

AuE893, ECE693/493: AUTOMOTIVE GROUNDING AND SHIELDING, Fall 2008
2:00-3:15 PM, Tuesday-Thursday

INSTRUCTOR: Prof. T. H. Hubing, Hubing@clemson.edu

OFFICES: 330 GCEC, 283-7218
310 Fluor Daniel Bldg., 656-7219

OFFICE HOURS: CGEC, 10 – 11 am, TTH
EIB, 10 – 11 am, MWF

OPTIONAL TEXT: Paul, C. R., Introduction to Electromagnetic Compatibility, 2nd ed., Wiley Interscience, ISBN-13: 978-0-471-75500-5, 2006.

REQUIRED CLASS NOTES: (Distributed electronically in pdf format via the Blackboard site)

COURSE OBJECTIVES:

1. To understand the fundamentals of electromagnetic compatibility, including noise coupling, radiated emissions, radiated susceptibility, electrostatic discharge and lightning.
2. To gain an ability to diagnose and solve noise problems in real circuit boards or electronic systems.
3. To be able to estimate resistance, capacitance and inductance parameters and reduce complex noise issues to basic circuit problems.
4. To be able to recognize the unintentional sources, coupling paths and antennas in a typical electronic system.
5. To be able to apply proper grounding, shielding and filtering techniques when appropriate to improve the electromagnetic compatibility (and/or reduce the cost) of electronic devices.

HOMEWORK

Homework is due approximately once each week. Students can work together on homework, but must turn in their own work. Homework assignments that are essentially copies of another student's assignment will not be accepted. Homework is due at the beginning of class. 10% will be deducted from homework that is turned in up to 24 hours late. 50% will be deducted from homework that is turned in between 1 day and 1 week late. At the end of the semester, all students scoring an average of 80% on their homework assignments will have their homework grade rounded up to 100%.

TESTS AND GRADING

Course Grades will be determined based on the following percentages:

Homework: 15% (at end of semester, homework averages >80% will be rounded up to 100%)
 3 Exams: 45%
 2 Labs: 10%
 Quizzes: 5%
 Final Exam: 25%

AuE 893 and ECE 693 students are required to turn in a project that will be defined in class. The project grade will replace the lowest exam grade (even if it is lower than the lowest exam grade). The project is optional for ECE 493 students.

TOPICS TO BE COVERED

	<u>Reading Assignment</u>
EMC Introduction, History	Introduction, dB_Notes
EMC Regulations, EMC Tests, Significant Figures, dB	
Non-Ideal Behavior of Components, Resistance	Resistance_Notes
Capacitance	Capacitance_Notes
Inductance	Inductance_Notes
Transmission Lines	Transmission_Line_Notes
Common Impedance Coupling	Common_Impedance_Coupling_Notes
Electric Field Coupling	Electric_Field_Coupling_Notes
Magnetic Field Coupling	Faraday's_Law_Notes, Magnetic_Field_Coupling_Notes
Crosstalk in Electrically Long Transmission Lines	Crosstalk_Notes
Frequency-Domain Representation of Time-Domain Signals	Time_Frequency_Notes
Tracing Current Paths	Current_Path_Notes
Radiation from Circuits, CM and DM currents	Radiation_Notes
Cables and Slots as Antennas	
Introduction to Shielding Theory	Shielding_Notes (Part_1)
Practical EMI Shielding	Shielding_Notes (Part_2)
Practical EMI Filtering	
Printed Circuit Boards as EMI Sources	PCB_Layout_Notes
Susceptibility Issues with Printed Circuit Boards	
Power Bus Decoupling	Power_Bus_Decoupling_Notes
PCB Design and Layout	Layout_Guidelines
Circuit and System Ground	
Conducted EMI Sources	Conducted_EMI_Notes
EMI/EMC Design Examples	
Electrostatic Discharge	Electrostatic_Discharge_Notes
Lightning	
Transient Protection	Transient_Protection_Notes
EMI Trouble Shooting	
Course Review	Sample_Final_Exam