

**M.E. ELECTRONICS AND TELE-COMMUNICATION
ENGINEERING FIRST YEAR SECOND SEMESTER - 2019**

EMI & EMC (MW)

Time: 3 hours

Full Marks:100

Answer Question No. 1 and any FIVE questions from the rest.

1. a) What do you understand by "Electromagnetic compatibility (EMC)"? Discuss on the main aspects of EMC. Why ESD protection techniques are also studied to make system EMC compatible? How can ferrite beads be used in headsets to protect user from unwanted coupled RF signals from cell phones? [2+4+2+2]
- b) The FCC defines a digital device as: "Any unintentional radiator (device or system) that generates and uses timing pulses at a rate in excess of 9000 pulses (cycles) per second and uses digital techniques ..." - write your opinion in the context of EMC. [2]
- c) Electrocardiogram (ECG) signals are obtained by suppressing common mode currents mixed with bio-electric signals. Which common mode suppression technique is used in ECG amplifiers? [2]
- d) Using figure illustrate the use of a semi-anechoic chamber for the measurement of radiated emissions. What will happen if radiation emission is measured in an acoustic anechoic chamber? [4+2]
2. How can a device connected in the power distribution emits unwanted signals to disturb other devices connected in the same network? How will you measure this interference level using line impedance stabilization network (LISN). Draw and explain different sub-circuits of the line impedance stabilization network (LISN) circuit. [4+2+10]
3. a) Convert: i) 23 mV to dBm and dB μ V
ii) 30 W to dBm and dBW. [4]
- b) Determine a simple expression to convert (RMS) voltage in dB μ V to dBm for a 100 Ω system. [4]
- c) A 50 Ω receiver is attached to an antenna via 200m RG58U coaxial cable. The receiver indicates a level of -20 dBm at 200 MHz. Determine the voltage at the base of the antenna in dB μ V and in V if the cable loss at 200 MHz is 8 dB/100ft. [8]
4. a) Draw a periodic, trapezoidal pulse train representing clock and data signals of digital systems. Show that the key parameters that contribute to the high-frequency spectral content of the waveform are the rise and fall times of the pulse. [2+6]

b) A 10-MHz clock oscillator transitioning from 0 to 5 V with rise/fall times of 20 ns and a 50% duty cycle is connected to a gate as shown in Fig. 1 A filter is connected as shown. Determine the level of the 11th harmonic at the gate terminals. [8]

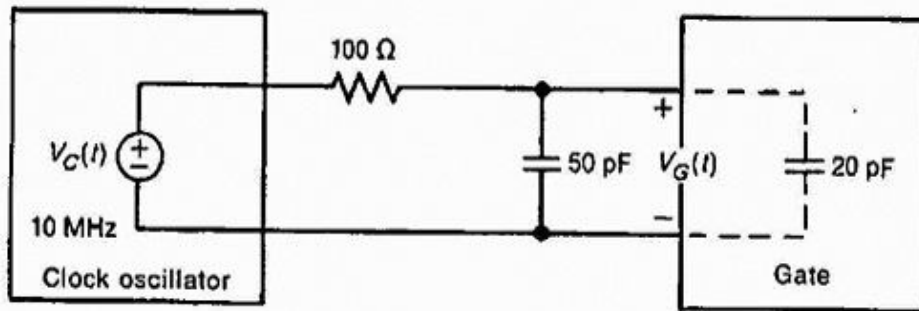


Fig.1

5. Draw the input voltage vs time and output voltage vs time plot for 0 to 20 μ s for the circuit shown in Fig.2. The source in the circuit can be represented by PWL function as shown in figure. Here the source is a trapezoidal pulse with delay = 0 and holds voltage sequence 0 V, 10 V, 10 V and 0V at 0 s, 0.1 μ s, 1.9 μ s and 2 μ s, respectively. The source and load resistances are 10 Ohm and 1k Ohm, respectively. T1 represents a transmission line with characteristic impedance of 50 Ohm and the path delay is 2 μ s. [16]

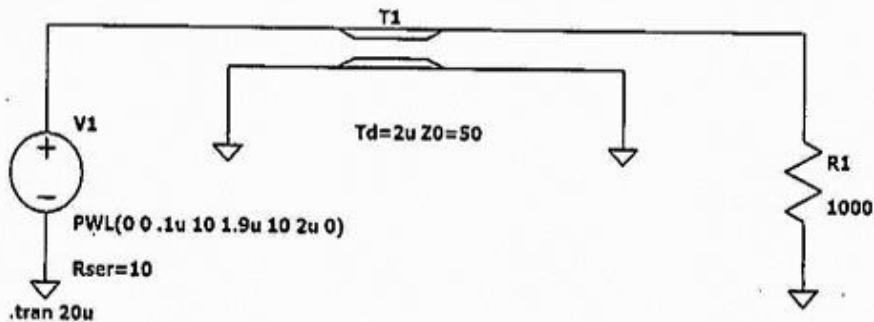


Fig.2

6. a) What is antenna factor? A 30 ft length of RG58U coaxial cable is used to connect an antenna to a 50- Ω spectrum analyser as shown in Fig. 3. The spectrum analyser measures 40 dB μ V when placed at 60 dB μ V/m electric field. The coaxial cable has 4.5 dB/100 ft loss at the frequency of the incident wave, 100 MHz. Calculate antenna factor. [2+6]

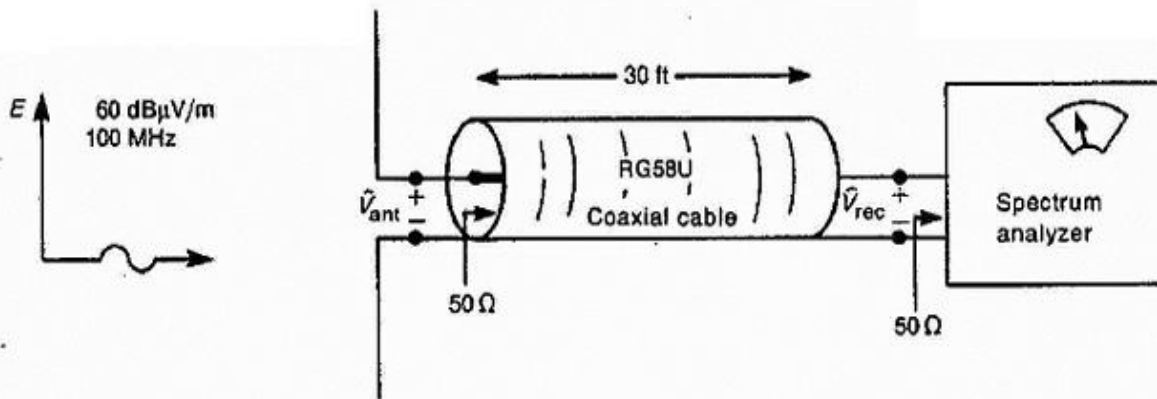


Fig. 3

- b) How BALUNS can be used to reduce common mode currents on antennas? [4]
- c) How will you design broadband antenna array for EMC measurement using narrow band antennas? [4]
7. 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. [1+1+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 $40 \text{ cm} \times 30 \text{ cm}$ door area with 9 circular holes (radius = 1 mm) per square cm? The operating frequency of the microwave oven is 2.45 GHz. [8]
8. Write short notes on (Any two) : [2x8]
- Grounding techniques and their performance comparison
 - Power supply filter
 - Common EMC mistakes and their prevention techniques
 - Arc suppression techniques