Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(ECE)/SEM-3/MCE-301D/2009-10

2009

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. Choose the correct alternatives of the following : 7 × 2

   i) Input impedance of a transmission line at a distance l will be its characteristic impedance when l will be

   a) λ b) $\lambda/2$

   c) $\lambda/4$ d) $\lambda/8$.

   ii) A matched load has a return loss of

   a) 1 dB b) 0 dB

   c) • dB d) none of these.

   iii) The correct relationship between the insertion loss and transmission co-efficient of a transmission line is

   a) I.L = 10 log $|T|$ dB b) I.L = – 10 log $|T|$ dB

   c) I.L = 20 log $|T|$ dB d) I.L = – 20 log $|T|$ dB.

iv) To reduce emission from a product we have to

a) increase the rise/fall time of its clock pulse

b) decrease the rise/fall time of its clock pulse

c) increase the rise time but decrease the fall time of clock pulse

d) decrease the rise time but increase the fall time of clock pulse.

v) Which type of waveform / waveforms is/are the main culprit to create EMI ?

a) A sinusoidal waveform

b) a rectangular waveform

c) both of these

d) none of these.

vi) Which loss/losses is/are the primary contributor to the schielding at low frequencies ?

a) Reflection loss

b) Absorption loss

c) Multiple reflection loss

d) Both (b) and (c).

vii) The antenna we generally use for measurement of radiated emission in an Anechoic chamber is

a) Yagi-Uda antenna

b) Folded dipole

c) Log periodic antenna

d) None of these.

2. a) What are the primary and secondary constants for a micro-strip line ?

   b) Derive the relation between Neeper and dB.

   c) Prove that the time average power flowing down a loss-less transmission line is

   $$Pav = | V_{max} |^2 / (2. s. z_0)$$

   where S = VSWR & z_0 = characteristic impedance of the line. 5 + 4 + 5

3. a) Find out the reflection co-efficient (Γ), VSWR (S) and fraction of the incident power delivered to the load when a transmission line of z_0 = 50 Ω is terminated in z_L = (25 + j 25) Ω.

   b) Why we do impedance matching and tuning in a transmission line ?

   c) Discuss the working principle of a Time-domain Reflectometree (TDR). 6 + 4 + 4

4. a) Define EMI and EMC.

   b) What are the 3 basic ways to prevent EMI ?

   c) How can an EM energy transfer to an electronic sub-system resulting EMI. (2 + 2) + 3 + 7

5. a) Describe how ESD and lightning can cause EMI to different electronic sub-system.

   b) A 50Ω source is attached to a 50 Ω receiver with a 200 feet of R_G = 58 U co-axial cable which has a loss of 4·5 dB / 100 feet at 100 MHz. The source is tuned to 100 MHz and the meter indicates that
   output = – 30 dB-m.

   Determine the voltage at receiver i/p in dB μV.

   If the voltage at O/P terminal of the source is measured and found to be 30 mV, determine the voltage at the input to the receiver in dB-m. (4 + 4) + (3 + 3)

6. a) What are the different mitigation techniques to prevent EMI ?

   b) Describe the "Hybrid Ground Scheme".

   c) A conducting Schield of thickness t, conductivity σ, permitivity $\varepsilon = \varepsilon_0$ and permeability μ has an incident uniform plane wave on its left-most surface. The medium on either side of the schield is free space. Derive the schielding effectiveness (S.E.) of that schield using the exact solution method. 3 + 4 + 7

7. a) What is Antenna factor ?

   b) Describe how radiated emission of a product can be measured using an Anechoic chamber.

   c) An antenna measures the radiated emission at 220 MHz from a product. A 50 Ω receiver is connected with the antenna with a 200 feet cable which has a loss of 8 dB/100 feet at 220 MHz. The receiver measures a level of – 93·5 dBm at 220 MHz. If the product providing this emission is located at a distance of 20 metre and the antenna provides 1·5 volt for every volt/metre of incident electric field at 220 MHz, then determine whether it comply "CISPR class B" and "FCC class B" limits and by how much. 2 + 5 + 7

8. Write short notes on any *two* of the following : 2 × 7 = 14

   a) LISN

   b) Common-mode choke

   c) Quasi-Peak detector

   d) EMP.