The Honors Program in Electrical Engineering at The University of Memphis

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Introduction

The Department of Electrical Engineering at The University of Memphis recently has instituted an Honors program in the junior and senior years. The program consists of Honors sections of two core courses in the curriculum, Electromagnetic Field Theory and Transform Methods in Network Analysis, and additional elective courses that are offered as separate Honors sections or taken on a contract basis. The Honors program culminates in an Honors research project and thesis, which is defended before a faculty committee. The emphasis in the Honors program is not on more advanced work or material, but upon a different pedagogical style that involves more discussion and active learning, consideration of larger issues in science and technology, has a larger project and design component, and allows the student to participate in exploratory research and analysis.

Requirements

Students are eligible for the honors program in electrical engineering if they maintain a GPA of 3.25 with junior or senior standing or have received approval of the departmental honors committee. Honors in electrical engineering requires 15 hours of upper division honors courses, of which 12 hours must be upper division electrical engineering courses and must include Honors Research Studies (ELEC 4998) and Honors Thesis (ELEC 4999). The Honors credits substitute for 15 of the 52 required upper division technical hours in our curriculum. Those students who complete the program and the regular B.S.E.E. requirements will be recognized at the commencement ceremony by having their degree conferred "With Honors in Electrical Engineering." Moreover, the student's diploma and record at The University of Memphis will reflect this accomplishment. The requirements are enumerated below:

1. Required Courses: 6 hours. Every Honors student in the department is required to successfully complete the two courses listed below.

   (a) ELEC 4998 (Honors Research Studies) In order to do scholarly work in engineering, at least a year is required to identify a topic, do background research, do experiments or research, and write a thesis. This course will immediately precede the ELEC 4999 (Honors Thesis). The student will work with his Honors Thesis advisor to identify and do background work on their topic. A formal write-up on background and preliminary work is required as a lead-in to the formal thesis.

   (b) ELEC 4999 (Honors Thesis) Under the direction of a faculty member, a student writes a thesis based upon background reading and experimental research on a topic in electrical engineering, and defends the thesis before a faculty committee. Approval of thesis topic and committee

by the departmental Honors Committee, and review by the University Honors Program is required,

2. Constrained Electives: (6 hours)

(a) Junior Year: (core) The junior year program is based on the regular and predictable offering of honors sections in two, selected core courses. These courses would be run as Honors sections, one each semester. The suggestion is that Honors students take at least one of these courses.

i. ELEC 3202 (Transform Methods in Network Analysis): In addition to catalog description, this course will additionally emphasize the fundamental importance of linear systems theory in science and engineering. A fuller treatment will be given of the mathematical theory and justification of linear methods for analysis of dynamic systems. More advanced topics, such as nonlinear systems, could be included.

ii. ELEC 3240 (Electromagnetic Field Theory I): In addition to the standard course material, field theory will be used to motivate a discussion of the logical unity of mathematics, physics, and engineering. Since Maxwell's equations are based upon observation, the course will explore the nature of the scientific method in which observation is given a mathematical form. Discussions will center on relationship among field theory, dynamic systems, and integral-differential calculus.

(b) Senior Year: Additional Honors credit is acquired in Honors sections of senior electives, Honors special topics classes, or by completing Honors contracts in regular sections.

i. ELEC 4XXX: (Senior EE Elective from an approved list). Engineers apply scientific and mathematical knowledge to real world problems. Therefore, the honors program includes a course which treats an advanced engineering application in detail. While the emphasis is on technical material, group projects, oral and written reports on background work for the project, and a discussion of the ethical and social responsibilities of engineers should also be incorporated. Honors credit given for honors sections and honors contract work in regular sections. Model courses for contracting must be designated. For each approved course, the instructor would produce a model contract for incorporation in program guidelines. Contracting requires faculty to do intensive work with one or more individuals.

ii. ELEC 49 lx (Honors Special Topics): Honors students would enroll in this course in order to take specialized or Graduate level courses, as approved by the departmental Honors Committee. This allows Honors students to participate in the graduate school experience without having to fulfill all the requirements for graduate school admission. A different section and title would be designated for each graduate course that is eligible.

Honor's Pedagogy

The pedagogical emphasis of the Honors program extends from the Honors sections and Honors contract work to the Honors Thesis and defense. The pedagogy is intended to promote independent, critical, and creative thinking about technology and engineering, and to provide skills to students that will allow them to do active learning throughout their careers. In class, this involves more discussion and group work than traditional lecture-based classes. More emphasis is placed on consideration of the engineering process, and the relationship of engineering to the broader disciplines of the natural sciences and mathematics.

Honors contracts enable students to obtain Honors credit in regular class sections. For Honors contract work, the student and instructor must commit to the principles of the Honors program. For contract work in a standard course, the student and professor work out the Honors component in advance, and execute a contract that explains their responsibilities. To fulfill the spirit of the Honors contract, the professor and student should meet on a regular basis to discuss the course material. If possible, Honors contracts should incorporate engineering design and projects, and group work.

The Honors program culminates in the Honors Thesis. The thesis work involves an in-depth investigation of a problem or area of electrical engineering. The student undertakes the work in close conjunction with a faculty advisor, and should, if possible, have a research component. An academic year is given for completion of the project and thesis, which should conform to accepted scholarly practice. The project involves library, analytical, and experimental investigation of the topic. The student will defend his thesis before a faculty committee.

A summary of an Honors section of Electromagnetic Field Theory is given as an example of the Honors pedagogy. The class began with a consideration and discussion of the problem solving process. Material was read and discussed in class, and then, applied to prerequisite material in vector algebra and calculus. During the semester, the instructor emphasized the synthesis of empirical results and mathematical theory in electromagnetic. The importance of differential calculus for physics and engineering was emphasized. The class discussed the limits of human understanding and the scientific method for comprehending the natural world. In class activities included group problem solving, student presentations at the board on class material and problems, readings and discussions from various sources, and discussion of the scientific method and engineering process. The instructor also spent a day reviewing recent statistics on the engineering job market, and discussed careers in engineering with the students. The students did a group design project to suspend a ping pong ball using electromagnetic methods. For an individual project, the students researched a prominent personality in science or mathematics, wrote a formal paper, and gave a formal presentation. Projects were done on Coulomb, Maxwell, and others. The projects and personalities were discussed in relation to the scientific method and as examples of engineering role models.

Conclusion

An Honors program has been established in The Department of Electrical Engineering at The University of Memphis. As of this writing, the program has 8 students actively engaged, with the first graduates with Honors expected in May 1997. The program is designed to produce independent and creative engineers, and to give the students a stimulating and enriching educational experience. The program culminates in an Honors Thesis, which has a large research component. The goal of the program is to prepare quality students for graduate school or careers in electrical engineering. The success of the program will ultimately be judged by the quality of the experience which our students receive. The emphasis of the program is on close contact between faculty and students, and active learning.

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