BE (ETC), 8th Semester, Final Examination, 2013

Bengal Engineering and Science University, Shibpur

Electromagnetic Interference and Electromagnetic Compatibility (ET 804/4)

Time: 3 hours **Full Marks: 70**

Answer any five questions

1. (a) How do electromagnetic emissions cause interference in electrical and electronic devices? Explain with suitable example. What is FCC regulation for electromagnetic emission for a digital device?

(b) Write down the FCC radiated emission limits for Class A and Class B digital devices. The radiated emissions from a product are measured at 50 MHz at 15 m away and are found to be 21mV/m. Does the product comply with the FCC Class B limit?

6+8=14

2. (a) What do you understand by electromagnetic compatibility (EMC) of a system? Define four basic EMC problems. Exp;ain the different aspects of EMC design with suitable example.

(b) What is conducted emission and explain noise current. State the principle of operation of' line impedance stabilization network (LISN)' and explain how conducted emission is measured. Write down the Conducted Emission Limits for Class A Digital Devices.

6+8=14

3. (a) What is the significance in determining electrical dimensions of an electric circuit or electromagnetic radiating structure? How do you calculate the electrical dimensions of a circuit or any electromagnetic structure? What do you understand by 'electrically small' structure and explain the characteristics?
(b) A radiating structure whose maximum dimension is 1.2 wavelengths and is operated at a frequency of 860 MHz. If this structure is immersed in a polyvinyl chloride (PVC) having dielectric 3.5. What would be its effective maximum dimension there in meter?

9+5=14

4. (a) Explain the dependence of the per-unit-length resistance and per-unit-length internal inductance of a wire on frequency (skin effect). Derive their mathematical expressions. Determine the resistance and internal inductance of a 2 in. length of 20-gauge solid copper wire at 200 MHz. Copper has conductivity of 5.8×10^7 S/m.
(b) What do you understand by land of a PCB and explain the skin effect of PCB land.

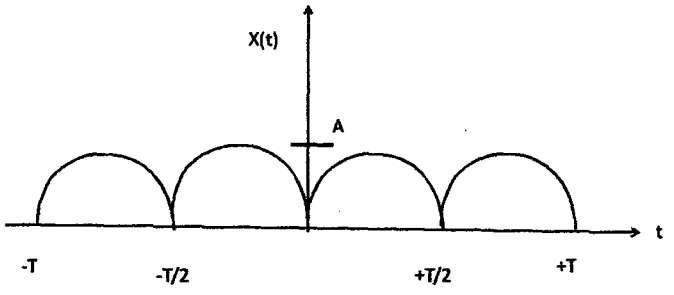
9+5=14

5. (a) What is the function of EMI Receiver and Spectrum Analyzer? Draw the simple electrical circuit for peak detector and quasi peak detector and explain their operations. Why quasi-peak

detection is important than peak detection in conduction emission measurement? What is an average level (AV) detector and how average level (AV) is measured.

(b) Determine the Fourier expansion (one-sided) for periodic signal of full-wave rectified sinusoid from a linear power supply (prior to filtering),

$X(t) = A \sin(2\pi t/T)$ for $0 \le t \le T/2$



9+5=14

6. (a)A Hertzian dipole has a length of 1 cm and carries a 1 A, 100 MHz current. Determine the magnitude and phase of the electric and magnetic fields at a distance of 1000 m away and broadside to the antenna ($\theta = 90^0$). Derive the formula you have used.

(b) Define radiation resistance and input resistance of the half-wave dipole.

9+5=14

7. (a)Explain the principle of operation of biconical antenna with a schematic diagram. Determine the half-angle of an infinite biconical antenna to give an input impedance of 50 V.

(b) Explain the effect of truncation of infinite cone. Which frequency range is used for radiation emission measurement by biconical antenna. Draw and explain its measurement setup.

7+7=14

8. Write short notes (any TWO) as follows:
   (a) Anechoic Chambers
   (b) Pyramidal microwave absorbers and Ferrite Tiles
   (c) Design of Log-periodic Antenna
   (d) Design of a microstrip lowpass filter

7 +7