Self-Study Report
For Fiber Engineering

A. Background Information

1. Degree Title

The title of the degree is Bachelor of Fiber Engineering\(^1\), abbreviated B. Fiber Engineering

2. Program Mode

The Bachelor of Fiber Engineering is offered full-time during the day at the Auburn University campus in Auburn, AL. Students can choose to participate in the cooperative education program.

3. Actions to Correct Previous Shortcomings

There were no reported shortcomings in the 1998-99 ABET Visit Final Statement for Textile Engineering. There were two concerns expressed during the visit in the fall of 1998. The first concern was that some student advisement responsibilities had been assigned to faculty members who do not have engineering backgrounds or experience. The second concern was regarding the difference between the published curriculum and that defined in the self-study. Both concerns were corrected and verified before the end of the visit.

4. Contact Information

Department Head  ABET Coordinator  ABET Associate Coordinator
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These faculty have been meeting regularly and as needed to prepare for the ABET visit. On 23 January 2004, Drs. Schwartz and Adanur attended a meeting with Dr. Ray Moore of the University of Nebraska-Omaha. The meeting in the Ramsay Hall Conference Room was organized by the Samuel Ginn College of Engineering for ABET preparation.

B. Accreditation Summary

1. Students

The Department of Textile Engineering maintains a full-time Academic Coordinator. Upon admission to the University, all entering freshmen attend an orientation session known as “Camp War Eagle.” Camp

\(^{1}\) “Bachelor of Textile Engineering” prior to Fall Term 2003.
War Eagle is “Auburn’s orientation experience, and is the introduction to the campus for many incoming freshmen.” At this orientation, the Department’s academic coordinator meets with pre-fiber engineering freshman to plan their schedule for the first semester to ensure they are enrolled in the proper courses required by the Department, College, and University. At the beginning of the first term in residence, each freshman is assigned an academic advisor from among the professorial faculty with engineering background/experience. During their academic careers, students are expected to meet regularly with the faculty to plan their programs of study and discuss educational goals; the signature of the faculty advisor is required for course registration. At the end of each semester, the Academic Coordinator monitors the performance of all students and, if a student had unsatisfactory performance arranges a meeting with the student to determine the cause and to propose remedies. Prior to a student’s last term, the Academic Coordinator performs a preliminary check of credits to be sure that the student will meet all of the requirements for graduation, although final determination of completion of the course of study is the responsibility of the College and the Registrar’s Office.

The Department of Textile Engineering receives transfer students through the Samuel Ginn College of Engineering. Transfer students must meet university admissions standards for acceptance as outlined on pages 9 and 57 of the Auburn University Bulletin, including 2.5 cumulative GPA on all college work. After acceptance by Auburn University, the transfer advisor in the College of Engineering evaluates the college transcripts of the transfer student and determines placement into either pre-fiber engineering or fiber engineering if all pre-engineering requirements have been met. This procedure is outlined on page 57 of the University Bulletin. After acceptance by the University and College of Engineering, the student is referred to the Department of Textile Engineering for registration advising in Student Online System (SOS), the university orientation for transfer students. For evidence that the process works, we have the Online Auburn Student Information System (OASIS), student folders, and senior credit checks conducted by College of Engineering advisors to clear seniors for graduation.

Credit for courses taken elsewhere must be granted by the Registrar's Office. After course credit is posted to the student's transcript, the College of Engineering advisors accept courses for credit based on course descriptions, time and content as noted on page 57 of the University Bulletin. If they have any questions about the equivalency of a course, they may require the student to furnish a course description or syllabus. For questions about fiber engineering major or elective credit, College of Engineering advisors contact the department for clarification. Auburn engineering students who take summer courses elsewhere must obtain approval from the College of Engineering and the Registrar's Office before taking the course. All engineering students are cleared for graduation by an advisor in the College of Engineering, not at the department level. Any courses that are substituted for a major course or are taken to satisfy technical elective credit are approved in writing by the department head.

2. Program Educational Objectives

As part of the University’s transition from quarters to semesters in AY 2000-2001, the entire curriculum in textile engineering was studied and revised in order to meet the requirements of that transition and ABET. All of the courses offered by the Department of Textile Engineering were scrutinized and revised by the faculty in order to be consistent with the University’s mission and accreditation criteria.

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Auburn University’s mission is defined by its land-grant traditions of service and access. The University will serve the citizens of the State through its instructional, research, and outreach programs and prepare Alabamians to respond successfully to the challenges of a global economy. The University will provide both traditional and non-traditional students broad access to the institution’s educational resources. In the delivery of educational programs on campus and beyond, the University will draw heavily upon the new instructional and outreach technologies available in the emerging information age.

The University will give highest priority for resource allocation to undergraduate education and for future development of those areas that represent the traditional strengths, quality, reputation, and uniqueness of the institution and that continue to effectively respond to the needs of students and other constituents. Consistent with this commitment, the University will emphasize high quality undergraduate education including a comprehensive general education that imparts the broad knowledge, skills, and values so essential to educated and responsible citizens as well as specialized career preparation for students. In establishing the primacy of undergraduate education to the institutional mission, the University will assure the continued strength of its faculty with the realization that the quality of instruction is directly related to the quality of the University’s faculty and the commitment of the faculty to excellence in undergraduate education. The University will provide graduate programs in areas of need and importance to the State and beyond. Graduate programs offer students opportunities for specialized advanced education in their chosen field and are important components of the services the University provides.3

The mission of the College is included in Appendix II, Self-Study Questionnaire for Review of Engineering Programs.

The mission of the Department of Textile Engineering is to be “actively involved in teaching, research and outreach, serving industries that make or use fibrous materials and polymers such as the textile, aerospace, transportation, and medical sectors. We provide a visionary, state-of-the art environment to prepare highly qualified graduates who are well-versed in the current technologies and are the independent thinkers who will be leaders of the future.”4

In order to assure that the highest quality education in fiber engineering is available to undergraduates, and in keeping with its mission, the following four program objectives have been identified by the Department:

1. Graduates will be able to analyze structure-property relationships in all forms of fibers and fibrous assemblies—fibers, yarns, conventional and non-conventional fabrics, and composite materials—and understand how these properties are affected by manufacturing methods.

2. Graduates will have the necessary foundation in mathematics, the physical sciences, and engineering to pursue advanced degrees in fibers, polymers, and related disciplines.

3. Graduates will take away from their courses, research projects, and general studies the required skills for problem solving, critical thinking, and communication that will make them successful in their chosen careers.

4. Graduates will have acquired the skills necessary to learn throughout their careers.

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3 *Auburn University Bulletin*, 99, p. 5.
These objectives are constantly being evaluated in light of the constituencies for the fiber engineering program—students, alumni, current employers of our graduates, potential employers of our graduates, and graduate programs that attract our graduates.

Courses in the major are designed to meet the first objective by exposing the students to textile manufacturing processes, the chemistry of fibrous materials, dyes, and finishes, and the mechanics of fibrous assemblies, composites and industrial textiles. To the best of its ability the Department tries to maintain state-of-the-art equipment and computers for use by the students. The faculty, all experts in their respective fields, constantly evaluate their courses to bring in the most up-to-date theories and processes. The Department also constantly monitors its curriculum, taking into account the opinions of its various constituencies. As the American industry continues its, sometimes painful, transition in the United States, the faculty have been modifying their courses to reflect these changes. The change of the name of the major from textile engineering to fiber engineering is reflective of the Department’s efforts to meet its objectives.

While the foundation in engineering and mathematics required in the curriculum is immediately relevant at the undergraduate level, it also has long-term relevance for students pursuing graduate degrees and for life-long learning. A number of graduates of the Department have entered graduate programs in areas such as materials engineering and science, fiber and polymer science, business, and industrial engineering.

Problem solving and critical thinking are emphasized in all courses in the Department. Many have laboratory sections that require the students to work in groups, conduct experiments, analyze data, and prepare written and oral reports. These are skills that are necessary for the success of our graduate throughout the remainder of their professional careers.

The Department maintains two advisory panels. The Alabama Textile Education Foundation (ATEF) consists of twenty-five representatives from various sectors of the textile and related industries. The ATEF meets twice a year to review the status of the Department and to award scholarship funds. The Department Head submits a report to the ATEF every six months. Draft copies of this self-study have been distributed to the ATEF for comment. Two years ago, the Department instituted a Futures Committee consisting of three faculty members, three students, one each from fiber engineering, textile management and technology, and textile chemistry, and three industrial representatives. The charge of the Futures Committee was “…to discuss and recommend to the Department Head and Faculty a vision of how the Department should proceed with its mission over the next decade in order to maintain its relevance.” Two recent changes arising from these committees are the renaming of the textile engineering degree to fiber engineering and the addition of an undergraduate mechanics of materials course to the fiber engineering curriculum. Ongoing is the addition of several polymer courses to the program leading to the development of a polymer engineering option. In 2002, the Department Head applied for a National Science Foundation (NSF) grant to revise the curriculum.

The Department conducts biennial surveys of companies who have hired fiber engineering students to determine whether the needs of this constituency are being met. The results of the most recent survey, conducted during the summer of 2003, are included in Appendix I-D.

Exit interviews are conducted with graduating seniors in order to determine their experiences, both positive and negative, throughout their time in the Department. The development of elective courses in biomedical applications of fibrous materials and one in ballistic protection materials was a need that resulted from these interviews.
Informed discussions are held with visiting graduates. As an example, the departmental ABET committee met with our graduate Mr. Andy Short during his visit on February 24, 2003 to get feedback and suggestions for the program. He suggested to have more statistics and design of experiments as well as the mechanics of materials course to be required. These recommendations were consistent with our experience and therefore they have been implemented.

Drafts of this document were made available to faculty, students, and our industrial board, and their comments were incorporated into the final self-study report.

3. Program Outcomes and Assessment

The outcomes for the fiber engineering program are designed to meet the requirements of Criterion 3, Program Outcomes, and in light of the constituencies of the program. These outcomes are:

1. Graduates will exhibit proficiency in the development design, and presentation of independent research projects. (3a, b, c, e, g, k)

2. Graduates will find ready employment in industry or be enrolled in graduate programs. (3a, e, f, g)

3. Graduates will be expected to provide technical support and leadership to the fiber, textile, and allied industries. (3d, f, h, i, j)

4. Graduates will have acquired the skills necessary to learn throughout their careers. (3i)

Specifically addressing each point in Criterion 3:

a. An ability to apply knowledge of mathematics, science and engineering

Fiber engineering is an applied field and courses in the major require mastery of engineering, science, and mathematical principles for the student to be successful. From the introductory engineering class, where a group-oriented design project is an integral part, through the final senior, independent design project, the fundamentals of science, mathematics, and engineering are stressed.

b. An ability to design and conduct experiments, as well as analyze and interpret data

In the introductory engineering course, yarn and fabric mechanics, textile testing, composite materials, and final design project, there is an emphasis on experiments and experimental design and with these, the analysis of experimental data and interpretation of their meaning.

c. An ability to design a system, component, or process to meet desired needs

The structure and performance of fibers and fibrous materials to meet specific applications is stressed at every level. Courses in biomedical applications, industrial fabrics, and composite materials give a background in designing for needs. Processes used to determine structure and design are key elements in yarn manufacturing, fabric formation, and composites design.
d. **An ability to function on multi-disciplinary teams**

Fiber engineering is inherently multi-disciplinary requiring knowledge of materials, mechanics, and machinery. In the introductory course, students from all engineering disciplines work in teams to achieve the final product. The importance of multi-disciplinary teams to produce fibrous products is reinforced in all engineering design courses. For FBEN 4910, 4920 Fiber Engineering Design I, II, the Senior Project Report form (Appendix I-F) is used to assess the performance of the team works.

e. **An ability to identify, formulate, and solve engineering problems**

All of the process courses in the program require students to design and develop products using the appropriate technology. In the testing course, students are expected to identify appropriate test methods and procedures to measure the property of interest. The final project requires the student to identify a practical problem and come up with an engineering analysis and solution.

f. **An understanding of professional and ethical responsibility**

All students are required to take at least one course in ethics, *i.e.*, PHIL 1040. Students are strongly encouraged to become active in professional societies and fraternities—*e.g.*, American Association of Textile Chemists and Colorists, Phi Psi, American Society of Mechanical Engineers—that have an active component dedicated to professional standards and ethics. In addition, professional and academic behavior is strongly reinforced in classroom work and assigned projects.

g. **An ability to communicate effectively**

Effective communications are stressed in all university courses. Laboratory exercises require cogently written laboratory reports while courses with group and individual design projects (ENGR 1110, FBEN 3300, FBEN 3400, FBEN 4920), require final oral presentations.

h. **A broad education necessary to understand the impact of engineering solutions in a global and societal context**

Auburn University requires a University Core Curriculum of forty-one credits, approximately one-third of the student’s academic program that “…seeks to assure that all graduates of Auburn University possess an educated appreciation of the natural world, of human life, and of the interaction between them, especially through technology.” In 2003, the Department developed an exchange program with Reutlingen University in Germany. One fiber engineering student is attending classes there during Spring 2004, and two Reutlingen University students will attend classes at Auburn during Fall 2004.

i. **A recognition of the need for, and ability to engage in life-long learning**

Throughout their courses in fiber engineering students come in contact with the dynamic nature of the field and are made aware that what they are currently learning will most probably be different than what they will encounter several years hence. The importance of keeping abreast with new developments is reinforced using field trips and trips to local trade and machinery shows.

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j. A knowledge of contemporary issues

Students are made aware of contemporary issues in their classes, from their membership in professional societies, and by the availability of trade and profession publications such as *Textile World*, *Southern Textile News*, *Chemical and Engineering News*, *Mechanical Engineering*, *Materials Today*, and *Textile Chemist and Colorist*. These publications are available for their perusal in the Department’s Learning Resource Center.

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

To the best of its ability the Department tries to maintain state-of-the-art equipment and computers for use by the students. The Department, in July 2002 and January 2003, purchased 5 and 11 new computers, respectively, in the Learning Resource Center and, through donations from industrial friends, such as Acordis Fibers, Sultex, and the Institute for Textile Technology, has updated yarn and fabric processing equipment. The Freshman Computer Initiative (FCI), required of all FBEN students, includes the following software:

- Disc 1 Engineering CD: PKZIP, WinZip, Acrobat, Cygwin, JDK, JDK Docs, jGRASP, GS/GSview, SecureCRT, SecureFTP, PSPICE
- Disc 2: Netscape
- Disc 3: Matlab Suite: Matlab, SIMULINK, Symbolic Math
- Disc 4: Solid Edge Origin: Origin

The assessment of each of these outcomes and the criteria for success are at the following levels:

1. Faculty: A 2-member faculty panel (not including the faculty member directing the independent research project) each submit an independent ranking (Appendix I-F) of the student’s oral and written senior design presentations on a scale of 1 (unsatisfactory) to 5 (outstanding). The average of score for the success criteria on both the oral and written presentations shall be 4 with no individual presentation receiving a rank lower than 3.

2. Students/Graduates: The Academic coordinator collects placement data from all seniors prior to graduation, with a follow-up after six months. At this time, 90% of all students are either employed in a professional job or enrolled in a graduate program.

3. Industry: Companies that have hired our students are surveyed biennially (see Appendix I-D) and asked to rank our graduates’ technical and leadership abilities on a scale from 1 (unsatisfactory) to 5 (excellent). The average rank in each category is 4 with no individual ranking below 3.

In Table 1 are presented the results of the rankings for independent research projects for the years 2001-2003—faculty ranking was begun in spring 2001.
Table 1. Independent Rankings of Research Project Presentations (P) and Written Reports (R) for Academic Years 2001-2003.

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The success criteria were not completely met and beginning in Fall Term 2003, regular meetings of students engaged in independent research were held to ensure that the timetable, as outlined in the preparation guide, is followed. Faculty would be encouraged to require more formal presentations in the classes prior to senior design class to improve quality.

From Fall Term 2000 through Spring Term 2003, the department has graduated 21 engineers. Of these, 14 are professionally employed and 4 are in graduate programs giving a success rate of 82%. Figure 1 provides an employment breakdown by year.

![Figure 1. Placement of FE Graduates 2000-2003](image)

In Table 2 are presented the responses for each of the questions in the survey of employers described earlier.

The response rate of the survey was 50%. In the survey, a range of 1 (unsatisfactory) to 5 (excellent) was used to evaluate the performance of our graduates. There is no program outcome that has an average of less than 3 (good), the minimum being 3.57, which is outcome ‘h’. The reason for this score may be the locality/regionality of our students. It is expected that the exchange program with Reutlingen University in Germany will help to improve our standing in this category. Similarly, there is no company that rated the average performance of our FE graduates less than 3. Two companies gave the highest score of 5 (excellent) for each category. The average of all questions for all respondents was 3.9610 – a score essentially ‘very good’.
Table 2 Industry survey results.

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Company average 3.18 3.91 3.91 3.36 4.45 3.64 5.00 3.00 3.73 5.00 3.36 3.91 4.00 5.00 3.87

Two recent changes have been made to the program based on the data obtained from the measures of outcome. These changes are:

- From looking at our curriculum and who employs our students and the graduate programs they enter, it was determined that the degree name “textile engineering” was too narrow a delimiter. Thus, permission was granted beginning with Fall 2003 to change the name of the degree to “fiber engineering” to more accurately reflect the curriculum and the industries served by the program.

- In many traditional textile engineering programs, machine design and mechanisms are stressed. However, reflecting changes in the field, fiber engineering students are more materials oriented, as can be seen in the research projects they choose. To this end, the requirement of an engineering core course in dynamics was replaced with one in mechanics of materials.

In addition, some notable achievements of fiber engineering students include:

- In 1999, Daniel Butts; currently a PhD candidate in materials engineering, was named Outstanding Student by the Association of Textile Industrial Engineers; Paula Bates was given this award in 2001.
- In 2000 Hillard Smithers received a NASA Space Grant Fellowship.
- L. Collins Dukes was awarded a scholarship by the Industrial Fabrics Foundation for 2003-2004.
- Jamie Wood was selected for Who’s Who among Students in American Colleges and Universities for 2003-2004.
- Katie Hudson was awarded the 2004-05 Luther B. Arnold Scholarship from the American Association of Textile Chemists and Colorists.

The following materials will be available for review:
• Original responses from the survey of companies hiring our graduate students,
• Senior project reports,
• Videotapes of presentations,
• Faculty evaluations of projects,
• Examples of completed projects,
• Summary of industrial/graduate student placements,
• Faculty and student handbooks,
• Course materials including, syllabi, homework assignments, and examinations,
• Records of exit interviews with graduating seniors.

We are in the process of preparing a form to solicit feedback from other departments on the campus to assess our students’ strengths and weaknesses as an internal, more direct assessment tool.

4. Professional Component

The fiber engineering curriculum is composed of three approximately equal components to prepare students both as engineering professionals as well as citizens of the world. Approximately one-third of the curriculum is devoted to the core. The core courses provide the liberal education component that ensures that engineering graduates are equipped with a fundamental knowledge of the impact of their profession from a national and global humanistic perspective. The Core Curriculum consists of courses devoted to English composition, technology and civilization, business ethics, the Great Books, fine arts, and the social sciences.

A second third of the curriculum is comprised of the fundamental courses in mathematics, the physical sciences, and engineering that are the foundation of an engineering education. In the sciences and mathematics, these courses include two semesters of chemistry, two semesters of physics, three semesters of calculus, one linear algebra, one linear differential equations, and a course in statistics. The core engineering courses required of fiber engineering students are introduction to engineering, statics, mechanics of materials, thermodynamics, heat and fluids, fundamentals of electrical engineering, introduction to computers, and engineering economics. These courses are part of the curriculum to ensure that fiber engineering graduates have a sound foundation in basic engineering and mathematics which they can use in the remainder of their coursework as well as to continue learning throughout their careers.

The third component of the fiber engineering program contains those courses that provide the student with the expertise in the field. The emphasis of courses in the fiber engineering program is the science of fibers and fibrous materials. These are fiber-to-yarn engineering, fabric design and engineering, textile testing and instrumentation, structure and properties of fibers, introduction to dyeing and finishing, mechanics of flexible structures, textile reinforced materials, engineered textile structures, fabrics for papermaking, and a six-credit, independent design problem. (Course syllabi are included in Appendix I-B.) In addition, students are encouraged to take elective courses in fields such as mechanical engineering, materials science, and chemical engineering.

Fiber to yarn engineering and fabric design engineering provide the necessary background in the manufacture of fibrous assemblies from fibers. The former course covers the mechanisms of yarn formation and the engineering properties of yarn as a function of the method of manufacture. The latter covers the manipulation of yarns by weaving, knitting, and braiding to form two- and three-dimensional fabric structures.
Textile testing and instrumentation is concerned with the techniques used to measure the engineering properties of fibrous materials. It encompasses mechanical, physical, and chemical analyses as well as the engineering principles associated with each testing apparatus.

Structure and properties of fibers concentrates on the manufacture and chemical structure of man-made fibers. It covers how structure and morphology affect the engineering properties of the principal manufactured fibers.

One of the principal methods of modification of textiles and fibers is through dyeing and finishing. Different techniques used to modify physical, chemical and optical properties are of importance to designing textile materials.

Mechanics of flexible structures and textile reinforced materials provide the necessary background into the engineering mechanics of fibrous assemblies and products composed of fibrous assemblies, such as composite materials. These courses include analysis, design methodology, and applications of fibrous assemblies.

In order to provide the student with examples of highly engineered, complex fibrous assemblies, courses on engineered textile structures and papermaking fabrics are included.

A two-semester, independent design project allows the student to bring together and focus his/her knowledge on a specific design problem. The first semester is taken up with the problem definition, background research, and theoretical underpinnings, while the second semester is devoted to experimental procedures, data collection and analysis, and preparation of the final report. Students are expected to give a formal oral presentation of their work as well as submit a comprehensive written report. This provides the capstone to their undergraduate engineering experience. Examples of design projects include medical stent design and development, composite part design and development (golf club shafts, tennis rackets…), manufacturing of woven fabrics with fiberoptics, etc.

5. Faculty

The faculty of the Department of Textile Engineering consists of eight professorial (tenure-track) faculty and one research faculty; all hold the Ph.D. The breakdown by rank is as follows:

- Full professor – 4
- Associate professor – 3
- Assistant professor – 1
- Research assistant professor – 1

These faculty members are both nationally and internationally recognized by their peers for their expertise in the mechanics of fibers and flexible assemblies, the chemistry of dyeing and finishing, quality control and assurance, yarn and fabric formation, the manufacture and mechanics of composite materials, biomedical textiles, and papermaking fabrics. This makes them well-qualified to cover the material in the curriculum.

The faculty are diverse both in sex and ethnicity. Five faculty (56%) are native to countries other than the United States, two are female (22%), and one African-American (11%). They have wide and diverse backgrounds; in addition to terminal degrees in fiber and polymer science, chemistry, agricultural chemistry, and mechanical engineering, they have undergraduate and/or graduate degrees in mechanical
engineering, civil engineering, textile engineering, textiles, materials engineering, engineering mechanics, chemistry, wood and paper science, pulp and paper technology, and mathematics. This multi-disciplinary richness is brought to bear in the classes that they teach.

Individual faculty areas of expertise are:

- **Prof. Adanur**: industrial textiles, fabric engineering, machine design.
- **Prof. Broughton**: nonwovens engineering, fiber extrusion, microscopy
- **Prof. Buschle-Diller**: dyeing and finishing, polymer chemistry
- **Prof. ElMogahzy**: quality engineering, yarn engineering
- **Prof. Gowayed**: mechanics of flexible structures, composites
- **Prof. Hady**: machine design, composites
- **Prof. McClain**: polymer chemistry
- **Prof. Schwartz**: mechanics of flexible structures, composites
- **Prof. Thomas**: protective materials, fabric engineering, manufacturing engineering

Curriculum Vitae for all faculty are included in Appendix I-C

Faculty in the Department of Textile Engineering are active in professional societies such as the Fiber Society, American Society of Mechanical Engineers (ASME), Materials Research Society (MRS), American Chemical Society (ACS), Textile Institute, National Organization of Black Chemists and Chemical Engineers (NOBCCHE), American Society for Quality Control (ASQC), American Association of Textile Chemists and Colorists (AATCC), and American Society for Engineering Education (ASEE). Membership in the above professional organizations helps the faculty stay current with developments in their fields of interest. In addition, most faculty have industrial consulting agreements, further exposing them to state of the art engineering practices.

6. Facilities

The textile engineering department has state-of-the-art laboratories in every aspect of textile engineering. These labs are listed in Table 3. Being part of the College of Engineering, we also have access to the other engineering labs in the college.

All the equipment and instrumentation in each lab are adequate to meet the instructional needs of the curriculum. A list of the equipment and instrumentation indicating the year they were purchased, their function, location and replacement value is included in Appendix I-E.

During the past five years, more than $1,000,000 worth of laboratory equipment has been donated to the Department. In addition, the Alabama Textile Education Foundation contributes equipment funds each year as shown below:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>$ 15,000</td>
</tr>
<tr>
<td>2002</td>
<td>$ 10,000</td>
</tr>
<tr>
<td>2001</td>
<td>$ 25,000</td>
</tr>
<tr>
<td>2000</td>
<td>$ 14,000</td>
</tr>
<tr>
<td>1999</td>
<td>$ 10,000</td>
</tr>
<tr>
<td>1998</td>
<td>$ 15,000</td>
</tr>
</tbody>
</table>
All equipment acquisition is geared to the development of competence to conduct experimental work that is expected of our graduates in the field.

The resources to update the labs come from industry, state and other private, state and federal institutions through research. Obsolete equipment is replaced with newer ones to keep continuity in education.

Within the last six years, the State of Alabama gave approximately $1.5 million to Textile Engineering as Research Line Item money. We had several weaving, nonwoven and other machinery donated to the department within the last five years (Table 4). In addition to the resources above, the $5/credit hour student fee on all engineering courses to be returned to the departments, is used for equipment repair, replacement and purchase costs. Table 5 gives a list of the purchased equipment for the department within the last five years.
### TABLE 3. Laboratory Facilities - Fiber Engineering

<table>
<thead>
<tr>
<th>Physical Facility Building and Room Number</th>
<th>Purpose of Laboratory, Including Courses Taught</th>
<th>Condition of Laboratory</th>
<th>Adequacy for Instruction</th>
<th>Number Student Stations</th>
<th>Area (ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textiles - Rm 231</td>
<td>Fiber Extrusion</td>
<td>Excellent</td>
<td>Excellent</td>
<td>NA</td>
<td>375</td>
</tr>
<tr>
<td>Textiles - Rm 208</td>
<td>Yarn Formation</td>
<td>Excellent</td>
<td>Excellent</td>
<td>NA</td>
<td>5900</td>
</tr>
<tr>
<td>Textiles - Rm 118</td>
<td>Fabric Formation</td>
<td>Excellent</td>
<td>Excellent</td>
<td>NA</td>
<td>5700</td>
</tr>
<tr>
<td>Textiles - Rm 005</td>
<td>Nonwovens</td>
<td>Good</td>
<td>Excellent</td>
<td>NA</td>
<td>5000</td>
</tr>
<tr>
<td>Textiles - Rm 226</td>
<td>High-Tech Textile Lab</td>
<td>Excellent</td>
<td>Excellent</td>
<td>2</td>
<td>450</td>
</tr>
<tr>
<td>Textiles - Rm 224A &amp; 232</td>
<td>Composites</td>
<td>Excellent</td>
<td>Excellent</td>
<td>NA</td>
<td>350</td>
</tr>
<tr>
<td>Textiles - Rm 108</td>
<td>Dyeing and Finishing</td>
<td>Excellent</td>
<td>Excellent</td>
<td>16</td>
<td>3500</td>
</tr>
<tr>
<td>Textiles - 003</td>
<td>Physical and Analytical Testing</td>
<td>Excellent</td>
<td>Excellent</td>
<td>25</td>
<td>2025</td>
</tr>
<tr>
<td>Textiles - 118B</td>
<td>Projects Lab</td>
<td>Excellent</td>
<td>Excellent</td>
<td>NA</td>
<td>300</td>
</tr>
<tr>
<td>Textiles - 116</td>
<td>Microcomputer</td>
<td>Excellent</td>
<td>Excellent</td>
<td>12</td>
<td>300</td>
</tr>
<tr>
<td>Textiles - 113</td>
<td>Chemical Research</td>
<td>Excellent</td>
<td>Excellent</td>
<td>4</td>
<td>350</td>
</tr>
<tr>
<td>Textiles - 109</td>
<td>Instrumentation</td>
<td>Excellent</td>
<td>Excellent</td>
<td>6</td>
<td>1000</td>
</tr>
<tr>
<td>Textiles - 118B</td>
<td>Machine Shop</td>
<td>Excellent</td>
<td>Excellent</td>
<td>NA</td>
<td>300</td>
</tr>
<tr>
<td>Textiles – 209A</td>
<td>Microscopy</td>
<td>Excellent</td>
<td>Excellent</td>
<td>6</td>
<td>200</td>
</tr>
<tr>
<td>Textiles - 002</td>
<td>NASA Lab</td>
<td>Good</td>
<td>Excellent</td>
<td>NA</td>
<td>225</td>
</tr>
<tr>
<td>Textiles - 007</td>
<td>Instrumentation Lab</td>
<td>Excellent</td>
<td>Excellent</td>
<td>2</td>
<td>225</td>
</tr>
<tr>
<td>Textiles - 215</td>
<td>Processing Lab</td>
<td>Excellent</td>
<td>Excellent</td>
<td>NA</td>
<td>350</td>
</tr>
<tr>
<td>Textiles - 001</td>
<td>Machine Shop</td>
<td>Good</td>
<td>Good</td>
<td>NA</td>
<td>1000</td>
</tr>
</tbody>
</table>

**Total area:** 27550
Table 4. List of Equipment Donated to the Department of Textile Engineering within the last five years.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Source</th>
<th>Replacement value ($)</th>
<th>Year Donated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durawound filament winding machine</td>
<td>AU Materials Engineering</td>
<td>35,000</td>
<td>2000</td>
</tr>
<tr>
<td>Braiding machine</td>
<td>AU Materials Engineering</td>
<td>25,000</td>
<td>2000</td>
</tr>
<tr>
<td>Hybrid Weaving/Knitting machines (2)</td>
<td>Private Industry</td>
<td>200,000</td>
<td>2000</td>
</tr>
<tr>
<td>L5200 Air-Jet Weaving Machine</td>
<td>SulTex, Inc.</td>
<td>15,000</td>
<td>2002</td>
</tr>
<tr>
<td>40” Model H Whitin Card</td>
<td>Acordis</td>
<td>2,500</td>
<td>2002</td>
</tr>
<tr>
<td>Reiter RSB 851 Draw Frame</td>
<td>Acordis</td>
<td>12,000</td>
<td>2002</td>
</tr>
<tr>
<td>Platt SACO Lowell 56 Spindle Ring Spinner</td>
<td>Acordis</td>
<td>1,120</td>
<td>2002</td>
</tr>
<tr>
<td>Zweigle Hairiness Tester</td>
<td>Acordis</td>
<td>8,000</td>
<td>2002</td>
</tr>
<tr>
<td>Instron Tensile Tester w/5 load cells</td>
<td>Acordis</td>
<td>16,600</td>
<td>2002</td>
</tr>
<tr>
<td>Oxford QP-20+ NMR</td>
<td>Acordis</td>
<td>9,000</td>
<td>2002</td>
</tr>
<tr>
<td>Benz Lab Jig</td>
<td>Acordis</td>
<td>20,000 (est.)</td>
<td>2002</td>
</tr>
<tr>
<td>International Package Dyeing Machine</td>
<td>Acordis</td>
<td>8,500</td>
<td>2002</td>
</tr>
<tr>
<td>Brinkman Trauttnauer Autoclave</td>
<td>Acordis</td>
<td>2,095</td>
<td>2002</td>
</tr>
<tr>
<td>Roaches Pyrotec IR Cannister Dye Bath</td>
<td>Acordis</td>
<td>21,000</td>
<td>2002</td>
</tr>
<tr>
<td>Roaches Dye Bath Model 95-74316-4</td>
<td>Acordis</td>
<td>35,000</td>
<td>2002</td>
</tr>
<tr>
<td>Murata Single Head Winder</td>
<td>Acordis</td>
<td>5,000</td>
<td>2002</td>
</tr>
<tr>
<td>Lab Dye Padder (Horizontal)</td>
<td>Acordis</td>
<td>29,000</td>
<td>2002</td>
</tr>
<tr>
<td>Lab Dye Padder (Vertical/Horizontal)</td>
<td>Acordis</td>
<td>23,000</td>
<td>2002</td>
</tr>
<tr>
<td>Werner Mathis Lab Jet</td>
<td>Acordis</td>
<td>95,000</td>
<td>2002</td>
</tr>
<tr>
<td>Werner Mathis Curing Oven</td>
<td>Acordis</td>
<td>51,600</td>
<td>2002</td>
</tr>
<tr>
<td>Hollongsworth SACO Lowell Rov-a-matic</td>
<td>Acordis</td>
<td>500</td>
<td>2002</td>
</tr>
<tr>
<td>Piconol Dobby Loom</td>
<td>ITT</td>
<td>15,000</td>
<td>2003</td>
</tr>
</tbody>
</table>
Table 5. Equipment purchased within the last five years.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Source</th>
<th>Value ($)</th>
<th>Purchase Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle Loom</td>
<td>Charles Bethea</td>
<td>13,000</td>
<td>2003</td>
</tr>
<tr>
<td>Gang Shuttle Loom</td>
<td>Kamber Narrow Fabrics</td>
<td>13,000</td>
<td>2004</td>
</tr>
<tr>
<td>Frejoth N/C Turret Milling Machine</td>
<td>Rutland Tool &amp; Supply</td>
<td>8,000</td>
<td>2002</td>
</tr>
<tr>
<td>Nova Lathe</td>
<td>Rutland Tool &amp; Supply</td>
<td>7,000</td>
<td>2002</td>
</tr>
</tbody>
</table>

We have secured funding ($12,000) for a fabric coating machine that will be purchased in the near future.

Textile Engineering's research covers the broad area of fiber extrusion, yarn and fabric formation, engineered fibrous structures, textile composites and wet processing of textiles. There are well-equipped labs in all of these areas.

**Fiber Extrusion**

Research scale equipment is available for melt extrusion and solution spinning of fibers. A complete fiber manufacturing line consists of melt extrusion equipment for thermoplastic polymers with draw winding. Two lab scale solution spinning lines are available, one capable of producing fibers from very small (less than one gram) amounts of polymer. Research is currently funded for formation of fibers from renewable resources. Within the last three years a new desk top fiber extruder was purchased. The godets and speed control in the existing pilot extrusion line were upgraded.

**Yarn Formation**

A complete array of production scale equipment for producing yarns from staple fibers is available. Modern equipment for opening, cleaning, carding and drawing can prepare staple fibers for ring, open-end or air-jet spinning. Recent research projects have investigated the effect of fiber properties on spinning characteristics and yarn properties and on real time correlation of spinning tension with sliver and yarn weight variation. A rotor spinning machine and a friction spinning machine were purchased within the last two years. A full-time technician is responsible for this lab as well as the nonwovens lab (below).

**Fabric Formation**

Modern machinery for knitting, braiding and weaving covers a broad spectrum of equipment categories. Vanguard circular knitting, Karl Mayer and Gibbs warp knitting machines are available, as well as several research scale tubular knitting machines. Two air jet weaving machines (one was donated recently), two Sulzer projectile weaving machines and a Pignone rapier loom represent weaving with a Bonas electronic Jacquard for CAD/CAM fabric formation. A shuttle loom and several braiding machines also contribute to the design and
formation of fabrics. A computerized braiding machine is used to produce structures to reinforce composites. A needle loom is used to produce narrow fabrics. A filament winding machine and a circular braiding machine were donated by Materials Engineering. We have a full time technician for this lab who also helps with the other labs. Student help is used in this lab.

Nonwovens

A complete laboratory for creating batts and webs for nonwoven fabric formation includes a Rando Model "C" for air laid webs, a roller top card and cross-lapper, a through-air oven for thermal bonding, needle punching equipment, a heated calendar, and thermal conductivity measurement capability. The lab is well suited for handling special fibers such as carbon and ceramic fibers. A project was recently funded by DoD to design carbon fiber blends for specific radar absorption properties. A needle punching machine and carding machine were purchased two years ago.

Advanced Fibrous Materials

A 20,000 lb. Instron material testing machine is used to test fabrics and composites. An air-jet filling insertion simulator has been developed to measure the air and yarn performance characteristics in air-jet weaving. An L5200 S 210 N2 IK TE Air-Jet Weaving Machine (L5200 series, filament execution, 210 cm max. reed width, low built, two color pick at will, crank shedding motion, electronic filling feeders) was donated to the lab. A private researcher donated two hybrid weaving/knitting patented machines to manufacture integrated 3D fabric structures, along with patent rights. An Instron Dynatup impact testing machine is used to measure the impact resistance of fibrous materials and composites. Funding has been secured for a coating machine to aid in fuel cell research.

Composites

Textile Engineering’s efforts in composites address design, manufacture and evaluation of textile composites with various architectures. Our equipment includes a small research loom, an industrial sewing machine, and a modern braiding machine for forming reinforcing fabrics. NSF funded the purchase of resin transfer molding equipment and a compression molding machine for composite manufacture. Under a NASA contract, we designed and built a 4-axis filament winding machine for the manufacture of flywheel rotors hubs and rims. A small displacement controlled fatigue machine is available. Polishing and imaging equipment is available for analysis of composite morphology.

Dyeing and Finishing

Laboratory equipment for wet processing of textiles (sizing, desizing, scouring, bleaching) includes two complete sizing and coating ranges for yarns with creels, pads, tenter frames (with optional IR and RF drying capability) and pick-up mechanisms, a size cooker, a beck and a programmable jet for desizing and bleaching. For coloration of textile materials various batch dyeing machines have been installed, such as a Mathis beaker dyer for small-sized samples with
IR heating and cooling systems, two programmable jet dyers for fabric, a winch dyeing machine with steam heating, and an Ahiba dyeing machine with product baskets. Several padders are available with adjustable pressure for pad-batch processes and coating as well as several drying ovens and a thermosol curing unit with variable heat transfer settings for fixation of colored products. For wet finishing of textile materials additionally an Atlas Laundr-o-meter, with 500 mL and 1 L stainless steel containers, is on hand. For determination of color coordinates according to standardized methods two spectrophotometers are available, one for solid samples, and one of liquids, such as dye baths. Further, two light boxes provide standardized light sources for quality control of dyed materials.

For polymer synthesis and fiber extrusion an experimental electrospinning unit complete with syringe pump and heating elements has recently been installed to solvent- or melt-spin nanoscale fibers. Wet spinning equipment and polymer extrusion of larger amounts of polymers are available. For polymerization and grafting reactions a UV-curing oven is available.

Analytical capabilities include a differential scanning calorimeter (DSC) to determine transition states and melting points of polymers, an FTIR-spectrometer with microscope, a dynamic contact angle analyzer (DCA) to determine wetting properties, a gas chromatograph and equipment to determine rheological properties of polymers. Moisture content is determined with a moisture analyzer with computer capabilities. Further analytic equipment includes several light microscopes with/without camera, a Kiejldahl apparatus for analysis of finishing agents, and other smaller instrumentation.

Currently we have a full-time research associate responsible for these labs. Graduate and undergraduate student help is also continuously used in these labs.

**Physical and Analytical Testing Capabilities**

A full array of analytical testing facilities for fibers, polymers, and textiles complements the Textile Engineering facilities. Key equipment includes a Perkin-Elmer FTIR with near infrared and microscopical (Spectratech) capability, a new differential scanning calorimeter, a Haake controlled stress rheometer, and a CS-5 Chroma Sensor by Datacolor for color analysis and color matching. For fiber testing, the Advanced Fiber Information System (AFIS) measures individual fiber lengths and diameters, neps, and trash from a small sample of staple fiber. The Uster HVI high volume instrument measures average cotton fiber properties such as micronaire, length, uniformity, strength, elongation, Rd, +b, trash, and color. A Uster Tensorapid III measures strength uniformity of yarns, testing from a package at five breaks/minute. A Lawson Hemphill constant tension transport electronic inspection board measures optical characteristics of yarns. We have two full time technicians working in these labs. Graduate and undergraduate student help is also used extensively.

**Automatic Control Lab**

The equipment in this lab includes digital and analog oscilloscope with 16 digital channels and two analog channels, function generator, multi-function digital multimeter, 2 dual power supplies, A3 size bread board, hot air soldering tools, data acquisition system, personal
computer, microcontroller programmer, development tool set for microcontroller and ultra-violet microcontroller eraser. The lab is located in the basement.

Balancing Lab

This lab houses a balancing machine capable of balancing rotors of a diameter up to 25”. Balancing is carried out in two perpendicular planes with the highest balancing grade according to NIST standards. A PC with control software (Multi-Physics Finite Element Analysis package “ALGOR”) is used. The lab is located in the basement.

7. Institutional Support and Financial Resources

Auburn University Textile Engineering Department is supported by the State of Alabama for education and research. The following table shows the state support for the last several years:

<table>
<thead>
<tr>
<th>Year</th>
<th>Educational Support</th>
<th>Research Line Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-99</td>
<td>$ 620,238</td>
<td>$ 320,955</td>
</tr>
<tr>
<td>1999-00</td>
<td>$ 601,016</td>
<td>$ 320,955</td>
</tr>
<tr>
<td>2000-01</td>
<td>$ 678,561</td>
<td>$ 284,121</td>
</tr>
<tr>
<td>2001-02</td>
<td>$ 673,293</td>
<td>$ 277,528</td>
</tr>
<tr>
<td>2002-03</td>
<td>$ 727,480</td>
<td>$ 341,486</td>
</tr>
<tr>
<td>2003-04</td>
<td>$ 736,865</td>
<td>$ 329,605</td>
</tr>
</tbody>
</table>

• Learning Resource Center (LRC, Textile Building, Room 116). Houses the computer labs thorough which access to the library and on-line search is possible. LRC also provides a comfortable environment for the students to study and interact with the faculty. The department receives several trade journals and papers regularly. These are placed in the LRC for use by the students.

• Library Services and Facilities.
  - Auburn University Ralph Brown Droughton Library has a large collection of materials for textile engineering. The textile section is located in the fourth floor of the library. Library resources available are described in Vol. I of the self study questionnaire.

• Computer Facilities
  - The College of Engineering provides computing services to engineering faculty and students via the Engineering Network. The Engineering Network is configured with internet addressing and is part of the larger AUNET and Internet. Using standards based internet working protocols, the College supports 300+ SUN workstations, 26 Sun servers including six enterprise multiprocessor servers.
The College also supports 900+ fully integrated PCs running native CIFS networking protocols supported by Samba and Active Directory. Engineering maintains a terabyte of on line disk storage for applications and 6,000 home directories. Two labs housing 24 Sun workstations running Solaris 2.8 and two Windows XP labs with 46 and 32 P4 2.4GHz/512MB PCs are available to all Engineering faculty, students and staff. All these labs are open 24 hours, 7 days a week while classes are in session with slightly more restricted hours during breaks. Nine departmental labs of 12 to 32 Windows NT, 2000, or XP workstations are also available for student use. All server and labs are managed by the College's Computing and Network Services.

- The College runs integrated NIS, SMB and AD domains providing students, faculty and staff access to all network and computing resources within the College with a single user-id/password. Usernames and passwords are synchronized with AU's central computing and network resources.

- The College maintains wide array of compilers, engineering programming libraries and major engineering applications that can be accessed from most nodes on the network.

- The Department of Textile Engineering provides a unique service to our students through the Office of Textile Relations. We have a full time Coordinator of the office who helps the students with recruiting, scholarship administration, academic advising, and graduate and intern placement. This office helps students to develop their leadership and professionalism by working with student organizations.

- In the 2003-04 academic year, the College of Engineering has provided funding for two graduate teaching assistants (GTA) who are helping the faculty with the course and lab work.

8. Program Criteria

1. Curriculum

There are no applicable program criteria for programs, such as fiber engineering, accredited under the “Other” classification. However we are similar to materials engineering programs with our materials being fibers, fiber-forming polymers and fibrous assemblies. In this regard, with respect to the application of engineering principles to the four major elements of the field, we address the criteria as follows:

- Structure: TXTN 3310, FBEN 2100, FBEN 2250, FBEN 4250, FBEN 5100
- Properties: TXTN 3310, FBEN 3600, FBEN 4500
- Processing: FBEN 2100, FBEN 2250; FBEN 3400
- Performance: FBEN 3300, FBEN 3600, FBEN 4250, FBEN 4500, FBEN 5100
2. Faculty

- **Structure**: McClain, Broughton, Adanur, ElMogahzy, Schwartz
- **Properties**: Adanur, Gowayed, Broughton, Schwartz
- **Processing**: Broughton, ElMogahzy, Buschle-Diller, Adanur, Thomas, Abdel Hady
- **Performance**: Adanur, Broughton, ElMogahzy, Gowayed, Schwartz
Appendices

Appendix I - Additional Program Information

A. Tabular Data for Program
   Table I-1. Basic Level Curriculum
   Table I-2. Course and Section Size Summary
   Table I-3. Faculty Workload Summary
   Table I-4. Faculty Analysis
   Table I-5. Support Expenditures

B. Course Syllabi
C. Faculty Curriculum Vitae
D. Questionnaire for Industry
E. Textile Engineering Laboratories Equipment List
F. Handbook for Senior Design

Appendix II – Self-Study Questionnaire for Review of Engineering Programs
### Table I-1. Basic-Level Curriculum
(Fiber Engineering)

<table>
<thead>
<tr>
<th>Year; Semester or Quarter</th>
<th>Course (Department, Number, Title)</th>
<th>Category (Credit Hours)</th>
<th>Math &amp; Basic Sciences</th>
<th>Engineering Topics Check if Contains Significant Design (✓)</th>
<th>General Education</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FR 1</strong></td>
<td>MATH 1610 Calculus I</td>
<td>4</td>
<td>( )</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>CHEM 1010 Chemistry I</td>
<td>3</td>
<td>( )</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>CHEM 1011 Chemistry I Lab</td>
<td>1</td>
<td>( )</td>
<td></td>
<td></td>
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<td></td>
<td>ENGL 1100 English Comp. I</td>
<td>( )</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HIST 1210 Tech. &amp; Civ. I</td>
<td>( )</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMP 1200 Intro. Computers</td>
<td>2</td>
<td>( )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENGR 1100 Engr. Orientation</td>
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<td>( )</td>
<td></td>
<td></td>
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<td>MATH 1620 Calculus II</td>
<td>4</td>
<td>( )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEM 1020 Chemistry II</td>
<td>3</td>
<td>( )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEM 1021 Chemistry II Lab</td>
<td>1</td>
<td>( )</td>
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<th>Math &amp; Basic Science</th>
<th>Category (Credit Hours)</th>
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<td>Tech. Elect. Or ROTC</td>
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<td>29%</td>
<td>43%</td>
<td>23%</td>
<td>5%</td>
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<tr>
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<td>Minimum semester credit hours 32 hrs</td>
<td>48 hrs</td>
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<td>37.5 %</td>
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Table I-2. Course and Section Size Summary  
(Fiber Engineering)

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<tr>
<th>Course No.</th>
<th>Title</th>
<th>No. of Sections offered in Current Year</th>
<th>Avg. Enrollment</th>
<th>Type of Class</th>
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<tr>
<td>ENGR 1110</td>
<td>Intro. to Fiber Engineering</td>
<td>2</td>
<td>20</td>
<td>25%, 75%</td>
</tr>
<tr>
<td>FBEN 2100</td>
<td>Fiber to Yarn Engineering</td>
<td>1</td>
<td>10</td>
<td>40%, 60%</td>
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<tr>
<td>FBEN 2250</td>
<td>Fabric Design and Engineering</td>
<td>1</td>
<td>7</td>
<td>50%, 50%</td>
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<tr>
<td>FBEN 2500</td>
<td>Biomedical Textiles</td>
<td>1</td>
<td>7</td>
<td>100%</td>
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<tr>
<td>FBEN 3300</td>
<td>Textile Testing &amp; Instrument.</td>
<td>1</td>
<td>7</td>
<td>40%, 60%</td>
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<td>TXTN 3310</td>
<td>Structure &amp; Properties of Fibers</td>
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<td>10</td>
<td>50%, 50%</td>
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<tr>
<td>FBEN 3400</td>
<td>Intro. Dyeing &amp; Finishing</td>
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<td>7</td>
<td>50%, 50%</td>
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<td>FBEN 3600</td>
<td>Mechanics of Flexible Structures</td>
<td>1</td>
<td>7</td>
<td>100%</td>
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<tr>
<td>FBEN 4250</td>
<td>Engineered Textile Structures</td>
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<td>7</td>
<td>100%</td>
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<td>FBEN 4500</td>
<td>Textile Reinforced Materials</td>
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<td>FBEN 4600</td>
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<td>Fiber Engineering Design II</td>
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<td>7</td>
<td>100%</td>
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<tr>
<td>Faculty Member (Name)</td>
<td>FT or PT (%)</td>
<td>Classes Taught (Course No./Credit Hrs.)</td>
<td>Total Activity Distribution</td>
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<tr>
<td>------------------------------</td>
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<td>--------------------------------------------------------------------------------------------------------</td>
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<td>Adanur, S.</td>
<td>FT</td>
<td>FBEN 3300(3); FBEN 4250(3); FBEN 7250(3); TXTN 3450(3); FBEN 8200(3)</td>
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<td>5%</td>
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</tr>
<tr>
<td>Broughton, R.</td>
<td>FT</td>
<td>TXTX 3310(4); ITAS 7200(3)</td>
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<tr>
<td>El Mogahzy, Y.</td>
<td>FT</td>
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<td>Hady, F.</td>
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<tr>
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* Course Coordinator, all engineering faculty participate in directing projects.
<table>
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<th>Classes Taught (Course No./Credit Hrs.)</th>
<th>Total Activity Distribution</th>
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<td>ENGR 1110(2); FBEN 2250(4); FBEN 6100 (3); FBEN 7950(1); ITAS 8950(1)</td>
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<td>Teaching: 50% Research: 45% Other: 5%</td>
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<th>Years of Experience</th>
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<th>State in which Registered</th>
<th>Level of Activity</th>
<th>Govt./Industry Practice</th>
<th>This Institution</th>
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<th>Research</th>
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Table I-5. Support Expenditures
Fiber Engineering

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Appendix I-B
Course Syllabi
ENGR 1110 INTRODUCTION TO FIBER ENGINEERING

Required

Catalog Description:
Introduction to engineering design, engineering teams, graphic presentation, technical writing, oral presentation.

Prerequisites: None

Textbook:

Course Objectives:
Provide an introduction to engineering design and teams with reinforcement through the completion of a team project. Provide instruction and opportunities for experience in engineering communication. Introduce issues related to the professional practice of engineering.

Lecture Topics Covered:
- Engineering as a profession
- Introduction to design
- Engineering communications
- Engineering economics
- Engineering ethics
- Engineering calculations
- Systems of measurement
- Problem solving
- Statistics

Laboratory topics covered:
- Design development
- Computer applications
- Oral communication
- Written communication
- Design project

Class/Laboratory schedule: (2), Lec. 1, Lab. 3

Contribution of course to meeting professional component:
Engineering topics: 2 hours

Students learn about engineering as a profession and the tools engineers bring to bear on problem solving. They are exposed to engineering practices, ethics, and the role of the engineer in society. The need for life-long learning is emphasized.

Relationship of course to program objectives:
Prepares students to meet the following Program Outcomes: 3a, 3c, 3d, 3e, 3f, 3g, 3h, 3i, 3j, 3k
Class lectures emphasize the role of the engineer in society and the personal and professional development required to be successful. Laboratory exercises reinforce classroom learning. The design project requires students to work in teams toward a stated objective and to be able to present the results both orally and in writing.

Prepared by: Peter Schwartz, 28 April 2004
FBEN 2100 FIBER TO YARN ENGINEERING

Required

Catalog Description:
Engineering aspects required to design and modify textile yarns in relation to textile end products.

Prerequisites: ENGR 1110, MATH 1720 or MATH 1620

Textbooks:

Course Objectives:
To provide the students with the theory and application of staple yarn forming systems and the properties of yarns produced on each system.

Lecture Topics Covered:
• Fiber to yarn conversion system
• Fiber selection and blending
• Fiber characteristics
• Yarn characteristics
• Preparation for spinning
• Cleaning
• Drawing principles
• Combing principles
• Roving process
• Ring-spinning
• Compact (condensed) spinning
• Rotor (open-end) spinning
• Air-jet spinning
• Friction spinning
• Fiber/machine interaction
• Blending analysis
Laboratory topics covered:
- Overview of fiber to yarn conversion
- Analysis of opening and cleaning
- Analysis of drafting
- Spinning analysis

Class/Laboratory Schedule: (3), Lec. 2, Lab 3

Contribution of course to meeting professional component:
Engineering topics: 3 hours
Students learn about the formation and structure of staple yarns. Laboratory exercises serve to complement and reinforce lecture materials as well as providing a hands-on experience.

Relationship of course to program outcomes:
Prepares student to meet the following Program Outcomes: 3a, 3e, 3i, 3j, 3k
Students apply mathematics, science, and engineering to the study of staple yarn structure and formation. Concepts of linear density, the effect of twist, and fiber properties are emphasized. Machine material interactions are discussed in class and carried through in laboratory exercises.

Prepared by: Yehia E. El Mogahzy, 6 October 2003
FBEN 2250 FABRIC DESIGN AND ENGINEERING

Required

Catalog Description:

Prerequisite: FBEN 2100

Textbook(s) and Other Required Material:
- Class notes for Braiding, Knitting and Tufting.

Course Objectives:
To provide the student with the knowledge of design and manufacturing principles of woven, knitted, braided and tufted fabric structures and their properties; principles, operating characteristics of modern fabric formation machines.

Topics Covered:
- Introduction to Fabric Structures and Formation (1 week)
- Yarn preparation for weaving, knitting, braiding and tufting (2 weeks)
- Woven fabric design, manufacturing, properties and analysis (4 weeks)
- Knit fabric design, manufacturing, properties and analysis (3 weeks)
- Braiding and narrow fabrics (2 weeks)
- Tufting process and tufted fabrics (2 weeks)
- Other fabric formation systems (1 week)

Class/Laboratory Schedule: (4), Lec. 3, Lab. 3.

Contribution of course to meeting the professional component:
Math and Basic Science: 0 hour(s)
Engineering Topics: 4 hour(s)
General: 0 hour(s)
Other: 0 hour(s)

Students will gain the ability to manipulate the yarns by weaving, knitting, braiding and tufting to form various fabric structures. Students are asked to design a textile product such as a flame resistant fabric. Students must consider the productivity, fiber type, yarn and fabric characteristics and cost. Reports are required for the labs in winding, sizing, woven, knit, braided and narrow fabric manufacturing.

Relationship of course to program outcomes:
Prepares students to meet the following Program Outcomes: 3a, 3b, 3c, 3d, 3g, 3j.
Students apply the knowledge of mathematics, science and engineering to do calculations related to fabric structure and manufacturing. They conduct lab experiments and analyze and interpret the data obtained. They are to design a fabric based system to meet certain needs. In labs and group
homeworks, they learn to function as a team. Students must use engineering-based spreadsheets, graphic programs and a word processor for all written reports. Using the Department’s Learning Center, students are expected to follow the latest issues and trends in fabric formation and engineering.

**Prepared by:** Dr. Sabit Adanur, 24 July 2003
FBEN 2500 BIOMEDICAL TEXTILES

Elective

Catalog Description:
Structure and properties of textile materials used in health related applications including wound closings and dressings, arterial grafts, surgical nets, bone and dental cements, synthetic tendons, ligaments and skin, super-absorbant materials, and prosthetic devices.

Prerequisite: CHEM 1010 or CHEM1030 or CHEM 1110

Textbook
- Class notes/handouts

Course Objectives:
To provide an understanding of the major types of fibrous and polymeric materials used in medical/health applications in the past and to the present.

Topics Covered:
- Introduction to fibrous materials
- Historical uses of fibrous materials in medicine
- Synthetic sutures and nets
- Arterial grafts and stents
- Hard implants
- Cement
- Hydrogels
- Artificial skin
- Surgical gowns
- Filtration/dialysis
- Super absorbants
- Composite materials
- Ethical issues

Class/laboratory schedule: (2), Lec. 2

Contribution of course to meeting the professional component:
Engineering Topics: 2 hours

Students gain an understanding of fibers and other materials used in health related applications. Fibers and textiles are playing an ever expanding role in these applications.
**Relationship of course to program outcomes:**

Prepares students to meet the following Program Outcomes: 3a, 3f, 3h, 3i, 3j

Students learn to apply mathematics, science, and engineering to understand the properties required for biomedical application of fibers and textiles. A major research paper allows the student to explore in depth the use of fibrous materials in a specific application.

**Prepared by:** Peter Schwartz, 2 June 2004
FBEN 3300 TEXTILE TESTING AND INSTRUMENTATION

Required

Catalog Description:
Theory and application of mechanical, physical, and chemical measurement of fiber, yarn and fabric properties. Engineering principles of testing instrumentation.

Prerequisite: FBEN 2250, PHYS 1600

Textbook(s) and Other Required Material:

Course Objectives:
To provide the students with the theory and application of mechanical, physical and chemical measurement of fiber, yarn and fabric properties, standard test methods and engineering principles of testing instrumentation.

Topics Covered:
- Engineering principles of measurements (2 weeks)
- Fiber property measurements (3 weeks)
- Yarn property measurements (4 weeks)
- Fabric property measurements (5 weeks)
- Design and development of new testing methods (1 week)

Class/Laboratory Schedule: (3), Lec. 2, Lab. 3.

Contribution of course to meeting the professional component:
Math and Basic Science: 0 hour(s)
Engineering Topics: 3 hour(s)
General: 0 hour(s)
Other: 0 hour(s)

Students will gain an appreciation for the need to test fibrous structures. They will learn the basic engineering principles of testing and testing equipment. The laboratory sessions complement the lecture. The meaning and interpretation of the test results are required. Students are asked to design a standard test method for a fiber, yarn or fabric property for which there is no available standard test method. They present their method to the class at the end of the semester. Students must consider the simplicity and ease of use for the test method they develop. Individual or team reports are required for each lab session.

Relationship of course to program outcomes:
Prepares students to meet the following Program Outcomes: 3a, 3b, 3c, 3d, 3g, 3h.
Students apply the knowledge of mathematics, science and engineering to do calculations related to fiber, yarn and fabric structure and properties. They conduct lab experiments and analyze and
interpret the data obtained. They are to design a new test method to measure a fiber, yarn or fabric property. In labs, they learn to function as a team. Students must use engineering-based spreadsheets, graphic programs and a word processor for all written reports.

**Prepared by:** Dr. Sabit Adanur, 8 September 2003
TXTN 3310 STRUCTURE AND PROPERTIES OF FIBERS

Required

Catalog Description:
The relationships between the chemical structure, fiber properties, and use of textile fibers. Polymer synthesis and fiber manufacture.

Prerequisite: CHEM 1020

Textbook:
- Instructor handouts

Course Objectives:
To give students the ability to select the best fiber for a textile application, to intelligently discuss fiber properties and applications with fiber suppliers and textile users, to predict fiber properties from a knowledge of the chemical structure of the polymer, and to give students practice in laboratory techniques that are used to study fibers.

Lecture Topics Covered:
- Review of organic chemistry concepts, nomenclature, and reactions
- Fiber properties of interest in textile products
- Polymers: definition and nomenclature
- Properties and structure of macromolecules
- Relationship between properties of molecules and fiber properties
- Structure-property relationships of the major fiber types

Laboratory Topics Covered:
- Microscopy
- Fiber identification
- Differential scanning calorimetry
- Tensile properties
- Measurement of molecular weight
- Infrared spectroscopy
- Quantitative fiber analysis

Class/laboratory schedule: (4), Lec. 3, Lab. 3

Contribution of course to meeting the professional component:
Engineering topics: 4 hours

Students learn about the structure, properties and manufacture of the major textile fibers. The laboratory exercises provide them with the opportunity to use techniques and equipment standard in the industry. Individual and/or team laboratory reports are required.
Relationship of the course to program outcomes:
  Prepares students to meet the following Program Outcomes: 3a, 3b, 3e, 3i, 3k

  Students apply knowledge of science and engineering to the study of the structure and properties of the major textile fibers and polymers. They conduct lab experiments, analyze data, and interpret the results. Teamwork is an important component in laboratory exercises.

Prepared by: Peter Schwartz, 2 June 2004
FBEN 3400 INTRODUCTION TO DYEING AND FINISHING

Required

Catalog Description:  
Principles and processes of bleaching, dyeing and finishing of textile materials, quality control, process control and environmental aspects.

Prerequisite: TXTN 3310

Textbook:  

Course Objectives:  
This course is designed to give the student a fundamental understanding of textile coloration and finishing processes. During the lab sessions the student has the opportunity to translate theoretical knowledge into action. A design project with focus on a selected wet process is part of the requirements for the course. The student further prepares a presentation of a state-of-art process related to the course topics, but not covered in class to help improve presentation skills. A fieldtrip to a local textile mill illustrates the large scale application of material discussed in the classroom and during laboratory sessions.

Lecture Topics Covered (lecture hours in parentheses; duration 50 min):

- Introduction – overview of dyeing and finishing (2)
- Chemicals used in textile processes (3)
- Color and color assessment (4)
- Dyeing theory (4)
- Dye classes by application method; pigments (10)
- Machinery for batch and continuous dyeing processes (4)
- Textile printing (4)
- Finishing processes – mechanical and chemical (8)
- Coating technology (2)
- Environmental aspects (2)

Topics Covered in Laboratory (lab hours 3 per week):

- Week 1 Safety in the lab; basic procedures in dyeing and finishing
- Week 2 Viscosity
- Week 3 Desizing and bleaching
- Week 4 Introduction to dyeing and direct dyeing of cotton
- Week 5 Mercerization of cotton and effect on dyeing
- Week 6 Reactive dyeing and discharge printing
- Week 7 Acid dyeing of nylon
- Week 8 Continuous dye range I: disperse dyeing of polyester
- Week 9 Continuous dye range II: vat dyeing of cotton
• Week 10 SPRING BREAK
• Week 11 Color matching I: acrylics and basic dyes
• Week 12 Color matching II
• Week 13 Azo dyeing and presentation of design project
• Week 14 Field trip

**Semester credit hours:** (4). Lec. 3, Lab. 3

**Contribution of Course to Meeting Professional Component:**
Engineering Topics: 4 Hours

During the laboratory sessions small teams of students learn to master a given task and to transform theoretical knowledge into practical application. The teams are composed of different students for the different tasks to strengthen their ability for solving problems via teamwork. A process design project helps them to develop creativity and take their knowledge further. The design project is presented in form of a poster session as it would take place at a professional meeting. An oral presentation on a theoretical topic demonstrates another way of communicating research ideas.

**Relationship of course to program outcomes:**
Prepares students to meet the following Program Outcomes: 3a, 3b, 3c, 3d, 3g, 3j.
Students apply the knowledge of mathematics, science and engineering to do calculations related to dyeing and finishing. They conduct lab experiments and analyze and interpret the data obtained. They are to design a continuous dye range. In labs they learn to function as a team.

**Prepared by:** Gisela Buschle-Diller, 20 June 2003
FBEN 3600 MECHANICS OF FLEXIBLE STRUCTURES

Required

Catalog Description:
Analysis of mechanical behavior and physical properties of flexible structures such as fibers, yarns and fabrics. The influence of geometric characteristics and physical properties on mechanical behavior.

Prerequisites: FBEN 2250, FBEN 3310, ENGR 2050

Textbook(s) and/or other required material:
Instructor prepared handouts

Course Objectives:
Present mechanics of fibers, yarns and fabrics to students and study the inter-relationship of different elements on the overall performance of the fabric. Students are expected to be able to apply mechanical modeling techniques introduced in this class, along with general textile knowledge relevant to fiber, yarn and fabric in the design of a textile product.

Topics Covered:
- Review of elastic behavior in 1D
- Ductile and Brittle behavior
- Review of fiber structure
- Tensile properties of fibers
- Effect of Temperature, light and moisture
- Elastic behavior of fibers in 3D
- Flexural and torsion rigidities
- True stress and true strain
- Creep and Relaxation
- Numerical examples
- Spun yarns
- Continuous filament yarns
- Idealized yarn geometry
- Mechanics of continuous filament yarns
- Mechanics of spun fiber yarns
- Peirce’s model for the geometry of plain weaves
- Jamming and cover factor
- Tensile properties of fabrics
- Shear properties of fabrics
- Drape
Class/laboratory schedule: (3), Lec. 3

Contribution of course to meeting the professional component:

Engineering topics: 3 hours

Students gain an understanding of the engineering properties of flexible fibrous assemblies, a unique class of engineering materials.

Relationship of course to program outcomes:

Prepares students to meet the following Program Outcomes: 3a, 3c; 3e; 3i; 3k

Students apply mathematics and engineering mechanics to the study of flexible fibrous assemblies. Students learn the concept of using models to predict the behavior of complex materials when an understanding of the mechanical properties of the components are known.

Prepared by: Yasser Gowayed, 20 August 2003
FBEN 4250 ENGINEERED TEXTILE STRUCTURES

Required

Catalog Description:
Design and application of high performance industrial textiles for civil engineering, architecture and construction, filtration, transportation, military/defense, safety/protective, medicine and composites.

Prerequisite: FBEN 2250, ENGR 2350. Coreq. ENGR 2200.

Textbook(s) and Other Required Material:

Course Objectives:
To introduce the student to the area of industrial textiles and provide a sound understanding of design, manufacturing, testing and applications of industrial textiles.

Topics Covered:
- Introduction / overview (1 week)
- Architectural and construction textiles (2 weeks)
- Filtration textiles (1 week)
- Geotextiles (1.5 weeks)
- Medical textiles (1.5 weeks)
- Military and defense textiles (1 week)
- Safety and protective textiles (3 weeks)
- Sports and recreation textiles (1 week)
- Transportation textiles (2 weeks)
- General industrial textiles (1 week)

Class/Laboratory Schedule: (3), Lec. 3.

Contribution of course to meeting the professional component:
Math and Basic Science: 0 hour(s)
Engineering Topics: 3 hour(s)
General: 0 hour(s)
Other: 0 hour(s)

Students will gain a solid understanding and appreciation of non-traditional, high performance industrial textiles. They will learn how to choose fiber, yarn and fabric structures and their properties for a specific application. They will use their math and engineering background for the application of specific fabrics. Students are asked to do a design project that utilizes one of the high performance fabric structures. They must consider the fiber type, yarn and fabric characteristics and cost. A report is required.

Relationship of course to program outcomes:
Prepares students to meet the following Program Outcomes: 3a, 3c, 3e, 3h, 3i, 3j, 3k.
Students apply the knowledge of mathematics, science and engineering to the design and application of high performance industrial textile structures. Design, manufacture and application of industrial textiles require a combination of various engineering skills. In the design project, they are to design a fabric based system to meet certain needs in a project. Students must use engineering-based spreadsheets, graphic programs and a word processor for all written reports. Using the Department’s Learning Center, students are expected to follow the latest issues and trends in design and application of high performance fabrics.

**Prepared by:** Dr. Sabit Adanur, 8 September 2003
FBEN 4500 TEXTILE REINFORCED MATERIALS

Required

Catalog description:
Material properties and manufacture of textile reinforced materials; preform structures such as weaves and braids, analysis, design methodology and applications.

Prerequisites: FBEN 3600, ENGR 2050

Textbook(s) and/or other required material:
Instructor prepared handouts

Course objectives:
Present manufacture and design of unidirectional, laminated and textile reinforced materials to students. Explore different fabric preforms and the impact of yarn spatial geometry on the mechanical response of textile composites. Utilize computer aided design methodology (software developed by instructor) in the design of textile composite products.

Topics covered:
- What are composites?
- Types of composite materials and their applications
- Fibers and matrix materials
- Design of unidirectional composites
- Composite manufacturing methods
- Manufacture a composite product using a compression molding machine
- Basic concepts of composite design
- Preform manufacturing methods – weaving and braiding
- The Fabric Geometry Model (FGM)
- Design of laminated composites
- Why textile composites?
- Computer aided design of textile composites

Class/laboratory schedule: (3), Lec. 3

Contribution of course to meeting the professional component:
Engineering topics: 3 hours
Students gain the ability to understand the mechanic of high-performance composite materials. Students are required to use software to design and model composite parts.

Relationship of course to program outcomes:
Prepares the students to meet the following Program Outcomes: 3a, 3c, 3e, 3i, 3k
Students use mathematics, engineering principles, and a knowledge of the mechanics of fibrous assemblies to design and model composite structures.

Prepared by: Yasser Gowayed, 20 August 2003
FBEN 4910 FIBER ENGINEERING DESIGN I

Required

Catalog Description:
Undergraduate design project, first semester

Prerequisite: Senior standing

Textbook:
• None

Course Objectives:
To help the student gain the experience of conducting a literature search, identifying opportunity areas for design, and proposing a design project.

Topics Covered:
Topics vary with the interest of the student and faculty

Class/Laboratory schedule: (3), independent work

Contribution of course to meeting the professional component:
Engineering Topics: 3 hours

Students begin the background work necessary to put together a design project. They acquire skills in searching the technical literature, analyzing technical reports, and identifying a need that requires an engineering solution.

Relationship of course to program objectives:
Prepares students to meet the following program outcomes: 3a, 3e, 3g, 3i, 3j, 3k

Students use their backgrounds in mathematics, science, engineering, and their major coursework to begin development of a design idea. They synthesize this in a technical report covering the background and scope of their proposed design project.

Prepared by: Peter Schwartz, 2 June 2004
FBEN 4920 FIBER ENGINEERING DESIGN II

Required

Catalog Description:
Undergraduate design project, second semester

Prerequisite: FBEN 4910

Textbook:
• None

Course Objectives:
To help the student gain the experience of completing a design project and presenting it orally and in a written report.

Topics Covered:
Topics vary with the interest of the student and faculty

Class/Laboratory schedule: (3), independent work

Contribution of course to meeting the professional component:
Engineering Topics: 3 hours

Students complete a major design project including prototype development, fabrication and testing. At the end of the semester, they present their results in an open forum where they are required to explain and defend their idea and methods.

Relationship of course to program objectives:
Prepares students to meet the following program outcomes: 3a, 3b, 3c, 3e, 3g, 3i, 3j, 3k

This project is the capstone of the students' program, bringing their knowledge of mathematics, engineering, science, and their major coursework to bear on a complete design to solve an identified engineering need. Through a written report and an oral presentation they learn how to effectively communicate their ideas.

Prepared by: Peter Schwartz, 2 June 2004
**FBEN 5100 FABRICS FOR PAPER MAKING**

Required

**Catalog Description:**
Design, analysis and applications of forming fabrics, press felts and dryer fabrics.

**Prerequisite:** Departmental approval

**Textbook(s) and Other Required Material:**

**Course Objectives:**
To provide the student with the knowledge of application of engineering principles to the design, manufacturing and performance of fabrics used in pulp and paper industry.

**Topics Covered:**
- Overview of pulp and paper technology (2 weeks)
- Forming and forming fabrics (4 weeks)
- Pressing and press fabrics (3 weeks)
- Drying and dryer fabrics (3 weeks)
- Paper structure, properties and testing (2 weeks)
- Future of paper machine clothing (1 week)

**Class/Laboratory Schedule:** (3), Lec. 3.

**Contribution of course to meeting the professional component:**
- Math and Basic Science: 0 hour(s)
- Engineering Topics: 3 hour(s)
- General: 0 hour(s)
- Other: 0 hour(s)

Students will gain an in-depth knowledge of value added paper machine clothing including forming fabrics, press felts and dryer fabrics along with some specialty structures. They will learn the basics of formation, pressing and drying in papermaking process. Students are asked to do a design project that utilizes forming fabrics to produce hand sheets. The properties of the sheets are tested to see the effect of various fabrics.

**Relationship of course to program outcomes:**
Prepares students to meet the following Program Outcomes: 3a, 3b, 3c, 3d, 3h, 3i, 3j, 3k.
Students apply the knowledge of mathematics, science and engineering to the design and application of high performance value added forming fabrics, press felts and dryer fabrics. Students must use engineering-based spreadsheets, graphic programs and a word processor for all written reports. Using the Department’s Learning Center, students are expected to follow the latest issues and trends in design and application of high performance fabrics.

**Prepared by:** Dr. Sabit Adanur, 8 September 2003
Appendix I-C
Faculty Curriculum Vitae
EDUCATION

- 1988 - Ph.D, Mechanical Engineering, Ain Shams University, Cairo, Egypt
- 1982 - MS, Mechanical Engineering, Ain Shams University, Cairo, Egypt
- 1975 - BS, Mechanical Engineering, Ain Shams University, Cairo, Egypt

EXPERIENCE

Years of experience at Auburn: 4

- 2000 - Present: Research Assistant Professor, Textile Engineering, Auburn University
- 1992 - 1999: Assistant Professor, Mechanical, Automotive, Ain Shams University, Cairo, Egypt
- 1988 - 1991: General manager of HICON, Development of industrial filament winder control, HICON, French company locate at St. Etienne France
- 1983 - 1987: Lecturer, Mechanical, Automotive, Ain Shams University, Cairo, Egypt
- 1975 - 1982: Demonstrator, Mechanical Engineering, Ain Shams University, Cairo, Egypt

SCIENTIFIC AND PROFESSIONAL SOCIETIES

- 2004 - Present: SAE
- 2002 - Present: ASM

RESEARCH INTERESTS

- Magnetic levitation control systems Fuzzy logic in different engineering fields design and manufacturing of composite materials Thermal and mechanical design of chemical reformers for hydrogen production

SELECTED PUBLICATIONS


CONSULTING EXPERIENCE

• 2003 - Present: Human Hair shaving analysis - Schick
• 2001 - 2002: development of cotton mix optimization software - Italian textile fabric producer company

PATENTS

SABIT ADANUR
Professor
115 Textile Building
Phone: (334) 844-5497, Fax: (334) 844-4068
E-mail: adanusa@auburn.edu
Website: www.eng.auburn.edu/~adanusa

EDUCATION
- 1989 - Ph.D., Fiber and Polymer Science, North Carolina State University, Raleigh, NC
- 1985 - MS, Textile Engineering and Science, North Carolina State University, Raleigh, NC
- 1982 - BS, Mechanical Engineering, Istanbul Technical University, Istanbul, Turkey

EXPERIENCE
Years of experience at Auburn: 12
- 1999 - Present: Professor, Textile Engineering, Auburn University
- 1996 - 1999: Associate Professor, Textile Engineering, Auburn University
- 1992 - 1996: Assistant Professor, Textile Engineering, Auburn University

SCIENTIFIC AND PROFESSIONAL SOCIETIES
- American Society of Mechanical Engineers (ASME)
- Phi Psi Textile Fraternity
- Technical Association for the Pulp and Paper Industry (TAPPI)
- The Fiber Society
- The Textile Institute (England)

INSTITUTIONAL AND PROFESSIONAL SERVICES
- 2003 - Present: Member - AU Academic Honesty Committee
- 2003 - Present: Chair - Textile Engineering ABET Committee
- 2003 - Present: Member - AU Budget Advisory Committee
- 2002 - Present: Member - Alumni Professorship Committee
- 2002 - 2002: Member - Ginn Professorship Selection Committee
- 2002 - Present: Member - Engineering Faculty Council (EFC)
- 2002 - Present: Member - AU Diversity Leadership Council

HONORS AND AWARDS
- 2000: College of Engineering Birdsong Merit Teaching Award - Auburn University.
- 1999: Auburn Alumni Professor - Auburn University. 4 years
• 1999: Alumni Engineering Council Senior Faculty Research Award - Auburn University.
• 1995: Faculty Early Career Development (CAREER) - National Science Foundation. 4 years
• 1991: George Goldfinger Award - North Carolina State University, Coll. of Textiles. Best Ph.D. Dissertation over two years

PROFESSIONAL DEVELOPMENT ACTIVITIES

• 1992 - Present: ASME Meetings - TED Executive Committee

RESEARCH INTERESTS

• Fabric design, development and analysis
• Nano fiber manufacturing and characterization
• Yarn and fabric testing and analysis
• Weaving and weaving machinery
• Engineered fibrous structures and composites
• Textile machinery and process design and development

SELECTED PUBLICATIONS


PATENTS

EDUCATION

- 1970 - Ph.D., Fiber and Polymer Science, N. C. State University
- 1967 - MS, Wood and Paper Science, N. C. State University
- 1964 - BS, Pulp and Paper Technology, N. C. State University

EXPERIENCE

Years of experience at Auburn: 28

- 1993 - Present: Professor, Textile Engineering, Auburn University
- 1976 - 1993: Associate Professor, Textile Engineering, Auburn University
- 1970 - 1976: Senior Research Chemist, Polyester Research, Goodyear Tire and Rubber Company

SCIENTIFIC AND PROFESSIONAL SOCIETIES

- 1976 - Present: American Chemical Society
- 1975 - Present: The Fiber Society
- 1964 - Present: TAPPI

INSTITUTIONAL AND PROFESSIONAL SERVICES

- 1999 - Present: Member International Nonwovens Conf. Committee - Internat Nonwovens and Disposables Association
- 1998 - Present: Member Technical Advisory Board - Internat Nonwovens and Disposables Association

HONORS AND AWARDS

- 2000: Mark Hollingsworth Prize - TAPPI Nonwovens Division. For service to TAPPI and the Nonwovens Industry
- 1999: Philpott-WestPoint Stevens Professorship - Auburn University.
- 1990: Outstanding Faculty Member - Textile Engineering Dept. Auburn University. Student voting
- 1990: Outstanding Faculty - Textile Engineering Department. Student voting
- 1982: Honorary Member - Phi Psi. Textile Honorary Fraternity

RESEARCH INTERESTS

- Fiber extrusion, Nonwovens technology, Chemical modification of fibers and polymers, Protective fabrics, Recycling of waste fibers (feathers), Construction of braided structures.

SELECTED PUBLICATIONS

PATENTS

GISELA BUSCHLE-DILLER
Associate Professor
223 Textile Building
Phone: (334) 844-5468, Fax: (334) 844-4068
E-mail: giselabd@eng.auburn.edu
Website: http://www.eng.auburn.edu/~giselabd/

EDUCATION

- 1989 - Ph.D., Chemistry, University of Stuttgart, Germany
- 1985 - Diploma, Chemistry, University of Stuttgart, Germany
- 1979 - Pre-Diploma, Chemistry, University of Stuttgart, Germany

EXPERIENCE

Years of experience at Auburn: 9

- 1999 - Present: Associate Professor, Textile Engineering, Auburn University
- 1998 - 2001: Adjunct Research Assistant Professor, College of Agricultural and Environmental Sciences, University of California, Davis
- 1995 - 1999: Assistant Professor, Textile Engineering, Auburn University
- 1995 - 1995: Research Associate, Analytical Laboratories, Rathgen Laboratories, Berlin, Germany
- 1990 - 1993: Postdoctoral Research Associate, College of Agricultural and Environmental Sciences, University of California, Davis

SCIENTIFIC AND PROFESSIONAL SOCIETIES

- 2001 - Present: Fiber Society
- 1995 - Present: American Association of Textile Chemists Colorists

INSTITUTIONAL AND PROFESSIONAL SERVICES

- 2003 - Present: U.S. Representative, Natural Polymers Division - Fraunhofer Inst. Applied Polymer Research, Germany
- 2001 - Present: Chair - International Student Committee, Auburn University
- 1998 - Present: USDA Research panel member, NRI & SBIR - US Department of Agriculture

HONORS AND AWARDS

- 2002: National Textile Center Award for Scientific Excellence - National Textile Center.
PROFESSIONAL DEVELOPMENT ACTIVITIES


RESEARCH INTERESTS

- Enzyme technology for fiber materials; electrospinning of biodegradable nanofibers, surface chemistry and surface modification technology, natural polymers, dyeing and finishing

SELECTED PUBLICATIONS

YEHIA EL MOGAHZY  
Professor  
207 Textile Bldg  
Phone: (334) 844-5463, Fax: (334) 844-4068  
E-mail: elmogye@auburn.edu  
Website: http://www.eng.auburn.edu/~yehiae/  

EDUCATION  
- 1986 - Ph.D., Fiber & Polymer Science, North Carolina State University  
- 1978 - MS, Textile Engineering, Alexandria University  

EXPERIENCE  
Years of experience at Auburn: 18  
- 2003 - Present: USDA National Research Review Committee Member, USDA-ARS  
- 2000 - Present: Consultant to the Egyptian Minister of Industry, The Ministry of Industry-Egypt  
- 1999 - Present: Manufacturing Cost Consultant, Mayfair Spinning-Pakistan  
- 1997 - Present: Quality Program-Consultant, Manifattura di Legnano  
- 1990 - Present: EFS Algorithms Consultant, Cotton Incorporated-U.S.A.  

SCIENTIFIC AND PROFESSIONAL SOCIETIES  
- 1997 - Present: Fiber Society  
- 1995 - Present: ASQC  
- 1990 - 1995: ASME  
- 1990 - Present: Textile Quality Control association  

HONORS AND AWARDS  
- 2002: WestPoint Stevens Distinguished Professor - Auburn University.  
- 1999: Birdsong Outstanding Faculty Award - Auburn University.  
- 1996: Outstanding Faculty member - Outstanding Faculty member.  
- 1995: Outstanding Faculty member - Auburn University.  
- 1994: Outstanding Faculty member - Auburn University.  
- 1993: Outstanding Faculty member - Auburn University.  

PROFESSIONAL DEVELOPMENT ACTIVITIES  
- 2004 - Present: Integrated Quality Control-ITAS-Course -  
- 1999 - Present: Video-Course on Statitistics and Quality Control -  
- 1995 - Present: Statistics for Engineers and Science-Course -
RESEARCH INTERESTS

- (1) Human-Related Aspects of Textiles
- (2) Judgmental-Forecasting Techniques
- (3) Protective Clothing

SELECTED PUBLICATIONS


PATENTS

YASSER GOWAYED  
Associate Professor  
222A Textile Building  
Phone: (334) 844-5496, Fax: (334) 844-4068  
E-mail: gowayed@auburn.edu  
Website: http://www.eng.auburn.edu/~ygowayed

EDUCATION

- 1992 - Ph.D., Fiber and Polymer Science, North Carolina State University
- 1989 - MS, Materials Engineering, The American University in Cairo
- 1980 - BS, Civil Engineering, Ain Shams University, Cairo, Egypt

EXPERIENCE

Years of experience at Auburn: 12

- 1996 - Present: Associate Professor, Textile Engineering, Auburn University
- 1992 - 1996: Assistant Professor, Textile Engineering, Auburn University
- 1980 - 1989: Senior Structural Engineer, Howeedy Consultants, Cairo, Egypt

INSTITUTIONAL AND PROFESSIONAL SERVICES

- 2003 - Present: Member - Presidential Symposium Committee
- 2002 - 2003: Member - Campus Planning Committee
- 2002 - Present: Faculty Advisor - Muslim Student Association
- 1996 - Present: Department representative - College of Engineering Faculty Council

HONORS AND AWARDS

- 2000: Outstanding Faculty Member - Auburn University.
- 1999: Outstanding Faculty Member - Auburn University.

PROFESSIONAL DEVELOPMENT ACTIVITIES

- 2000 - 2001: Visiting Professor, Philadelphia University - Sabbatical year

RESEARCH INTERESTS

- Modeling, design and manufacture of textile composites
- Mechanics of flexible structures
- Image analysis
SELECTED PUBLICATIONS

ALIECIA R. MCCLAIN
Assistant Professor
221 Textile Building
Phone: (334) 844-5459, Fax: (334) 844-4068
Email: amcclain@eng.auburn.edu
Website: http://www.eng.auburn.edu/~amcclain/

EDUCATION

- 1998 – Ph.D., Agricultural and Environmental Chemistry, Division of Fiber and Polymer Science, University of California Davis.
- 1991 – M.S., Polymer Chemistry, Clark-Atlanta University,

EXPERIENCE

Years of experience at Auburn: 5

- 1998 – Present: Assistant Professor, Textile Engineering, Auburn University.
- 2002: Visiting Professor, Tuskegee University

HONORS AND AWARDS

2003: Outstanding Faculty Member - College of Engineering.
2000: Honorary Member of Phi Psi Textile Fraternity.

RESEARCH INTERESTS

- Polymer Chemistry
- Fiber and Polymer Science
- Nano-Fibers
- Conducting and Electro-Optic Polymers
- Environmental Science Orientation
- Wastewater Treatment
- Biological Wastewater Treatment
- Hazardous Waste Clean-up
- Industrial Wastewater Treatment

SELECTED PUBLICATIONS


PATENTS

PETER SCHWARTZ
Professor & Head
101 Textile Bldg.
Phone: (334) 844-5452, Fax: (334) 844-4068
E-mail: schwartz@eng.auburn.edu
Website: schwartz.eng.auburn.edu

EDUCATION

• 1981 - PhD, Fiber and Polymer Science, North Carolina State University
• 1972 - MA, Mathematics, University of Pittsburgh
• 1970 - MS, Engineering Mechanics, Georgia Institute of Technology
• 1968 - BEng, Textile Engineering, Georgia Institute of Technology

EXPERIENCE
Years of experience at Auburn: 3

• 2002 - Present: Professor Emeritus, Textiles & Apparel, Cornell University
• 2001 - Present: Professor & Head, Textile Engineering, Auburn University
• 1997 - 1998: Gastprofessor, Polymers and Composites, Technical University of Hamburg-Hamburg
• 1996 - 2002: Professor, Textiles & Apparel, Cornell University
• 1989 - 1989: Visiting Associate Professor, Mechanical Engineering, Massachusetts Institute of Technology
• 1987 - 1994: Associate Professor, Textiles and Apparel, Cornell University
• 1982 - 1987: Assistant Professor, Textiles and Apparel, Cornell University
• 1976 - 1982: Instructor, Textile Technology, North Carolina State University
• 1972 - 1976: Senior Engineer, Manufacturing Engineering, Talon/TEXTRON

SCIENTIFIC AND PROFESSIONAL SOCIETIES

• American Association for Engineering Education
• American Association of Textile Chemists & Colorists
• American Chemical Society
• American Society of Mechanical Engineers
• Fiber Society
• Materials Research Society

INSTITUTIONAL AND PROFESSIONAL SERVICES

• 2001 - Present: Head, Department of Textile Engineering - Auburn University
• 2001 - Present: Operating Board - National Textile Center
• 1993 - Present: Editorial Board, - Advanced Composites Letters

HONORS AND AWARDS

• 1995: Gamma Sigma Delta Distinguished Research Award - Cornell University.
• 1994: ASTM Committee D-13 Harold DeWitt Smith Memorial Award - ASTM.
• 1993: Kappa Omicron Nu/Human Ecology Alumni Distinguished Teaching Award - Cornell University.
• 1992: Andrew D. White Outstanding Faculty Award - Cornell University.
• 1991: Honor Society of Gamma Sigma Delta - Cornell University.

RESEARCH INTERESTS

• Percolation modeling of flow through porous media
• Stochastic modeling
• Micromechanics of composite materials

SELECTED PUBLICATIONS


PATENTS

HOWARD LAVANN THOMAS, JR.
Associate Professor
115 Textile Engineering Building
Phone: (334) 844-5546, Fax: (334) 844-4068
E-mail: thomahl@eng.auburn.edu
Website: http://www.eng.auburn.edu/~hthomas

EDUCATION

• 1991 - Ph.D., Textile and Polymer Science, Clemson University
• 1987 - MS, Textiles, Georgia Institute of Technology
• 1974 - BS, Textiles, Georgia Institute of Technology

EXPERIENCE
Years of experience at Auburn: 9

• 1995 - Present: Associate Professor, Textile Engineering, Auburn University
• 1990 - 1995: Professor, Institute of Textile Technology
• 1981 - 1986: TTU Ingenieur, Textil Technische Untersuchung, Sulzer Ruti AktienGesellschaft
• 1978 - 1981: Industrial Engineer, Corporate Industrial Engineering, Springs Industries
• 1976 - 1978: Industrial Engineer, Cotton and Blended Fabrics Division Engineering, J.P. Stevens and Company
• 1975 - 1976: Industrial Engineer, Cone Mills Corporation

SCIENTIFIC AND PROFESSIONAL SOCIETIES

• 1994 - 2000: American Association of Textile Chemists and Colorists
• 1993 - 1999: The Textile Institute

INSTITUTIONAL AND PROFESSIONAL SERVICES

• 2003 - Present: Faculty Senator - Auburn University
• 1996 - 2000: Faculty Senator - Auburn University

RESEARCH INTERESTS

• Geotextile barrier fabrics
• Protective and barrier fabrics
• Textile machinery improvement and development
• Kinetic Energy Dissipation Media

SELECTED PUBLICATIONS


**CONSULTING EXPERIENCE**

- **2002 - 2003:** Revision of Surgical Instrument Low Friction Barrier - Core Dynamics
- **2001 - Present:** Development of Ballistic Resistant Materials - Plainsman Armor International

**PATENTS**

Appendix I-D

QUESTIONNAIRE

About the GRADUATES of the

AUBURN UNIVERSITY’S

TEXTILE ENGINEERING PROGRAM

Please evaluate the performance of your employee(s) who are the graduates of Auburn University’s Textile Engineering Program (not Textile Management and Technology nor Textile Chemistry) within the last 5 years using the following scale in the following categories by writing the number in the box after each category:

1: unsatisfactory
2: average
3: good
4: very good
5: excellent

a) ability to apply knowledge of mathematics, science and engineering ………………………………

b) ability to design and conduct experiments, as well as to analyze and interpret data ………………

c) ability to design a system, component, or process to meet desired needs ………………………

d) ability to function on multidisciplinary teams ………………………………………………………

e) ability to identify, formulate and solve engineering problems …………………………………

f) understanding of professional and ethical responsibility …………………………………………

g) ability to communicate effectively …………………………………………………………………

h) the broad education necessary to understand the impact of engineering solutions in a global and societal context ………………………………………………………

i) recognition of the need for, and an ability to engage in internal and external continued education and training ………………………………………………………

j) knowledge of contemporary issues ………………………………………………………………

k) ability to use the techniques, skills and modern engineering tools necessary for engineering practice……………………………………………………………………

You may enter any other comments that you would like to make about our graduates:

Evaluator Name:      Title:     Date:  
(optional)

Return to:  
Dr. Sabit Adanur  
Department of Textile Engineering  
Auburn University, AL 36849-5327
## Appendix I-E

### TEXTILE ENGINEERING LABORATORIES

### EQUIPMENT LIST

<table>
<thead>
<tr>
<th>Equipment Name</th>
<th>Year Purchased</th>
<th>Function</th>
<th>Location</th>
<th>Replacement Value ($1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fiber Extrusion Lab</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oven</td>
<td>1987</td>
<td>Heat treatment</td>
<td>231</td>
<td>1</td>
</tr>
<tr>
<td>Commercial extruder</td>
<td>1987</td>
<td>Fiber extrusion</td>
<td>231</td>
<td>400</td>
</tr>
<tr>
<td>Desk top extruder</td>
<td>1994</td>
<td>Fiber extrusion</td>
<td>231</td>
<td>70</td>
</tr>
<tr>
<td><strong>Yarn Manufacturing Lab</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chavis winder</td>
<td>1983</td>
<td>Winder</td>
<td>208</td>
<td>30</td>
</tr>
<tr>
<td>Automatic Winder</td>
<td>1985</td>
<td>Winder</td>
<td>208</td>
<td>50</td>
</tr>
<tr>
<td>Saco-Lowell comber</td>
<td>1985</td>
<td>Combing</td>
<td>208</td>
<td>27</td>
</tr>
<tr>
<td>Uster classimat system</td>
<td>1987</td>
<td>Yarn testing</td>
<td>208</td>
<td>8</td>
</tr>
<tr>
<td>Peyer yarn monitor</td>
<td>1989</td>
<td>Yarn analysis</td>
<td>208</td>
<td>6</td>
</tr>
<tr>
<td>Savio textile machine</td>
<td>1989</td>
<td>Winding</td>
<td>208</td>
<td>25</td>
</tr>
<tr>
<td>Murata air-jet spinning machine</td>
<td>1989</td>
<td>Yarn manufacturing</td>
<td>208</td>
<td>120</td>
</tr>
<tr>
<td>Saco-Lowell</td>
<td>1991</td>
<td>Roving</td>
<td>208</td>
<td>50</td>
</tr>
<tr>
<td>Trutzchler</td>
<td>1991</td>
<td>Carding</td>
<td>208</td>
<td>100</td>
</tr>
<tr>
<td>Ring sinning machine</td>
<td>1983</td>
<td>Yarn manufacturing</td>
<td>208</td>
<td>60</td>
</tr>
<tr>
<td>Open end spinning machine</td>
<td>1996</td>
<td>Yarn manufacturing</td>
<td>208</td>
<td>80</td>
</tr>
<tr>
<td>Friction spinning machine</td>
<td>1997</td>
<td>Yarn manufacturing</td>
<td>208</td>
<td>100</td>
</tr>
<tr>
<td>Equipment Name</td>
<td>Year Purchased</td>
<td>Function</td>
<td>Location</td>
<td>Replacement Value ($1000)</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>----------------</td>
<td>---------------------------</td>
<td>----------</td>
<td>---------------------------</td>
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<tr>
<td><strong>Fabric Formation Lab</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratera flat braiding machine</td>
<td>1979</td>
<td>Braiding</td>
<td>118B</td>
<td>25</td>
</tr>
<tr>
<td>New England Butt braiding</td>
<td>1982</td>
<td>Braiding</td>
<td>118B</td>
<td>35</td>
</tr>
<tr>
<td>Wardwell composite braiding</td>
<td>1995</td>
<td>Braiding</td>
<td>118B</td>
<td>150</td>
</tr>
<tr>
<td>Spool winding</td>
<td>1995</td>
<td>Winding for braiding machine</td>
<td>118</td>
<td>30</td>
</tr>
<tr>
<td>Draper shuttle loom</td>
<td>1975</td>
<td>Weaving</td>
<td>118</td>
<td>10</td>
</tr>
<tr>
<td>Tsukadoma air jet loom</td>
<td>1992</td>
<td>Weaving</td>
<td>118</td>
<td>90</td>
</tr>
<tr>
<td>Air-Jet weaving machine</td>
<td>2002</td>
<td>Weaving</td>
<td>226</td>
<td>15</td>
</tr>
<tr>
<td>Nouvo Pignone rapier loom</td>
<td>1993</td>
<td>Weaving</td>
<td>118</td>
<td>180</td>
</tr>
<tr>
<td>Sulzer projectile 7200</td>
<td>1997</td>
<td>Weaving</td>
<td>118</td>
<td>100</td>
</tr>
<tr>
<td>Jakob Muller narrow loom</td>
<td>1998</td>
<td>Weaving</td>
<td>118</td>
<td>20</td>
</tr>
<tr>
<td>Karl Mayer sample tricot machine</td>
<td>1983</td>
<td>Knitting</td>
<td>118</td>
<td>30</td>
</tr>
<tr>
<td>Gibbs warp knitting machine</td>
<td>1983</td>
<td>Knitting</td>
<td>118</td>
<td>30</td>
</tr>
<tr>
<td>Vanguard circular jersey machine</td>
<td>1991</td>
<td>Knitting</td>
<td>118</td>
<td>80</td>
</tr>
<tr>
<td>Vanguard sweat shirt machine</td>
<td>1991</td>
<td>Knitting</td>
<td>118</td>
<td>80</td>
</tr>
<tr>
<td><strong>Nonwovens Lab</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber locker</td>
<td>1980</td>
<td>Nonwoven manufacturing</td>
<td>009</td>
<td>70</td>
</tr>
<tr>
<td>Air compressor</td>
<td>1980</td>
<td>Supplies compressed air</td>
<td>009</td>
<td>40</td>
</tr>
<tr>
<td>Calendar Roll</td>
<td>1987</td>
<td>Fabric bonding</td>
<td>009</td>
<td>15</td>
</tr>
<tr>
<td>Power supply unit</td>
<td>1988</td>
<td>Power supply</td>
<td>009</td>
<td>5</td>
</tr>
<tr>
<td>Thermal convection oven</td>
<td>1989</td>
<td>Heats fibers to bond</td>
<td>009</td>
<td>15</td>
</tr>
<tr>
<td>Space humidifier</td>
<td>1990</td>
<td>Stabilize humidity</td>
<td>009</td>
<td>5</td>
</tr>
<tr>
<td>Feeder-Webber</td>
<td>1991</td>
<td>Cleans and aligns fibers</td>
<td>009</td>
<td>45</td>
</tr>
<tr>
<td>Lapper with aprons</td>
<td>1991</td>
<td>laps fiber web coming out of card</td>
<td>009</td>
<td>40</td>
</tr>
<tr>
<td>Slitter with power supply</td>
<td>1994</td>
<td>Slitting</td>
<td>009</td>
<td>4</td>
</tr>
<tr>
<td>Rotorring System</td>
<td>1995</td>
<td>Nonwoven mfg.</td>
<td>003</td>
<td>15</td>
</tr>
<tr>
<td>Equipment Name</td>
<td>Year Purchased</td>
<td>Function</td>
<td>Location</td>
<td>Replacement Value ($1000)</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>----------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Network analyzer</td>
<td>1996</td>
<td>Analysis</td>
<td>003</td>
<td>3</td>
</tr>
<tr>
<td>12 inch card roller top sample</td>
<td>1995</td>
<td>Carding</td>
<td>005</td>
<td>10</td>
</tr>
<tr>
<td>ASI Pentium 100 comp., monitor</td>
<td>1996</td>
<td>Interface</td>
<td>005</td>
<td>1</td>
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<tr>
<td>Vector drives</td>
<td>1997</td>
<td>Interface</td>
<td>005</td>
<td>5</td>
</tr>
<tr>
<td>CMC Even-feed</td>
<td>1996</td>
<td>Opens fibers</td>
<td>007</td>
<td>15</td>
</tr>
<tr>
<td>ASI Pentium 133 computer</td>
<td>1996</td>
<td>Interface</td>
<td>007</td>
<td>1</td>
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</tbody>
</table>

Advanced Fibrous Materials Lab

<table>
<thead>
<tr>
<th>Equipment Name</th>
<th>Year Purchased</th>
<th>Function</th>
<th>Location</th>
<th>Replacement Value ($1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instron 22000 lb</td>
<td>1994</td>
<td>Material testing</td>
<td>226</td>
<td>60</td>
</tr>
<tr>
<td>Computers, printers (3)</td>
<td>1994</td>
<td>Data acquisition</td>
<td>226</td>
<td>5</td>
</tr>
<tr>
<td>Heat chamber</td>
<td>1995</td>
<td>Material testing</td>
<td>226</td>
<td>15</td>
</tr>
<tr>
<td>Air-jet Simulator</td>
<td>2003</td>
<td>Data acquisition</td>
<td>226</td>
<td>300</td>
</tr>
<tr>
<td>Hybrid Woven/Knitting Mach (2)</td>
<td>1999</td>
<td>Weaving/knitting</td>
<td>226</td>
<td>200</td>
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</tbody>
</table>

Composites Lab

<table>
<thead>
<tr>
<th>Equipment Name</th>
<th>Year Purchased</th>
<th>Function</th>
<th>Location</th>
<th>Replacement Value ($1000)</th>
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<tbody>
<tr>
<td>Compression molding machine</td>
<td>1997</td>
<td>Composite mfg.</td>
<td>224A</td>
<td>25</td>
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<tr>
<td>Resin transfer molding</td>
<td>1995</td>
<td>Composite mfg.</td>
<td>224A</td>
<td>85</td>
</tr>
<tr>
<td>Fatigue machine</td>
<td>1998</td>
<td>Composite testing</td>
<td>224A</td>
<td>15</td>
</tr>
<tr>
<td>Four axis filament winder</td>
<td>2001</td>
<td>Composite mfg.</td>
<td>232</td>
<td>220</td>
</tr>
</tbody>
</table>

Dyeing and Finishing Lab

<table>
<thead>
<tr>
<th>Equipment Name</th>
<th>Year Purchased</th>
<th>Function</th>
<th>Location</th>
<th>Replacement Value ($1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrophotometer, computer</td>
<td>1975</td>
<td>Analysis</td>
<td>108</td>
<td>1</td>
</tr>
<tr>
<td>Perkin-Elmer spectrophotometer</td>
<td>1975</td>
<td>Analysis</td>
<td>108</td>
<td>25</td>
</tr>
<tr>
<td>Continuous dye range</td>
<td>1977</td>
<td>Dyeing</td>
<td>108</td>
<td>500</td>
</tr>
<tr>
<td>Tru Shade Varidrive dye machine</td>
<td>1977</td>
<td>Dyeing</td>
<td>108</td>
<td>10</td>
</tr>
<tr>
<td>Morton Systems dye machine</td>
<td>1977</td>
<td>Dyeing</td>
<td>108</td>
<td>10</td>
</tr>
<tr>
<td>Launder-ometer</td>
<td>1977</td>
<td>Testing</td>
<td>108</td>
<td>25</td>
</tr>
<tr>
<td>West Point Slasher</td>
<td>1979</td>
<td>Apply size to yarn</td>
<td>108</td>
<td>125</td>
</tr>
<tr>
<td>Equipment Name</td>
<td>Year Purchased</td>
<td>Function</td>
<td>Location</td>
<td>Replacement Value ($1000)</td>
</tr>
<tr>
<td>---------------------------------------</td>
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<td>---------------------------</td>
<td>----------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Creel</td>
<td>1979</td>
<td>Hold yarn packages</td>
<td>108</td>
<td>30</td>
</tr>
<tr>
<td>Slasher</td>
<td>1979</td>
<td>Applies size to yarn</td>
<td>108</td>
<td>125</td>
</tr>
<tr>
<td>Slasher controls</td>
<td>1979</td>
<td>Applies size to yarn</td>
<td>108</td>
<td>4</td>
</tr>
<tr>
<td>Slasher dials</td>
<td>1979</td>
<td>Applies size to yarn</td>
<td>108</td>
<td>1</td>
</tr>
<tr>
<td>Pennsylvania scale</td>
<td>1980</td>
<td>Measurement</td>
<td>108</td>
<td>1</td>
</tr>
<tr>
<td>Aliba Texomat dye machine</td>
<td>1980</td>
<td>Dyeing</td>
<td>108</td>
<td>10</td>
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RESPONSIBILITIES
Each student has responsibility to select a project advisor (or co-advisors) before the second week of the semester. A weekly meeting time with your advisor(s) should be arranged to measure the work progress of your FBEN 4910. These deadlines are suggested:

1. By end of week two—Select topics and key terms to use in library search.
2. By end of week six—Retrieve all sources for review.
3. By end of week nine—Give the project advisor(s) the first draft of the literature review.
4. By end of week eleven—Give to the project advisor(s) a first draft of the title, introduction, specific objectives, plan of work, and list of references.
5. By end of week thirteen—Verify with the project advisor(s) that the project is on schedule to initiate the 4920 portion.
6. By one week prior to last day of classes—Obtain the project advisor(s) approval of the final report and provide the project advisor(s) with 2 unbound copies and submit one additional copy in Room 115 for department files.

Your project advisor(s) will determine your final grade, and may incorporate the required additional independent evaluations from two faculty members. An advisor can penalize the student by 20% on the final grade for failure to meet the suggested deadlines above. (Refer to the grading philosophy provided on the next page). Grading responsibility splits 50-50 with co-advisor.

Final reports submitted after Dead Day may be reduced by one letter grade.

GRADING POLICY
Written reports are required for FBEN 4910. A written report and oral presentation (open to department faculty, staff, and students) are required for and FBEN 4920.

The project advisor(s) will base the grade on evaluation of:

1. Neatness of presentation
2. Organization of content
3. Adherence to format
4. Readability
5. Specific objectives
6. Theoretical underpinnings
7. Plan of work (procedures)
8. Significance of work (FBEN 4920)
9. Logic of conclusions (FBEN 4920)
10. Recommendations (FBEN 4920)

Advisors will also evaluate:

1. Quantity of work done
2. Urgency and quality of work
3. Research procedures used
4. Adherence to instructions
5. Responsibility and attitude
6. Motivation and initiative

**FBEN 4920 INITIATION**
The following steps should be taken to prepare for the actual research proposed in your FBEN 4910 report to be done during the 4910, 4920 semester(s), respectively:

1. Determine availability and functionality of machinery and equipment.
2. Get assurance of help from staff and others.
3. Obtain necessary materials.
4. Develop time frame for work to begin and end.
5. Discuss with advisor methods of evaluation and data collection.
6. Obtain permission for use of human and/or animal subjects when required.
7. Obtain permission for use of industry facilities if appropriate.

Readiness to initiate the work proposed should be confirmed with your project advisor(s) by the thirteenth week of the FBEN 4910 semester.

**RESEARCH TOPICS SUGGESTED BY FACULTY**

**Dr. Abdel-Hady**
- Composite materials design and manufacturing
- Principles of stable winding over axi-symmetric structures
- Filament winding manufacturing technique
- Design with polymer based composites
- Finite element analysis with composite materials
- Graphical programming and instrumentation
- Graphical programming in LabView®
- Automatic control applied to the spinning process.
- Instrumentation of textile testing rigs
- Use of textiles in hover-craft vehicles.
- CAD/CAM systems

**Dr. Adanur**
- Property-performance relations of industrial textiles
- Medical textiles
Design and characterization of geotextiles
Paper machine clothing
Recycling of industrial textiles
Design and manufacture of complex shape composites
Measurement of warp and weft tension during weaving
Textile machine design

Dr. Broughton
- Design and development of a hollow fiber spinning process
- Modeling and testing of air conditioning filter performance
- Development of a new IR spectroscopy test for “sticky” cotton
- Development of a new test method for friction properties of fibers
- Development of an antibacterial fiber/fabric
- Use of neural networks in textile manufacture
- Selection of cotton fiber properties for textile manufacturing
- Development of a new carbonized rayon fiber
- Development of a new solvent spun rayon
- Development of spinning processes for polymers produced by microorganisms

Dr. Buschle-Diller
- Enzyme technology for fibers
- Surface chemistry of fibers
- Solid and liquid waste treatment technology
- Fiber modification and its effect on dyeing and finishing properties
- Enzymatic de-inking of paper
- Development of paper recycling process

Dr. ElMogahzy
- Fiber-to-yarn engineering
- Fiber blending theory and practice
- Quality control and SPC
- Waste Management Strategies
- Quality projection and fingerprinting

Dr. Gowayed
- Textile Composites
- Geotextiles
- CAD
Dr. McClain
- Development of new coated fibers/fabrics for removal of organic waste
- Design and preparation of high performance chelating agents based on fibrous materials (woven and nonwoven)
- Removal of heavy metal contaminants from wastewater
- Investigation of the adsorption properties of functional fibers
- Wastewater treatment

Dr. Schwartz
- Electrostatic fiber spinning and applications
- Stochastic analyses of fibrous assemblies

Dr. Thomas
- Interaction of hydrophilic and hydrophobic substances in size solutions
- Development of a new test for moisture and heat transmission using inanimate test objects
- Yarn response to variation in beat up angle on weaving machine
- Evaluation of tension variation device response times compared to machine imposed strain rates on weft
FBEN 4910 and FBEN 4920

REPORT FORMAT

Reports submitted in FBEN 4910, and FBEN 4920 will be permanently bound in hard cover grouped by academic year (i.e., 2000-2001 Fall through Summer inclusive). To have these reports uniform in quality the following guidelines are provided. Reports not prepared as prescribed will not be accepted. Paper quality used in these reports should be 20 pound or better (20 pound is the normal photocopy paper weight) with a brightness of 84 or higher.

1. The report should be double spaced using Times New Roman 12pt or Arial 12pt.
2. Laser or high quality inkjet printers should be used.
3. Each major section of the report should start on a new page with a top margin of 1.5 inches. The section title should be centered and entirely uppercase, and should be numbered using Roman numerals. Begin typing the first line of text, even if it is a subheading, one space below.
4. First, second and third order subheadings should be aligned at the left margin with first letter capitalized and all words underlined. The fourth order subheading should also be aligned at the left margin with first letter capitalized and all words underlined; however, no number should be used for the fourth order subheading. No more than four subheadings should be used. One blank line should proceed all subheading except the one case covered by item #3 above. The following mixed number/letter system is recommended to differentiate subheadings:

Example:
I. MAJOR SECTION
   A. First Order Subheading
      1. Second Order Subheading
         a. Third Order Subheading
            i. Fourth Order Subheading

5. Left-hand margins for every page, including the title page, should be 1.5 inches.
6. Right-hand margins should be 1 inch.
7. The top margin of all pages other than a major section’s beginning page should have a margin of one inch. All pages except the title page should be numbered at the bottom with the number centered on the 0.5 inches from the bottom. Pages prior to introduction should be numbered with lower Roman numerals, i.e., i, ii, iii, iv, ...The title page is assumed to be page number i but should not be numbered. The last line of text should be 0.75 inches from the bottom (leaving 0.25 inches between the text and the page number).
8. Major sections of your report should carry the following exact titles in the order shown below:
9. All reports will have a proper title page as illustrated below. A properly formatted title page, in Microsoft Word format (*.doc), may be downloaded at:  
ftp://schwartz.eng.auburn.edu/courses/srproj/title.doc

10. For the Table of Contents format, see the attached page. Subheadings which do not have number or letter should not be included in the Table of Contents. A copy of this page may be downloaded from ftp://schwartz.eng.auburn.edu/srproj/toc.doc

11. Statements in the report requiring a reference should be followed by the reference number in brackets, i.e., [3], meaning referenced material is from reference number 3 in the LIST OF REFERENCES.

12. Only those materials specifically mentioned in your report should be included in the list of references. The references are to be listed and numbered in order of their appearance in the text of the report. The formats for references are:

- **Book** [Authors(s), *Title*. Publisher, City, Page(s) Cited, Year.], *e.g.*, Russell, B. and Whitehead, A. N., *Principia Mathematica*. Oxford University Press, Oxford, pp. 26-39, 1918.

- **Web Page** [Page Title, URL, Date Accessed], *e.g.*, Auburn University College of Engineering Internal Homepage, http://www.eng.auburn.edu/, accessed 04 June 2001.


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INTRODUCTION
An introduction will normally address two primary aspects of a project: the scope of the intended work and justification for doing the work.

Scope:
May include statements covering a broader “overview” of the area being researched as well as being narrower “specific” statements defining the precise aspect of the broader area that will be addressed. Statements indicating what “will not” be included may also be appropriate (i.e., “The research proposed herein will be limited to _____________ and _____________ and will not include ________________”).

Justification:
Reasons supporting the idea of doing research should be given. What is the rationale for doing this particular study? Why is it significant or important that this work be done? Generally the following are considered to be good reasons for doing a research project:
Knowledge for the sake of knowledge
- Improve environment
- Reduce cost
- Improve process efficiency
- Improve product quality
- Determine the best of alternatives
- Initiate an original idea
- Design a new product, process or method

LITERATURE REVIEW
Need instruction to set up format and indicate where and how search was conducted. Search should be complete to indicate “STATE OF THE ART” but do not leave out history.
“Review” means report of others have published. Don’t try to be philosophical or put words in that represent your opinion. You will have an ample opportunity for that later on.
The most critical aspect of a review is the development of “note cards” concerning each reference in the review. Knowing what is relevant and jotting it down with proper reference notation is an essential step to produce a quality review.
Developing the review organization should entail a general separation of materials as either “broadly” related to the research topic or “specifically” related to the proposed work. Then, each relevant point of the review should be classified. Further classification of the relevant points should reveal an “organizational structure”.
The final test of the survey structure is whether it has a logical “flow” from start to finish. It should serve as a natural bridge between the report’s introduction and the specific objectives of the proposed work. The major headings in the review and subheadings of each section should be viewed separately as an outline to check the structure and to ensure consistency of form.
Actual writing of review should be relatively easy since all that is required is to “connect” relevant points in the logical outline.

**SPECIFIC OBJECTIVES**

The objective(s) of this research is (are):

Then make a list of the specific goal(s) of the proposed work:

\[ i. e., \text{“to determine, isolate, identify, provide, design \underline{\ldots}“}, \]

Be sure the objective is something you will be able to judge the success or failure after the project has been completed.

If there is only one objective, a list is inappropriate. Sometimes a primary objective followed by one or more secondary objectives is a better approach to a project. In some cases you may have preliminary objectives leading up to a primary objectives that depends on the success of the earlier steps.

**PLAN OF WORK**

The detail of your approach should be stated in logical sequence. Answer these questions in this section: 1) What materials, which process variables, what range of values, which test methods, what equipment will you use to accomplish your stated objectives? 2) How will you evaluate the results in order to make meaningful and valid conclusions? 3) Will statistics be used and if so what and how? 4) What is the overall experimental design?).

Copies of the “OBJECTIVE” and “PLAN OF WORK” from FBEN 4910 must be included as an appendix in the FBEN 4920 report, respectively. Explanation of the changes made in the proposed work should be included as part of the FBEN 4920 “EXPERIMENTAL” section.

**OTHER GENERAL GUIDELINES**

1. As in all technical writing, use the third person, passive voice.
2. The reader should not have to read your mind—put it on paper.
3. Be precise and complete; avoid colloquial jargon.
4. Keep sentence construction simple where practical.
5. Reference all statements that are not generally known facts. Broad generalizations should usually be referenced, or followed by specific referenced example.
6. Tables should be numbered (Arabic) and titled above the table; figures should be numbered (Arabic) and titled below. Titles for tables and figures should be understandable without refer ring to the text (See attached examples).
7. Drawings and figures should be generated using computer packages, such as Excel® for charts and graphs and Freehand® for drawings. Labels and legends should be easily readable when the figure is placed in the document.
8. Units (SI preferred) should be included on graphs and tables.

The following is a list of areas in which some previous research proposals and final reports have been deficient. Your grade will be better if you:
1. Follow the format.
2. Avoid mistakes in grammar.
3. Use the spellcheck feature of your word processor and proofread the report before submitting it.
4. Have the goal (benefit) of the work clearly stated in the “OBJECTIVE(S)” section of the report.
5. Have a specific work plan; a table of the different experiments planned is useful.
6. Have suitable controls to compare with your experimental results.
7. Assume that your reader is not familiar with your topic, but is capable of understanding it. Too much explanation is always better than too little.

FBEN 4920 GUIDELINES
The student has responsibility to arrange a weekly meeting with the advisor. The final grade will be determined by the advisor using the following elements:

- Advisor(s) evaluation 70%
- Oral presentation 30%

For the oral presentation, either a PowerPoint® presentation or the use of appropriate overhead projector transparencies of enlarged key parts of the FBEN 4920 report should be prepared. The presentation should include:

- The title
- Acknowledgments
- The introduction
- Key items from the literature
- The objectives
- Experimental procedures
- Key items from the results
- The conclusions
- The recommendations

Students are expected to wear non-casual suit or dress for the presentation. You should plan for about 20 minutes, including 5 minutes for questions. During the last 2 weeks of the semester, a schedule will be issued for presentations. In addition to the project advisor(s) two other faculty, appointed by the department head, will be asked to evaluate your report and presentation. Your project advisor(s), at their discretion, may take these independent observations into account when assigning a final project grade.

The actual work of FBEN 4910-4920 should be completed by the thirteenth week of the last semester to allow adequate time for report preparation. The project advisor(s) must approve the
final report prior to grading. Final reports are due one week prior to the last class day. Reports received after Dead Day will be reduced by one letter grade.

**FBEN 4920 REPORT FORMAT**

**Title page**

- **Abstract**: A brief account of the project including a clear description of the problem addressed and major findings of the work.
- **Table of Contents**
- **List of Tables**
- **List of Figures**
- **Introduction**
- **Literature Review**
- **Objectives**
- **Theoretical Background**
- **Experimental Procedure**
- **Results and Discussion**: Actual tabulation of data with narrative or significant results obtained. (Move lengthy data to appendix using tables and/or figures in text). Be sure to cover each objective in the same order as presented in the objectives section.
- **Conclusions and Recommendations**: Briefly state each conclusion that may be drawn from the work and make recommendations for future work that is needed in this area.
- **List of References**
- **Appendices**: A separate appendix, titled at the top, for each different entry appropriate for this project.
**Table and Figure Format**

**TABLES**

Number tables using Arabic numerals with the title at the top of the table. Tables should be numbered sequentially and inserted into text below the paragraph in which the table is first mentioned.

**Example:**

Table 6. Weibull shape and scale parameters for creep-rupture lifetimes of 7-graphite fiber hexagonal microcomposites under different levels of static stress.

<table>
<thead>
<tr>
<th>Stress Level* [%]</th>
<th>Applied Stress [MPa]</th>
<th>Sample Size</th>
<th>Shape Parameter</th>
<th>Scale Parameter [sec]</th>
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<td>24</td>
<td>0.36</td>
<td>294</td>
</tr>
</tbody>
</table>

*Percent of median microcomposite tensile strength
FIGURES:

Number figures using Arabic numerals with the title at the bottom of the figure. Figures should be numbered sequentially and inserted into text below the paragraph in which the figure is first mentioned.

Example:

Figure 1. Computerized data acquisition system and sensor electronics to study dynamics of yarn motion.
It will be the responsibility of each student to provide the following form as proof of meeting deadlines with the project advisor(s) signatures and dates. This form must be turned in to the FBEN 4920 class instructor prior to Dead Day.

1. Advisor(s), topic and key terms selected. 

   Advisor’s signature: ___________________________  Date: ________________

2. Review sources with computer list selected. 

   Advisor’s signature: ___________________________  Date: ________________

3. Literature review 1st draft turned in. 

   Advisor’s signature: ___________________________  Date: ________________

4. Other 4910 1st drafts turned in. 

   Advisor’s signature: ___________________________  Date: ________________

5. Student is ready to initiate research. 

   Advisor’s signature: ___________________________  Date: ________________


   Advisor’s signature: ___________________________  Date: ________________

7. All supplies and materials disposed of properly and work space left clean. 

   Advisor’s signature: ___________________________  Date: ________________
Senior Project Report Form

Student: __________________________
Evaluator: _______________________

Please rank on a five-point scale using the following: 1=unsatisfactory; 2=marginal; 3=average; 4=above average; 5=outstanding

**ORAL PRESENTATION**

Speaking ability: ___
Quality of visuals: ___
Overall evaluation of oral presentation: ___

**WRITTEN PRESENTATION**

Introduction: ___
Background/Literature Review: ___
Theoretical Background: ___
Experimental Procedures: ___
Discussion and Conclusions: ___
Tables and Figures: ___
Overall evaluation of written presentation: ___

If this is a team project, your evaluation of their performance as a team: ___