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"You're Hired!" — The EE Apprentice

Real-World EE Class Project Emphasizes Technical and Project Management Skills

Dr. Rhonda Drayton, Associate Professor of Electrical and Computer Engineering at the University of Minnesota, has developed an interesting—and practical—class project for a RF/Microwave design course. The project mimics a common scenario of creating and selling a design to a client. Although set up as a consultant/client scenario, the lessons are easily translated to supplier/customer application engineering, as well as to internal development in a large company environment. Details of the project are included in the following Project Description distributed to the students:

University of Minnesota ECE Department EE5602 Project Description

Introduction: You are a member of the advanced design team in a small start-up company, Minnesota Active Devices. Your team has a chance to score a very lucrative contract for the company with a well-known provider of RF/microwave products, RFDevices. They have a number of wireless applications products, but are particularly interested in your company's excellent design of low noise and power amplifiers. Minnesota Active Devices has been asked to provide a prototype design model using discrete devices for a low-noise amplifier and a power amplifier. If selected, the best prototype designs will be fabricated and tested by the RFDevices for consideration as an IC design to incorporate into their current product line.

Deliverables: A hard and electronic copy of your report must be submitted no later than the final exam period for this course. RFDevices requires identification of the transistor vendor, lumped element vendors and substrate board supplier and manufacturer in the report, as well as a CD-ROM that contains all circuit design models, simulation results and plots as well as board layouts. It is assumed that you will use Agilent's Advanced Design System or Ansoft Designer Software.

Format for Deliverables: The report should be presented in three parts. The first is a commercial viability section which includes a brief description of the targeted applications, volume level, and competing vendors (include at least 5) with similar products of like specifications. The second is a technical description that includes the design objectives, AC and DC circuit design and models, the performance curves—i.e. gain, noise, VSWR, 1 dB compression point, IM products, discussion of design trade-offs, circuit layout and substrate requirements, as well as design size and dimensions. Since the discrete parts are built with tolerances, also include the impact of design tolerances in the matching network on overall performance. The third is a budget on the cost to manufacture the prototype design along with the cost of each of the necessary parts. Develop a cost/part approximation for this prototype scenario.

Reference materials: You can get started by looking at the Web sites of the following example vendors:

- Discrete component vendor: Murata
- Active circuit vendor: RFMD
- Active transistor components: Agilent [now Avago]
- Substrate: Rogers Corporation

Application Areas: We will be investigating designs for cellular phone applications in the 825-850 MHz range. The LNA designs should have approximately 20 dB with noise figures of 1.4 and the power amplifiers should have gains of about 30 dB with efficiencies of 40%.

Timeline:

[Note: This project was for the Fall semester]

- Monday, 11/21, submit in writing or e-mail by 5 pm your ranked preference for a power amplifier or LNA design.
- Submit a draft of the design you plan to implement by Monday 11/28 with part one justification described.
- Deliverables by final exam period, as noted above.

According to Dr. Drayton, "The students did wonderfully, and I was thoroughly impressed with their work. I think we all stretched in a good way with this assignment." Interested readers can contact her by e-mail at drayton@umn.edu, or by mail at Rhonda Franklin Drayton, Ph.D., Dept. of Electrical and Computer Engineering, University of Minnesota, 4-174 EE/CSci Building, 200 Union Street SE, Minneapolis, MN 55455. She has a Web site at: www.ece.umn.edu/faculty/drayton.html.