M.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING
FIRST YEAR SECOND SEMESTER - 2024

EMI & EMC (MW)

Time: 3 hours | Full Marks:100

Answer any FIVE questions

1. a) Suggest some techniques to prevent EMI from a mobile phone. Discuss different ways of electromagnetic energy transfer with examples. [2+4]

   b) "FCC Conducted Emission Limits for Class A Digital Devices at 25 MHz is 73 dBμV (QP) and 60 dBμV (AV)" - Explain the reason behind these limits? What are QP and AV? [2+2]

   c) RG58U coaxial cable is specified as having 4.5 dB/100 ft loss at 100 MHz. A 50 Ω source is attached to a 150 Ω signal measurer with 300 ft of RG58U cable. The source is tuned to a frequency of 100 MHz, and the dial indicates an output of -25 dBm. Calculate the voltage at the input to the signal measurer in dBmV. [10]

2. a) For the 1-V, 10-MHz, 50% duty cycle trapezoidal waveform, determine the level at 10 MHz, 20 MHz and 130 MHz for the 20 ns rise/fall time. [6]

   b) A transmission line with 100 Ω characteristic impedance with length corresponds to a time delay of 1 ns is connected with a source and a load as shown in Figure 1. The generated voltage can be defined using a piece wise linear function PWL(0 0 0.001n 20 1.999n 20 2n 0) which means initial 0 V at 0 s attains to 20 V after 0.001 ns and remains at 20 V till 1.999 ns then come down to 0 V at 2 ns. The source is having a series resistance of 200 Ω and the load is a 500 Ω resistor. Plot output voltage across load vs time for 0 to 8 ns. [14]

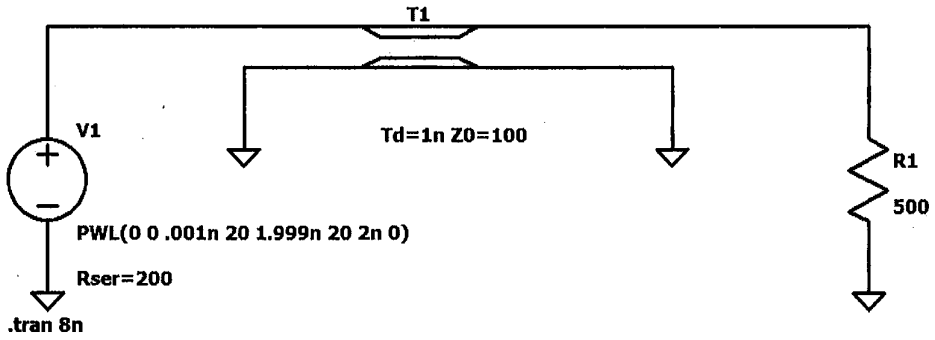

Figure 1

3. a) Discuss various important sub-circuits used in LISN. Draw the equivalent circuits of a LISN for even mode and odd mode currents. [4+6]

   b) What is the reason behind the arc during switching off an inductive load? Using circuit diagrams explain arc suppression techniques for inductive loads. [10]

4. a) What is shielding effectiveness? How will you relate shielding effectiveness with absorption loss and reflection loss? Deduce reflection loss at the interface between two media. [2+2+6]

   b) Explain the effects of a single aperture and linear aperture arrays on shielding effectiveness. With proper explanation write your opinion on leakage from a microwave oven with linear array of see-through-holes with 60 cm × 30 cm door area with 25 circular holes (radius = 0.8 mm) per square cm? The operating frequency of the microwave oven is 2.45 GHz. [10]

5. a) Write properties of an attenuator. Design a - 10 dB attenuator for 50 Ohm system. [6]

   b) What are uses of BALUN in EMC design? [4]

   c) What is antenna factor? A known, incident, linearly polarized, uniform plane wave is incident on an antenna and the electric field at the position of the antenna in the absence of the antenna is 62 dBμV/m. A 30 ft length of RG58U coaxial cable is used to connect the antenna to a 50 Ω spectrum analyzer. The spectrum analyzer measures 40 dBμV. The coaxial cable has 4.5 dB/100 ft loss at the frequency of the incident wave, 100 MHz. Calculate the antenna factor. [2+8]

6. a) Draw the equivalent circuit of a non ideal capacitor. Show the Bode plots of the impedance variation with frequency. Explain your plots. [10]

   b) A 1/8-W carbon resistor has the measured Bode plot of the impedance shown in Figure 2. Determine the lead inductance and parasitic capacitance. [10]

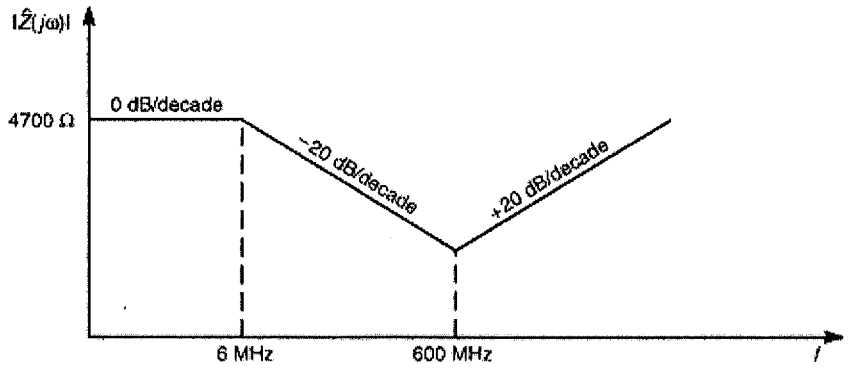

Figure 2

7. Write short notes on (Any two): [2x10]
   a) Matching Schemes for Signal Integrity
   b) High-Speed digital interconnects and signal integrity
   c) Human body model for ESD and its use