

GEORGIA TECH'S PULP AND PAPER ENGINEERING PROGRAM

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A program of technical electives in pulp and paper engineering was established in the fall of 1974 at Georgia Tech to help meet the need of the pulp and paper industry for engineers both well grounded in engineering fundamentals and also knowledgeable of the special problems of the pulp and paper industry.

The pulp and paper engineering (PPE) program, while centered in the Chemical Engineering School, is multidisciplinary in nature. Five technical electives in PPE have been approved for addition to the curriculum. Three of these are offered in the Chemical Engineering School and deal with the basic processes required for conversion of wood to pulp. The other two courses, a survey course and a course dealing with paper preparation and properties, is team taught by personnel from Ch.E. and Textile Engineering and is co-listed in both schools.

A committee composed of faculty from the Schools of Chemical, Textile, Mechanical, and Ceramic Engineering and the School of Architecture directs the program. An Industry Advisory Committee made up of pulp and paper industry leaders has been formed to help guide the development of the PPE Program.

Georgia Tech does not plan to develop a pulp and paper engineering degree program. The goal of the PPE Program is an engineer completely competent in the basic engineering fundamentals and who also possesses special training in pulp and paper engineering.

PULP AND PAPER MANUFACTURING is one of the major industries in the U.S. with manpower needs of up to 3000 new B.S. technical graduates each year. A large number of these B.S. graduates are employed in Georgia which is the

leading state in the production of paper products with 20 pulp and paper manufacturing plants.

A survey in 1970 by the Technical Association of the Pulp and Paper Industry (TAPPI) found that about 80% of the new B.S. graduates hired by the pulp and paper industry had no special training in pulp and paper engineering. Consequently, most pulp and paper manufacturers must devote the first 3 to 12 months of a new engineer's employment to on-the-job training in the basics of pulp and paper engineering. This often results in low productivity for an extended period of time for the company and a feeling of futility by the new engineer.

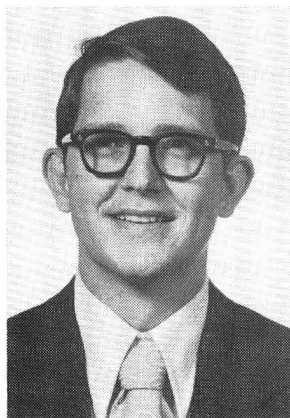
An interesting result revealed by the TAPPI survey was that many pulp and paper companies felt that graduates from pulp and paper degree programs who were trained in pulp and paper technology were lacking in engineering fundamentals. The pulp and paper industry, the survey showed, wanted engineers (usually Ch.E.) both well grounded in engineering fundamentals and also knowledgeable of the special problems of the

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pulp and paper industry. A program of technical electives in pulp and paper engineering was established in the fall of 1973 at Georgia Tech to help meet this industry need.

COURSES TAUGHT

THE PULP AND PAPER engineering (PPE) program, while centered in the Ch.E. school, is



George R. Lightsey earned a B.S. in ChE. from Mississippi State University in 1965 followed by a Ph.D. in ChE. in 1969 from Louisiana State University. Following a 21 month tour of duty in the U.S. Army, during which he was assigned to NASA—Lewis Research Center, Cleveland, Ohio, he was employed by Buckeye Cellulose Corp. in Memphis, Tenn. In Sept., 1973, he came to Georgia Tech as an assistant professor in ChE. He is currently chairman of the multi-disciplinary Pulp and Paper Engineering Committee.

multidisciplinary in nature so that students from any engineering discipline may participate. A committee is composed of faculty from the schools of Chemical, Textile, Mechanical, and Ceramic Engineering and the School of Architecture directs the program. Five technical electives in PPE have been approved for addition to the curriculum (Table I). The first of these, "Survey of Pulp and Paper Technology", is a course dealing with all aspects of pulp and paper manufacturing. It is team taught by personnel from Chemical and Textile Engineering and is co-listed in both schools. This course is designed for students who may not have a strong interest in pulp and paper, but want a general understanding of the industry. The first half of the course is taught by chemical engineering faculty and includes an introduction to the chemical and physical properties of wood. The major pulping and bleaching processes are also described. The second half of the course is taught by textile engineering faculty. The fundamentals of paper making are covered with emphasis on the physical and chemical methods of fiber modification. The operation of a paper machine is described. Methods for testing paper and uses of paper products completes the course. The text for this and all the PPE courses is *Handbook of Pulp and Paper Technology* by K. W. Britt.

Another course, "Pulp and Paper Processes I", describes in detail the operation of a modern kraft pulp mill. The course is offered in the chemical

engineering school with the mechanical engineering school providing guest lectures on forestry operations. The steps in the kraft process required to convert wood into pulp are covered. Also, the kraft chemical recovery process is outlined. A description of the common bleaching steps in a kraft mill completes the course. Since most pulp mills in the Southeast use the kraft process an entire course was devoted to a detailed description of it.

The third course in the series, "Pulp and Paper

TABLE I
Courses Taught in Pulp and Paper Engineering Program

COURSE	DESCRIPTION
Survey of Pulp and Paper Technology	A survey is made of the chemistry of pulp preparation, additives, and mechanical systems used in pulp and paper manufacturing.
Pulp and Paper Processes I	A study is made of the various processes in a Kraft pulp and paper mill necessary to convert raw material into pulp. The chemical and mechanical characteristics of Kraft pulping, bleaching, and chemical recovery processes are examined in detail.
Pulp and Paper Processes II	The major pulping processes other than Kraft pulping are examined to establish a general knowledge of the various factors affecting each pulping process. The unique advantages and disadvantages of each of the pulping processes is stressed.
Paper Formation and Properties	The processes involved in the fabrication of paper and paper products from pulp are examined. The effects on paper properties of Chemical and mechanical pretreatment of pulp are demonstrated in the laboratory.
Pulp and Paper Mill Emission Control	The methods available for control of gaseous, liquid, and solid wastes from pulp and paper mill operations are surveyed. Major biological, chemical, and physical methods for treatment of waste streams and in-plant changes to prevent waste generation and increase waste by-products utilization are described.

Processes II", includes the major pulping processes other than kraft. The properties of softwoods, hardwoods, non-wood fiber sources, and secondary fibers used in these processes are described. The sulfite, both acid and neutral, semi-chemical, and mechanical pulping processes are outlined. A brief description of some of the more important non-sulfur pulping processes such as oxygen pulping concludes the course.

Following the courses dealing with the pulping of wood, "Paper Formation and Properties", which describes the processes involved in the fabrication of paper and paper products, is offered. The steps in pretreatment of the pulp prior to the paper machine are explained. The functions of the various operations in a paper machine are then described. Considerable emphasis is placed on the mechanism for coating paper and the resulting paper properties. Testing of paper and the properties and uses of paper are also covered. Guest lectures are given by faculty from textile, ceramic engineering, and architecture in the areas of pulp additives, clay coatings, and uses of paper in structures respectively.

The last course in the series is "Pulp and Paper Mill Emission Control". Several courses in water and air pollution control are offered at Georgia Tech. However, pulp and paper mills have many unique pollution control problems. The course begins with a discussion of some of the regulatory and economic constraints that limit the options in control of emissions from pulp and paper mills. A guest lecturer from the federal or state EPA Office is asked to lead the discussion. All three types of emissions—gases, liquids, and solids—are considered. While methods of treating these wastes are described, emphasis is placed on process changes that reduce or eliminate the wastes.

STUDENT OPTIONS

THE PPE PROGRAM has been structured to meet the needs of three types of students (Figure 1). The students who only need a general knowledge of the pulp and paper industry are encouraged to take the survey course. Many textile engineering students have elected to take this option. For students whose main interest is environmental engineering we recommend the survey and the emission control courses. This option has appeal primarily to civil and mechanical engineering students.

The main thrust of our program is directed at

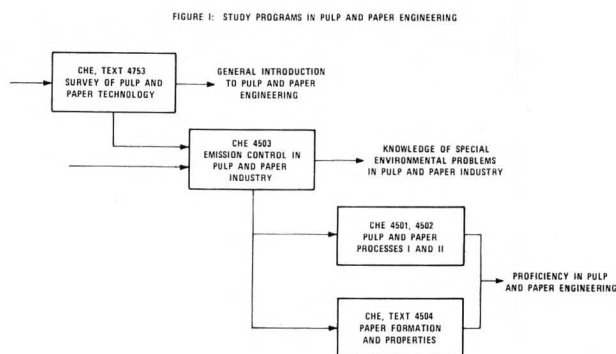


FIGURE 1. Study Programs in Pulp and Paper Engineering.

engineering students who wish to become proficient in all areas of pulp and paper engineering, with the goal being a career in the pulp and paper industry. For these students we suggest the four advanced PPE courses. If a student working toward an advanced degree (M.S. or Ph.D.) successfully completes the four advanced PPE courses and also completes an independent pulp and paper related research project, he or she is awarded a certificate of proficiency in pulp and paper engineering.

TEACHING AIDS

SEVERAL TEACHING AIDS are used in the PPE courses (Table II). The introduction of each PPE course usually consists of a brief history of the topic covered by the course and an

TABLE II
Teaching Aids used in Pulp and Paper Engineering Courses with Student Evaluation

Educational films	2.6
Guest lectures from industry, government, and Georgia Tech. Faculty.	2.2
Plant trips to pulp and paper mills	2.4
Term paper dealing with current industry problem	1.8
Laboratory demonstrations of pulping and paper making processes.	2.6
Use of visual aids such as samples of raw materials, intermediate and finished products, wastes, etc. and a scale model of a pulp and paper mill.	2.4

KEY:

- 3.0 significantly improved quality of course
- 2.0 moderately improved quality of course
- 1.0 no improvement in quality of course
- 0 detracted from quality of course

educational film dealing with the pulp and paper industry. Normally one or two guest lectures from experts in various areas of pulp and paper are included in each course. For example, in "Pulp and Paper Processes I", an M.E. professor lectures on forest operations and usually an industry expert on some phase of kraft pulping. A plant trip is also offered to students if sufficient interest is shown. A term paper dealing with a current problem in the pulp and paper industry is required in all PPE courses except the survey course.

Other teaching aids used to make the PPE courses interesting as well as educational are laboratory demonstrations of pulping and paper making processes and visual aids such as samples of raw materials, intermediate and finished products,

The PPE program is structured to meet the needs of three types of students: those needing a general knowledge of the industry; those wishing to apply environmental engineering to the industry; and those having a professional interest in the industry.

wastes etc., and a scale model of a pulp and paper mill.

At the conclusion of each of the three PPE courses that were first taught the students were asked to complete a questionnaire evaluating the courses as a whole and the effectiveness of the teaching aids discussed above. Table II shows the student's evaluation of the teaching aids used in the PPE courses. The use of educational films, laboratory demonstrations, and visual aids received the most favorable student response. The students were slightly less favorably impressed with the guest lectures. The lower rating of the guest lectures resulted primarily from the low scores given one guest lecturer who misunderstood the topic on which he was to speak. The lowest student rating was given to the term paper requirement. Despite the relatively unfavorable student reaction, the term paper requirement will remain. It should be noted that three students, two Ch.E. and one M.E., have used the ideas generated during preparation of their term papers as the basis for graduate research.

INDUSTRY ADVISORY COMMITTEE

TO HELP EVALUATE and strengthen Georgia Tech's Pulp and Paper Engineering Program, an Industry Advisory Committee composed of in-

dustry leaders has been formed. The initial meeting of the advisory committee and Georgia Tech faculty was held at Georgia Tech in September, 1974. Many useful suggestions were made by the advisory committee which have resulted in improvements to the PPE program. Perhaps the most important development to come out of the meeting was the decision to limit the PPE program to a series of technical electives to supplement the traditional engineering training given in the various engineering schools rather than attempt to develop a formal degree program.

Other recommendations of the industry advisory included:

- Equipment for a small pulp and paper laboratory for instructional and research needs should be obtained. However, no formal PPE laboratory courses should be in-

cluded in the PPE program.

- "Real-life" problems of the pulp and paper industry should be given the students in the PPE courses for term papers, special problems, etc. These problems would be supplied by industry (no shortages anticipated).
- A continuing education program, developed in cooperation with TAPPI and other groups serving the pulp and paper industry, should be developed.

CONCLUSIONS

The pulp and paper engineering program at Georgia Tech is and will continue to be flexible. Modifications of the program will be made as needed to fit the changing needs of our students and of the pulp and paper industry. The one constant in our program is the goal of an engineer completely competent in the basic engineering fundamentals who also possesses special training in pulp and paper engineering. □

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