

## ECE 4391 Electromagnetic Compatibility Quiz 1

June 13, 2001

Professor Leach

Name \_\_\_\_\_

**Instructions.** Print your name in the space above and at the top of all other pages in your quiz. Be brief with your answers. Draw simple diagrams that illustrate your answers. The quiz is closed notes and closed calculator. **Honor Code Statements:** *I have neither given nor received help on this quiz.* Initials \_\_\_\_\_

1. In using network theory to model electromagnetic noise coupling in circuits, what basic underlying assumption is made to justify its use?
2. At low frequencies, a shield around a conductor is used primarily to eliminate what type of noise coupling to the conductor?
3. Why is inductively coupled noise not a function of the load impedance of the circuit the noise is coupled into?
4. Under what conditions will a shield around a current carrying conductor prevent magnetic field radiation from the conductor?
5. For what reason is the chassis of electronic equipment connected to the ac power safety ground?
6. A single power supply ground reference for a circuit eliminates what noise coupling mechanism to the circuit?
7. Use an illustration to show how placing a high-gain amplifier into a metal shielded enclosure can cause feedback which makes the amplifier oscillate. What precautions can be taken to prevent the oscillations?
8. The guard shield on a guarded meter is supposed to be connected to a point in a circuit to prevent what type of noise coupling into the meter input?
9. When wires from a power supply are connected to a circuit, what are the two primary rules of decoupling the supply at the circuit?
10. Why does a balanced signal source connected to a differential amplifier provide noise cancellation compared to a single-ended or non-balanced source?
11. Give two reasons why a twisted pair of signal conductors is less susceptible to noise pickup.
12. A signal source is connected to the input of an amplifier with a shielded-twisted pair. Where should the cable shield be connected if
  - (a) the source is floating and one side of the amplifier input is grounded.
  - (b) one side of the source is grounded and both sides of the amplifier input are floating.
  - (c) one side of the source is grounded and one side of the amplifier input is grounded.

*Problems 13 and 14 are on the back of this page.*

13. A coaxial cable is used to connect a source with one side grounded to an amplifier input with one side of its input grounded. The cable shield is grounded on both sides. An external magnetic field fluxes through the ground loop formed by the cable shield which causes a shield current  $I_s$  to flow. Draw the equivalent circuit diagram and use a loop equation to show that a series voltage is induced in the center conductor of the cable which is equal to the shield current multiplied by the shield resistance  $R_s$ . Assume the mutual inductance  $M$  between the shield and the center conductor is equal to the shield self inductance  $L_s$ .
14. Briefly discuss the most important characteristics of the different types of capacitors. What limits the upper frequency limit? What can be done to increase the upper frequency limit?