Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(ECE)/SEM-3/MCE-302(A)/2011-12

2011

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.

Question No. **1** is compulsory and answer any *four* from the rest.

1. Briefly answer the following : 7 × 2

   a) Write the lossless and distortionless condition of a transmission line.

   b) What is electromagnetic compatibility ?

   c) How can you determine characteristic impedance of a transmission line ?

   d) What are the advances of coplanar transmission line compared to microstrip and slot lines ? Explain.

   e) Draw the electric and magnetic field distribution of a twin wire line, coaxial line and a microstrip line.

   f) What are FCC and CISPR ? Explain their role in EMC.

g) Calculate the maximum frequency of operation of a copper wire of radius 0·01 mm for which it is in *dc* region. Conductivity of copper = $5 \cdot 8 \times 10^7$ S/m.

2. a) Draw and explain the switch voltage-switch current characteristic of arcing at mechanical switch with fixed contact distance. Hence define breakdown voltage, glow voltage. 7 + 2

b) What is 'Showering Arc' ? Draw and explain the 'Showering Arc' characteristic of an inductive load. 1 + 4

3. a) Calculate the resistance per unit length of a circular conductor in terms of skin depth and frequency both for high frequency and low frequency approximations. 5

b) What is PCB board land ? What are the requirements of PCB board land for high frequency applications ? What are the effects of component leads in PCB board ? Hence draw the equivalent circuit of leads at high frequency.

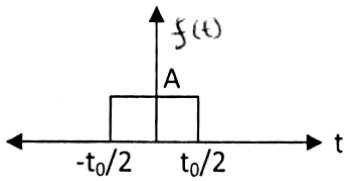
2 + 2 + 3 + 2

4. a) Draw the equivalent circuit of a physical parallel plate capacitor. Explain the source of each component. Hence draw the frequency response. Derive the expression of self resonance frequency. 1 + 2 + 2 + 2

b) What is LISN ? Draw and explain the LISN circuit for the measurement of conducted emission. Define unintentional receiver. 2 + 3 + 2

5. a) Derive the required condition of matching of a transmission line using quarter wave transformer. Derive the expression of bandwidth of a quarter-wave transformer. 2 + 4

   b) Find the Fourier Transform of the rectangular pulse. 4



   c) Find DTFT of $x(n) = a^n u(n) + b^n u(-n-1)$. 4

6. a) What are three ways to prevent interference ? Discuss radiated emissions, radiated susceptibility, conducted emissions and conducted susceptibility. 2 + 3

   b) Discuss the arrangements required for radiated emission measurement. 3

   c) Derive the expression of pure standing wave pattern. Plot the pure standing wave pattern with attenuation coefficient. Define class *A* and class *B* digital devices. 3 + 1 + 2

7. Write short notes on any *four* of the following : 4 × 3½

   a) Quasi TEM mode of microstrip transmission line

   b) Electrostatic discharge (ESD)

   c) Smith Chart

   d) TEMPEST

   e) Transmission line impedance

   f) Arc Suppression schemes.

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