Ref. No.: Ex/ET/T/415C/2018

B.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING
FOURTH YEAR
FIRST SEMESTER EXAM 2018

PRINCIPLES OF EMC

Time: Three hours Full Marks:100

Answer **Q.1** and ***any four*** questions from the rest.

1. Answer ***any five*** from the following: [4x5=20]

   a) 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 regarding aforesaid definition.

   b) "FCC Conducted Emission Limits for Class A Digital Devices at 25 MHz is 73 dBμV (QP) and 60 dBμV (AV)." - explain.

   c) Using circuit diagram explain the use of power supply filter. What is the role of common-mode choke in the power supply filter?

   d) "Grounding is an important and often misunderstood aspect of noise and interference control." - explain using examples. What type of ground does not carry current during normal operation?

   e) Explain "specific absorption rate" and its use.

   f) Draw the schematic of a diagnostic tool that can separate the total conducted emission into its common- and differential-mode components at each frequency of the regulatory limit.

   g) Suggest some techniques to prevent EMI from a fluorescent light. With regard to EMI, discuss with example different ways of electromagnetic energy transfer.

2. a) Derive an expression to convert power in dBm to voltage (RMS) in dBmV for Z Ω load impedance. [5]

   c) A coaxial cable is specified as having 'Z' dB/100 ft loss at 100 MHz. A 'S' Ohm source is attached to a 'M' Ohm signal measurer with 'L' ft of that cable. The source is tuned to a frequency of 100 MHz, and the dial indicates an output of 'Y' dBm. Calculate the voltage at the input to the

signal measurer in dBμV. Repeat your calculations when a load of 'R' is connected at the end of cable in parallel with the measurer. Assume any other suitable parameter if you require. [7+8]

3. Explain conducted emission measurement techniques using diagrams. Using circuit diagrams discuss various important sub-circuits of line impedance stabilization network (LISN). Draw the equivalent circuit of LISN as seen by the product over the conducted emission regulatory frequency range. Illustrate the contributions of differential-mode and common-mode current components on the measured conducted emissions. [20]

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+8]

   b) For the 1-V, 10-MHz, 50% duty cycle trapezoidal waveform, determine the level at 110 MHz for the 20 ns rise/fall time and for the 10 ns rise/fall time. [10]

5. 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. [14]

   b) A product requires 20 dB of shielding at 200 MHz. It is planned to use 100 small round cooling holes (all the same size) arranged in a 10 by 10 array. What is the maximum diameter for one of the holes? [6]

6. Write short notes on (any two): [2x10=20]
   a) Grounding techniques and their performance comparison
   b) Common EMC mistakes and their prevention techniques
   c) Effects of EMI on human being and possible protections
   d) Power line filters