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Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (ECE)/SEM-3/MCE-302A/2012-13

2012
EMI/EMC

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any four from the rest.

1. Answer any seven from the following : $7 \times 2 = 14$

a) What is EMI ?

b) What is ESD ?

c) What is the absolute value of 180 dBμV ?

d) What is the range of frequencies, as defined by FCC for EMC requirement of electronic systems ?

e) What is the maximum value in dBμV for the FCC class A conducted emission limits ?

f) What is grounding from the background of preventing EMI ?

g) What is a single point ground system ?

h) What is shielding ?

i) What is skin depth ?

j) What is the value of ε_r for a dielectric substrate using glass epoxy ?

k) What is end to end bridging capacitance in a WWR ?

l) What are bi-conical antennas ?

m) What is an LISN ?

2. What is EMI ? What are the mechanisms of transferring electromagnetic energy ? Discuss in detail with necessary diagram. What are ESD and EMP ? 3 + 3 + 4 + 4

3. What are class *A* and Class *B* digital devices in relevant to EMC compliance ? Discuss in detail. What are the differences between the Quasi-Peak and Average Detector values ? What is the highest frequency up to which the radiation emissions are to be measured, if the PC have a clock frequency of 3GHz ? What is the basis of such measurements ?

5 + 3 + 3 + 3

4. What is shielding effectiveness ? Derive an expression for the shielding effectiveness for electronic and magnetic metals, considering reflection, absorption and multipath-reflection losses. 4 + 10

5. What are PCBs ? How does the skin effect depend on the land thickness and land areas ? How the SMT components mitigate the effects of the components leads of the Thru-hole components ? Explain the lumped circuit model of lead inductance and lead capacitance. 3 + 3 + 4 + 4

6. What are the different types of capacitors used for EMC suppression ? Explain with equivalent circuit and relevant Bode Plots, the non-ideal behaviour of a capacitor. What are the problems associated with the choice and effectiveness of capacitors used for high frequency noise suppression required for regulatory compliance ? 4 + 5 + 5

7. Derive an expression for $E_{\text{far field}}$ and $H_{\text{far field}}$ for an electrical Hertzian dipole. What is antenna factor ? What are the factors which need to be considered for calibration of a measurement antenna ? What are the different antennas used in different frequency ranges in radiation emission measurements ? 6 + 2 + 3 + 3

8. Derive an expression for the power loss in cables. Explain how conducted emission can be tested by LISN. What is the difference between the LISNs used for conducted emission testing for FCC/CISPR22 and MIL-STD-46IE ? 6 + 5 + 3