique that provides a low resistance path between electrical or electronic equipment and the earth or common reference low impedance plane to bypass fault current or EMI signal.

#### 2. Why is grounding essential to suppress EMI?

Electrical grounding is essential for the protection of personnel against electric shock, fire threat because of insulation burnout from lightning or electrical short circuit and protection of equipment and systems against electromagnetic interference.

#### 3. How interference is avoided in power supply lines?

The interference is avoided in power supply lines

By using power line filter.

Avoid unnecessary switching operations.

Noisy circuits (with a lot of switching activity) should be physically separated from the rest of the design.

Harmonic Wave Filters can be used.

Design for operation at lower signal levels, reducing the energy available for emission.

#### 4. What is a limit on the lower frequency portion of the conducted emission and which is the standard followed during the testing?

The FCC Part 15 EMC Regulations limit the maximum allowable conducted emission, on the ac power line in the range of 150 KHz to 30 MHz.

For conducted emissions, standard used for testing are the LISN (Line Impedance Stabilisation Network).

#### 5. What is LISN?

**LISN** means Line Impedance Stabilization Network. A network inserted in the supply mains lead of an apparatus to be tested providing in a given frequency range a specified load impedance for the measurement of disturbance voltages and possibly isolating the apparatus from the supply mains in that frequency range.

#### 6. What are the two main objectives of LISN?

The two main objectives are:

- (i) Provide constant impedance over range of frequency.
- (ii) Provide pure power without EM noise.

#### 7. What are the four stages involved in EMC test?

The four stages involved in EMC test:

Development test  
Pre-compliance test  
EMC compliance test  
Production test

**8. Mention the various type of EMC test.****10. How shielding is provided?**

The various type of EMC test conducted at the various stages during the development cycle are

- i) Conducted emissions
- ii) Radiated emissions
- iii) Conducted immunity
- iv) Radiated immunity
- v) ESD immunity
- vi) Transient immunity
- vii) Surge immunity

**9. What is shielding and mention its need.**

EM shielding is the technique that reduces or prevents coupling of undesired radiated EM energy into equipment to enable it to operate in compatibility in its EM environment.

Shielding is provided by putting metallic barrier in the path of EMW between the emitter and a receptor. A conductive enclosure used to block electro static fields is also known as faraday cage.

**11. What is shielding effectiveness?**

Shielding effectiveness is defined as the reduction in magnetic electric or EMF magnitude caused by the shield. The effectiveness of shield depends on shield material as well as the characteristics of the incident field and the distance between source and victim.

**12. How do measure the shielding effectiveness?**

The shielding effectiveness (S) in dB calculated as the sum of three components namely reflection loss, absorption loss and a correction factor (B)

$$S=A+R+B.$$

**13. What is the purpose of apertures in shielding?**

The apertures in shielding wall can be modeled as simple geometrical shapes such as rectangular slots and circular holes to obtain shielding effectiveness in the presence of discontinuities. Nad to improve the thermal environment.

**14. list the types of earth electrode systems.**

- i) Single rod electrode
- ii) linear array of vertical rods
- iii) Driven square array of vertical rods
- iv) Buried horizontal grid
- v) Bed of vertical rod connected by a buried grid.

**15. What are the precautions will be taken while earthing?**

- i) check moisturization
- ii) corrosion reduction
- iii) cathode protection
- iv) chemical salting.

7. Discuss in detail about transient and surge suppression devices. ⑤

\* transient suppression devices Definition

\* Types

- ↳ MOVs
- ↳ SZD
- ↳ BAD

\* Gas tube suppressor.

\* Location of arrestors, voltage limiting.

Unit III EMI Mitigation Techniques

1. Describe the difference b/w radiated differential mode and common mode coupling with suitable example.

\* Definition of common mode coupling

\* Block diagram of " " " "

\* Construction details

\* Block diagram of diff. mode coupling

\* Construction details

2. Explain in detail about ground loop coupling and power supply coupling.

\* Definition.

\* Example & illustration of the generation of common mode currents

\* Methods (i) Common mode choke

(ii) optical coupler

3. Explain in detail various coupling methods.

\* Differential mode

\* Common mode

\* Antenna mode

\* conducted Diff. mode

\* conducted common mode

\* Radiated diff. mode.

4. Explain in detail about transient sources and automotive transients.

\* Sources of continuous EMI

\* " " Transient EMI

\* supply line transients

\* Lightning Discharge {

- Cloud to cloud
- Cloud to ground

\* Automotive transients

\* suppression of transient environment.

\* protection of a central suppressor.

#### Unit IV Standards and Regulations

1. Explain the following: Basic standard, product standard.

\* Definition and General

\* Basic EMC Standard (part 1-9)

\* Example CISPR 11 & CISPR 22

Product standards:-