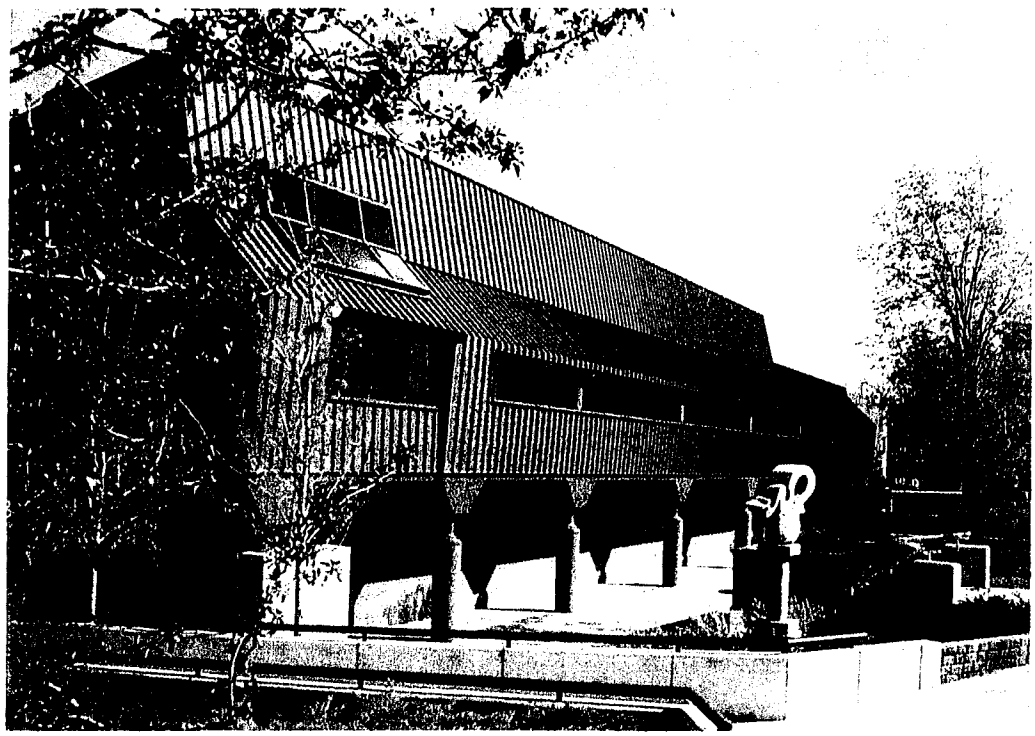
RUBBER (ENGINEERING) TECHNOLOGY

ACADEMIC PROGRAM REVIEW
2002 - 2003



MEMORANDUM

DATE: November 21, 2002

TO: Academic Senate

FROM: Academic Program Review Council

RE: Recommendations for:
Bachelor of Science Degree in Rubber Engineering Technology
Associate in Applied Science Degree in Rubber Technology

CC: Matthew Yang, Bob Marsh, Weilin Chang, Laurie Chesley, Thomas Oldfield, Barbara Chapman

DESCRIPTION OF PROGRAMS:

BS Degree in Rubber Engineering Technology

Established in 1998 to enhance the associate degree in rubber, this is the only BS degree in rubber engineering technology offered in the United States. This program was created in response to a void identified by the rubber industry, which is a major contributor to the program. FSU associate degree graduates and university transfers are given an opportunity to continue their rubber education. The focus of the curriculum is on manufacturing, but graduates are expected to be employed as engineers, designers, supervisors, and sales/marketing personnel, with many graduates likely achieving high-level management positions. Above average salaries are expected to be offered by employers ranging from small companies to international corporations.

State-of-the-art machinery and equipment are used in the laboratories to support and supplement the concepts in lectures and individual discussions.

A student rubber organization provides activities such as field trips, contacts with rubber industry professionals, and structured social activities. Fundraising supports trips to periodic national rubber conventions and expositions. Admission requires an associate degree in rubber technology (or equivalent) with a cumulative 2.5 GPA, a 2.5 GPA in required MATH courses, and a 2.7 GPA in RUBR courses.

Admission is competitive. Application must be submitted before March 1 for admission to the program in the following fall semester.

Graduates must complete all Ferris general education requirements as outlined in the General Education section of the University catalog.

AAS Degree in Rubber Technology

Established in 1998, this is the only associate of applied science (AAS) degree program in rubber technology available in the United States. This is the major preparatory program for the FSU bachelors in rubber engineering technology and is also used as the first two years of program laddering for students seeking manufacturing engineering technology, product design technology, sales/marketing and production management bachelors degrees. Students who choose not to continue in a bachelors program can be employed as

technicians and first-line supervisors with rubber processing companies and large multi-disciplined corporations. There is great demand for graduates of this program.

An understanding of processing techniques is the foundation for operation of major rubber processing machinery. The student also learns about auxiliary equipment, tooling, controls, testing and materials selection and properties. There is related coursework in the physical sciences, general education, product design, and mechanical principles. Laboratory experiences are used to provide practical applications for the concepts presented in lectures.

A student rubber organization provides activities such as field trips, contacts with rubber industry professionals, and structured social activities. Fundraising supports trips to periodic national rubber conventions and expositions.

The requirements for admission are a 2.0 GPA in high school and college work, plus high school algebra (ACT=19). The entering student should be mathematically, mechanically, and scientifically inclined.

Graduates must complete all Ferris general education requirements as outlined in the General Education section of the University catalog.

COST INFORMATION:

According to the 1999-2000 report from institutional research:

Total cost per SCH	
BS Degree in Rubber Engineering Technology	$197.03
AAS Degree in Rubber Technology	$207.62
Total program cost	
BS Degree in Rubber Engineering Technology	$12,806.99
AAS Degree in Rubber Technology	$13,287.66

RECOMMENDATIONS:

We recommend that the programs be continued.

(1) The program has a number of important strengths:

- The emphasis on preparation of students for a career in the rubber industry by these programs is central to the mission of Ferris State University.
- These programs are the first of their kind in the country and there are essentially no competitors.
- These programs are highly visible to industry.
- The demand for graduates is very high. There are far more jobs open than graduates of these programs. Many students report job offers after completion of their second internship.
- Salaries of recent graduates exceeds $40,000 per year.
- The programs occupy a recently renovated and expanded state of the art facility and are well equipped. There has been extremely strong industry support for these programs with respect to providing equipment and resources.

- The full time faculty is well qualified with considerable experience in industry
- The full time faculty is enthusiastic about their program.
- The quality of instruction as measured by the surveys of students and graduates is high.

(2) We recommend that the following steps need to be taken to maintain the quality of these program:

- This program is new and unique. Time is required for the programs and the University to identify a target audience for recruitment of students. The program faculty and the administration of the College of Technology should work with University Advancement and Marketing to develop a focused recruiting plan specific to this program that is directed not only at the high school market, but also at non-traditional sources of prospective students such as the military. New ways must be identified to reach prospective students who are unaware of the tremendous opportunities in this industry.
- The program faculty and administration should continue efforts to encourage industry to fund a directed marketing campaign that is carried out by someone dedicated to this program.
- The faculty should continue to maintain and expand relationships with industry to facilitate the recruitment of students and the acquisition of additional equipment.
- The faculty of this program should continue to work with and seek the advice of the Advisory Committee.
- The faculty should continue to review and revise the curriculum to meet the needs of industry.
- The faculty of the program must establish definite admission criteria, which are consistent with the academic demands of the curriculum and adhere to those standards.

Criteria Summary for:
BS Degree in Rubber Engineering Technology
AAS Degree in Rubber Technology

BS Degree in Rubber Engineering Technology

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State-of-the-art machinery and equipment are used in the laboratories to support and supplement the concepts in lectures and individual discussions.

A student rubber organization provides activities such as field trips, contacts with rubber industry professionals, and structured social activities. Fundraising supports trips to periodic national rubber conventions and expositions. Admission requires an associate degree in rubber technology (or equivalent) with a cumulative 2.5 GPA, a 2.5 GPA in required MATH courses, and a 2.7 GPA in RUBR courses.

Admission is competitive. Application must be submitted before March 1 for admission to the program in the following fall semester.

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An understanding of processing techniques is the foundation for operation of major rubber processing machinery. The student also learns about auxiliary equipment, tooling, controls, testing and materials selection and properties. There is related coursework in the physical sciences, general education, product design, and mechanical principles. Laboratory experiences are used to provide practical applications for the concepts presented in lectures.

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The requirements for admission are a 2.0 GPA in high school and college work, plus high school algebra (ACT=19). The entering student should be mathematically, mechanically, and scientifically inclined.

Graduates must complete all Ferris general education requirements as outlined in the General Education section of the University catalog.

- **CENTRALITY TO FSU MISSION:**
  The emphasis on preparation of students for a career in the rubber industry by these programs makes them clearly central to the mission of Ferris State University.

- **UNIQUENESS AND VISIBILITY OF PROGRAM:**
  Both the BS and AAS degree programs are unique. They are the first of their kind in the country and there is really only one other BS program in the country that is similar to the one at Ferris State University. The programs are highly visible to industry but do not seem to be visible to prospective students.

- **SERVICE TO STATE, NATION, WORLD:**
  These programs are too new to be able to document their level of service. The few graduates that have been produced have found jobs in the industry and have been a credit to the programs and to Ferris State University.

- **DEMAND BY STUDENTS:**
  The lack of demand by students is a matter of considerable concern to the faculty and administration of this program. It does not appear to be a problem specifically related to Ferris, but rather to the industry as a whole.

- **DEMAND FOR GRADUATES:**
  The demand for graduates is very high. There are far more jobs open than graduates of these programs. Many students report job offers after completion of their second internship.

- **PLACEMENT RATE AND AVERAGE SALARY OF GRADUATES:**
  The placement of graduates of the BS program is 100%. The average starting salary of BS graduates is approximately $45,000.

- **SERVICE TO NON-MAJORS:**
  The programs offer courses for plastics students who wish to pursue a dual major. They are also considering offering entry level and rubber testing courses for other non-majors allowing them to obtain certificates.

- **QUALITY OF INSTRUCTION:**
  The quality of instruction as measured by the surveys of students and graduates is high.

- **FACILITIES AND EQUIPMENT:**
  The programs occupy a recently renovated and expanded state of the art facility and are well equipped. There has been extremely strong industry support for these programs with respect to providing equipment and resources.

- **LIBRARY INFORMATION RESOURCES:**
  The library resources appear to be adequate for the needs of the program.
- **COST:**

  According to the 1999-2000 report from institutional research:

	Total cost per SCH
AAS Degree in Rubber Technology	$207.62
BS Degree in Rubber Engineering Technology	$197.03
	Total program cost
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- **FACULTY:**
  - **QUALIFICATIONS:**
    The full time faculty is well qualified with considerable experience in industry. They are enthusiastic about their program.
  - **PROFESSIONAL AND SCHOLARLY ACTIVITIES:**
    The full time faculty is active in professional organizations and works closely with industry.
  - **QUANTITY:**
    The number of faculty appears to be adequate for the needs of the programs.
- **ADMINISTRATION EFFECTIVENESS:**
  The administration appears to be supportive of the programs.

MEMORANDUM

DATE: November 21, 2002

TO: Academic Senate

FROM: Academic Program Review Council

RE: General Recommendations for Programs reviewed in the 2002-2003 review cycle

CC: Vice-Presidents Chapman, Oldfield, and Chesley; All Deans

Approximately one year ago 12 panels charged with reviewing a total of 18 programs were formed. These panels were composed of program faculty and friends of the program. The panels collected information, analyzed that information, and wrote thorough and rigorous reports that detailed the status of the programs. These reports also identified needs of the programs. Based upon the written documents submitted to the Academic Program Review Council, the answers to written questions generated by the Council, and discussion with panel members and program administrators, the APRC has generated specific recommendations for each program reviewed. These recommendations have been submitted as separate memos. On behalf of the entire University, the APRC extends its appreciation and gratitude for the work done by the program review panels.

GENERAL RECOMMENDATIONS

The following recommendations are derived from our collective review of the programs and represent our suggestions for addressing concerns that affect more than one program in the University. A review of general recommendations from previous Academic Program Review Council reports reveals that, although progress has been made, some programs still encounter the same or similar difficulties observed in previous years. It is clear many of these problems must be solved at the institutional level. If a similar recommendation was made previously, the years are indicated in parentheses.

THERE SHOULD BE A MORE THOROUGH PROOFREADING OF THE UNIVERSITY CATALOG BEFORE IT IS PUBLISHED.

At the beginning of each recommendation memo, under the section titled program description, a statement concerning each program is reproduced exactly as it appears in the online catalog. Often, the first impression of the University that is gained by prospective students and the general public is obtained through the Catalog. Therefore, it is a matter of concern when there are misspellings and examples of poor use of language in one of the most visible documents of the University.

THE ANNUAL REPORT ON THE CUMULATIVE IMPACT OF ACADEMIC PROGRAM REVIEW RECOMMENDATIONS SHOULD LIST THE RECOMMENDATIONS MADE BY THE COUNCIL AND THE SPECIFIC ADMINISTRATIVE RESPONSE TO THEM.

The Academic Program Review Council would like to thank Vice-President Chapman for providing the Senate and the Council with an Annual Report on the Cumulative Impact of Academic Program Review, which was in the form of a memo dated August 5, 2002. The Council recognizes that it may not be possible for the University to completely address all of the recommendations made by the Council in a calendar year and appreciates the efforts of the administration to follow up on the issues that are raised. The Council notes, however, that some of the actions taken do not directly correspond to the actual recommendations of previous Councils. For the sake of clarity of communication, the Council requests that in future updates, starting with the current review cycle, there be a list of the specific recommendations of the Council and the administrative response to them (2001-2002). There is a precedent for this in the memo from Teshome Abebe, former Provost and Vice-President for Academic Affairs dated July 30, 1996 in which he provided a status report on the progress that had been made concerning the Senate-approved APRC recommendations for programs reviewed in 1995-1996.

OTHER DIVISIONS OF THE UNIVERSITY SHOULD BE REVIEWED WITH RESPECT TO THE QUALITY OF SERVICE THAT THEY PROVIDE TO ACADEMIC PROGRAMS AND THE EDUCATIONAL MISSION OF THE UNIVERSITY. FEED BACK CONCERNING THE OUTCOME OF THESE REVIEWS SHOULD BE SUPPLIED TO THE ACADEMIC SENATE AND THE ACADEMIC PROGRAM REVIEW COUNCIL.

The Council appreciates the decision by the administration to develop a review process for University Advancement and Marketing and the computer consortia. The council would like to point out, however, that the focus of these reviews as described in the memo from Dr. Chapman dated August 5, 2002 does not completely address the concerns of previous Academic Program Review Councils. Hopefully the QI2000+ Committee mentioned in the document will establish a thorough process of review of divisions in the University that support and serve academic programs so that, when problems arise because of policy or implementation of policy, a mechanism will be in place to correct the problems and allow affected programs input in the development of new policies. The purpose of this request is to ultimately improve the quality of academic programs (2000-2001, 2001-2002).

THE UNIVERSITY SHOULD REVIEW THE POLICIES ASSOCIATED WITH THE ISSUING OF STUDENT ID CARDS AND THE PROCEDURES FOR ASSIGNING STUDENT BARCODES.

Students still have trouble accessing library databases from off-campus. Barcode numbers needed for database login are not tracked when ID's are issued so students must call the library to have their barcode entered before they can access the databases from off-campus. The FLITE staff has worked diligently to alleviate some of these problems, however, much of the difficulty could be avoided by coordination between Telcommunications and FLITE.

THE UNIVERSITY AND, IN PARTICULAR, THE COLLEGE OF ARTS AND SCIENCES, SHOULD ENSURE THAT AN ADEQUATE NUMBERS OF COURSES, OFFERED IN AN APPROPRIATE FORMAT (12 WEEKS), ARE OFFERED DURING THE SUMMER SEMESTER.

The curricular design in several of the colleges (particularly Allied Health and Business) requires that students build a full load schedule during the summer. While offering courses of varying lengths during the summer may be convenient for faculty, such an arrangement makes it extremely difficult for students to achieve a full load of classes. That in turn may cause the student to choose a course based on the timeframe in which it is offered rather than the its educational value.

THE UNIVERSITY SHOULD REQUIRE THAT THE ADMINISTRATIVE PROGRAM REVIEW FORMS SHOULD BE FILLED OUT ACCURATELY AND COMPLETELY.

The Administrative Program Review documents provided to the council by the program panels varied significantly with respect to their completeness and reliability. In several cases, questions on the form were not answered and data related to enrollment according to class standing and the number of graduates in a given year was not listed. The Council relies heavily on this document in assessing the status and viability of each program.

THE DESIGN AND DISTRIBUTION OF SURVEYS FOR ACADEMIC PROGRAM REVIEW SHOULD BE PROCESSED THROUGH A CENTRAL UNIVERSITY OFFICE WITH INPUT FROM THE PROGRAM REVIEW PANEL.

The academic program review process relies extensively on information gathered through surveys. It is apparent to the council that this type of activity should be coordinated through a central office, which provides services to panels for programs undergoing review. Most program faculty are not trained or experienced in survey methodology. This often results in poorly designed surveys, low response rate, and information of dubious validity. This problem is compounded by the fact that other divisions within the University are sending out different surveys, in many cases to some of the same individuals. It is true that different divisions within the University may be interested in obtaining different kinds of information, however there is certainly a basic core of information that is important to all units within the University. A standardized survey form should be designed and distributed utilizing established survey methodology. This form should allow individual programs or units in the University to ask additional specific questions related to information unique for their needs. The staff of this central office should provide support for follow up procedures to ensure adequate response rates. They should also assist the program review panels in the use of applicable statistical procedures to insure proper interpretation of the data.

THE UNIVERSITY NEEDS TO HAVE A CENTRAL DATABANK THROUGH WHICH ALUMNI AND GRADUATES OF PROGRAMS ARE TRACKED.

Most panels reported that significant numbers of surveys were returned due to an incorrect address. There is no question that in this mobile society it is difficult to keep track of individuals, however, if there is a cooperative approach to collecting data from various sources on campus, it should be possible to increase the reliability of existing databases.

INSTITUTIONAL RESEARCH SHOULD COMPILE THE INFORMATION REQUIRED BY PROGRAM FACULTY AND ADMINISTRATORS FOR THE PROGRAMS UNDERGOING THE ACADEMIC PROGRAM REVIEW PROCESS.

The document titled Academic Program Review: A Guide for Participants lists some specific types of information that are required for the review process. Currently, the seeking out and collecting of relevant programmatic information on an individual basis is an inefficient process and is an inordinately consuming use of program faculty and administrator's time. The previous Academic Program Review Council did meet with a representative from Institutional Research last spring to discuss their methods of data collection and how they arrived at their interpretation of the data. At that time, this individual expressed a willingness to work with the Panels in obtaining the information that they need. The current Academic Program Council should develop a specific list of the information that is required and communicate this to the staff in Institutional Research. The council requests administrative approval for this expansion of duties by the staff of Institutional Research (2001-2002).

THE UNIVERSITY SHOULD CONTINUE TO EXPLORE WAYS IN WHICH IT CAN HELP PROGRAMS MAINTAIN AND ACQUIRE NEW EQUIPMENT AS THE NEEDS OF INDUSTRY CHANGE.

The Council appreciates the response of the administration documented in Dr. Chapman's August 5, 2002 memo to previous recommendations concerning maintenance and acquisition of equipment. The Council also recognizes there is no way that the University can fund all of the equipment requirements of all of the programs at the University. With a few exceptions, most of the programs reviewed this cycle had adequate facilities and equipment. However, concern was expressed by several program panels related to funding for maintenance, replacement of equipment items, and the purchase of new equipment. Updating of computers to handle increasingly sophisticated software continues to be a problem. The University should continue to provide support for the maintenance of equipment and establish funds the upgrading of equipment. The procedures for requesting such funds should be widely communicated throughout the campus. In addition, the University should continue to encourage and support the efforts of faculty and program administrators as they seek off campus sources of equipment and resources. (1995-1996, 1997-1998, 1998-1999, 1999-2000, 2001-2002)

THE UNIVERSITY SHOULD INVEST IN PROGRAM SPECIFIC ENROLLMENT AND RECRUITING EFFORTS:

The current guidelines for the academic program review process require the APRC to evaluate enrollment in programs as a part of the review process. Low enrollment in a program does have a direct impact on program cost and faculty productivity (as defined by the business operations of the University), particularly in programs that are laboratory and technology intense. Low enrollment does not necessarily have a direct relationship to the quality of education that is delivered to students.

As far as the Academic Program Review Council was able to determine, at least with respect to the programs that were reviewed this year, low enrollment levels were unrelated to the quality of instruction, the availability of jobs in the field, the potential salaries of employees in the field, and even the availability of financial aid in the form of scholarships to students. Some of the under-enrolled programs that were reviewed this year have few or no competitors in the state of Michigan and in some cases in the country. The faculty in several

of these under-enrolled programs has made an intensive recruiting effort, which seems to have had only a limited impact on increasing student numbers. On the other hand, new degree initiatives in the College of Education and Human Services and in the College of Arts and Sciences have resulted in programs with rapidly increasing enrollments but limited opportunities in the job market. The difference seems to be the visibility of programs to prospective students.

It has become apparent to the members of the Council, particularly those who have served several years, that allocating a few marketing dollars to a program with enrollment difficulties and creating an attractive brochure does little to increase student numbers. Asking faculty to spend increasingly more time in recruitment efforts is not a particularly productive or effective approach to solving the problem. Typically faculty members have had little, if any, training in marketing techniques, demographic analysis, and brochure design. Most faculty members choose teaching because of their love of their subject area and their desire to share their knowledge with students, not because of an interest in the marketing of their program to prospective students.

If the University is truly committed to its historic mission of preparing students for a career and wishes to continue to serve the state of Michigan by providing graduates who are prepared to work in vital areas of our economy such as heavy industry or health care and yet maintain the fiscal viability of the University, it must address the issues related to the marketing low enrollment programs at an institutional level. It must supplement the efforts of faculty and administrators in programs with low enrollment through the use of institutional resources for focused marketing that increases the visibility of low enrollment programs and increases the awareness on the part of prospective students that many of the programs at Ferris State University lead to career options in vital industries in which high paying jobs are going unfilled.

THE ACADEMIC SENATE SHOULD REVIEW ITS CHARGE TO THE ACADEMIC PROGRAM REVIEW COUNCIL.

The Academic Program Review Council has begun the second round of program review. It is time to review and to reevaluate the criteria that are utilized as the basis for recommendations that are listed in the document Academic Program Review: A Guide for Participants. The academic program review process should focus on the quality of instruction offered in each program. Some of the criteria mentioned previously seem to have a marginal relationship to that goal, at best. For example, the focus on enrollment, productivity, cost of instruction, demand for graduates and the salaries they achieve are certainly of interest and importance to the administration. The question that arises is whether the academic program review process is the appropriate medium to collect and tabulate that data. Perhaps the academic program review process should focus more directly on what skills or competencies are required of graduates, how effectively programs deliver instruction that provides students with those skills and competencies, how the programs assess the skills and competencies of their students and graduates, and what hinders the programs in their attempts to fulfill their responsibilities to their students.

The Academic Program Review Council, 2002-2003

Jack Buss, Arts and Sciences , Chair
Douglas Fonner, Arts and Sciences
Carrie Forbes, Library and Information Services
Michael P Keating, Optometry
Richard Kowalkoski, University College
Jim Mayhew, Allied Health Sciences
Connie L Morcom, Education and Human Services
Norwood "Woody" Neumann, Pharmacy
Dan Skurski, Technology
William Smith, Business
Randy Stein, Technology

Questions for APR Panel
AAS Degree in Rubber Technology
BS Degree in Rubber Engineering Technology

1. Please list the primary skills, abilities, and knowledge base that you expect that a graduate of your program would possess.

   Our graduates should possess basic compounding skills and knowledge of chemicals used for the compounding. They should also understand the behavior of thermosets in processing and performance when made into parts, be knowledgeable about efficient manufacturing techniques and possess good analytical skills. They are expected to have good communication and the necessary business skills to move into management later in their career.

2. For each skill, ability or knowledge base listed above, identify the major component(s) of your curriculum that are designed to develop that characteristic in your graduate.

   Compounding skills: RUBR 110, Intro to Rubber Technology
   RUBR 223, Rubber Measurement & Testing
   RUBR 321, Rubber Compounds/Compounding
   PLTS 320, Plastics and Elastic Material
   Processing and manufacturing skills:
   RUBR 121 & 211, Rubber Processing 1 & 2
   RUBR 212, Rubber Tool Design & Construction
   RUBR 312, Rubber Product Design
   RUBR 411, Advanced Rubber Processing
   STQM 311, Continuous Improvement Tools
   Technical related courses in CHEM, EEET, ETEC, MECH, MFGE, MFGT and PHYS.
   Management and communication skills:
   COMM 121, Fundamentals of Public Speaking
   MGMT 305, Supervision and Leadership
   PLTS 300, Plastics Engineering Management Systems
   ACCT 201, Principles of Accounting 1
   RUBR 499, Rubber Senior Seminar
   ENGL 150, 211or 250 and 311, English classes
   Internship provides good learning experience for the combined skills.

3. On page 4, the administrative report for 2001 indicates that an area of concern is enrollment, particularly incoming freshman. The future goal was to fill freshman class capacity starting in 02F. On page 88 it is indicated that 8 new students enrolled in the fall of 2002. On the same page reference is made to an attached "Recruitment Plan Outline". Where is this located in the document?

   Sorry, it was left out. It is attached.

4. Please explain your recruitment strategies. Who are your target students? To what degree have you involved industry in your recruiting efforts? To what degree have you received administrative and institutional support in your recruiting efforts? Is

there anything hindering your efforts?

Industry representatives, program personnel and students have all been active in recruiting for the Rubber Program. The Rubber Manufacturers Association sent letters to 3,000 high school counselors in Michigan, Ohio and Indiana, and donates to a fund that has given a $1,000 scholarship to all new rubber students. Using Programmic Marketing funds, a mailing was made to 1,000 Michigan high school seniors who expressed interest in similar kinds of careers. We have arranged for several visits from high school students. Several of our students have visited their high schools to talk about the career opportunities. Presentations have been made to a number of rubber professional groups to encourage them to help recruit. The biggest limitation is the fact that this program consists of only 2 faculty and part of an administrator, which limits the recruiting efforts that can be made. We would hope to obtain additional Programmic Marketing funds.

5. On page 4 in the administrative report, future goals are set for 70% retention in the AAS program and 50% in the BS program. What are your current attrition rates? What steps have you taken to address attrition?

Tracking rubber students through the courses in their major suggests that the above goals are being met. Fewer students have graduated to date, as they are completing non-rubber graduation requirements, but most, if not all, are expected to fulfill their requirements.

6. How much overlap does your program have with the plastics program? What is the advantage to having two separate degree programs in this area compared to tracks in a common elastomer degree program? Are you competing for the same students?

Plastics stresses thermoplastic materials, whereas we stress thermosets; these are divergent materials and have distinctly different applications and processes. The rubber industry needs specialists in the area of thermosets who can begin contributing when employed with a minimum of training. A common degree would dilute the value of the current rubber degree. Because rubber holds appeal for students who want to deal more with material development than simply processing, we are not necessarily competing for the same students, although there is overlap.

Excluding internships, 9 rubber courses are unique to this curriculum and 3 are common to plastics (PLTS300, PLTS320 and PLTS/RUBR499). A "track" would greatly dilute the educational outcome.

Additional comments by Stan Smith are attached.

7. Please describe your internships. How are the sites for internship selected? How are they supervised? What is the rationale for allowing students to take internships at different points in the curriculum e.g., summer of freshman or sophomore year?

Internship sites are selected based on whether the processes employed at that location will give a good learning experience and whether that employer demonstrates a high

level of commitment to the educational process. Students may submit new sites for faculty approval. Students are visited, supervisors are contacted as are the students, weekly reports are submitted, and final reports by the student and supervisor are reviewed. Students are encouraged to do the internship early but some choose not to. It is somewhat more difficult to be placed during a recession.

8. On page 39 it is mentioned that in response to employer concern consideration is being given to allowing students to take English 211 rather than English 250. What is the status of this proposal? Do you plan to make English 211 a requirement or just an option?

   ENGL211 is an option to ENGL250.

9. Please explain the decision to delete Chem 311 from the curriculum.

   There was considerable overlap in content between CHEM311 and rubber classes, especially RUBR223. The Rubber Advisory Board stated strongly that they didn't want the program to emphasize chemistry, so the needed content is presented in the rubber courses with a more practical emphasis. There were pedagogical issues with CHEM311.

10. On page 51 you discuss "Rubber Engineers" on which Ferris State University has a monopoly. Since the program is titled BS Degree in Rubber Engineering Technology, why do you use that term? What is the industry standard for an engineer?

    Most of our graduates will have the title "_____ Engineer" upon graduation. The industry standard is generally much more loose than the educational standard. Many corporations make no distinction between a technology degree and an engineering degree, while some large corporations have a different career path for graduates of ABET-accredited engineering programs.

    Please also see attached comments by Stan Smith.

11. Does your program meet the standards for accreditation for a degree in Rubber Engineering Technology?

    The ABET accreditation standard would be very similar to that for plastics. The addition of calculus might be sufficient to meet this standard. There is no evidence that employers care whether this program is ABET-accredited.

12. Please clarify the labor market analysis on pages 53 and 54. Which components of this document relate to the plastics industry and which to the rubber industry?

    Sorry about the headings. A similar document for plastics Program Review was rewritten for rubber, and the headings were not changed. All the information is pertinent to rubber.

13. How up to date are the resumes in section VI?

    The resumes for Yang and Marsh are current. Auggie Gatt's resume does not reflect that he has been an Assistant Professor at Ferris since August, 1999.

14. On page 53 it is indicated that only one other school offers a BS similar to ours and no other schools offer a comparable AAS degree. Why are there so few institutions that prepare students to fill the 400 positions available for BS graduates and 1,200 openings for AAS graduates?

    There is considerable investment required to begin a program like this. Over $2,000,000 has been put into our labs, $8,000,000 including the building expansion. Considerable industry backing is required, such that sufficient support may only be available to one school at a time. Available positions are filled, but with less-prepared candidates than our graduates.

    Additional comments by Stan Smith: See attachment.

15. What is your rationale for offering the AAS degree when the majority of positions appropriate for AAS grads are filled with non-degreed personnel and it is difficult for AAS graduates to advance to professional level positions?

    An A.A.S. graduate would enter a position that might be otherwise filled with someone who has 10 years experience, and many experienced people never enter these positions. Thus, the A.A.S. degree has value. There is no down side to offering this degree. The great majority of A.A.S. graduates will continue on the their B.S. degree, allowing them to more readily enter professional level positions. There is a financial incentive: Perkins funds would not be available if we didn't have an A.A.S.

    Additional comments by Stan Smith: See attachment.

16. Please discuss the status of your equipment.

    The equipment is, for the most part, in good condition and is representative of what is used in the industry. Our equipment spans most major processes used and is a mixture of state-of-the-art and older but serviceable types. There is currently enough machinery that students are not deprived of ample time and, thus, learning experience.

17. On page 57 it is indicated that the entrance requirements have not been enforced. Please explain the basis for this decision.

    The Rubber Program was modeled after the Plastics Program. Requirements for entrance into the B.S. program were taken from plastics. The only statistical evidence shows that students will typically perform at the same level in the B.S. program as in the A.A.S. program. Lacking any valid evidence that showed we

should hold students back, we made the politically expedient (and morally correct?) decision to generate B.S. graduates sooner.

18. If a student is dual enrolled in AAS programs in plastics and rubber, who gets the credit from enrollment?

Students are enrolled in either program. The Ferris system does not have a provision for dual majors.

RECRUITMENT PLAN OUTLINE

* Activity is being pursued

1. *Recruit FSU Career Exploration students **Marsh**
2. *Mailings to students who express interest in similar areas via ACT test **Gregory, Marsh**
3. *Visit high schools (1/semester/faculty?): **Langell, Pierce, Speirs, Yang**
   a. * St. Clair Intermediate School District Plastics Academy **Marsh**
   b. *Kent Career Technical Center **Marsh**
   c. Skill centers
   d. ISD's
4. *Invite high schools to visit Ferris **Yang**
   a. Major Career Day for many high schools
   b. FSU Dawg Days for undecideds (Marsh did this, poor response)
5. Visit Michigan community colleges:
   a. *Grand Rapids Community College **Schult, Marsh**
   b. *St. Clair County Community College **Schult, Marsh**
6. *Visit Ohio & Indiana community college plastics programs (long-term, set up articulation agreements) **Pierce, Marsh**
7. *Contact advisors of SPE student groups to determine student interest in continuing education at Ferris **Pierce**
8. *Presentations at SPE & ACS Rubber Group meetings **Gatt, Marsh, Speirs, Yang**
9. *Campaign to have SPE, ACS, SPI, APC, etc. to make plastics/rubber college education a more visible part of their publicity **Pierce**
10. *Scholarships for student recruiters **Pierce, Marsh**
11. *Visit FSU chemistry, physics classes, CDTD, Machine Tool **Speirs**
12. *Alumni mailing with Program Review questionnaire **Speirs, Marsh**
    a. Admission fee waiver
    b. Recruiting packages to alumni (& other interested parties) **Marsh**
13. *Faculty to visit recruits when they visit interns **Wolfer**
14. *Offer plastics/rubber survey class in metro areas to HS seniors (may not be feasible) **Marsh**
15. Participation in Project Lead the Way
16. Participate in science fairs
17. Participate in PlastiVan
18. *Produce video, CD or DVD **Schult/Muccio**
19. *Improve Plastics web site **Langell**
20. Develop Rubber web site
21. COT Newsletter to HS students
22. Community service ads
23. Ads in HS newspapers
24. Programs in plastics factories
25. Web course for use by HS teachers
26. Sponsor HS plastics competition
27. *Standardized email attachments for recruits **Gregory, Marsh**
28. *Letters to students on Orentec screen on SIS **Gregory, Marsh**
29. Develop recruiting kit & send to skill centers & college prep classes
30. *Phone campaign **Marsh**
31. Develop posters for high schools, community colleges, etc.
32. *Offer continuing ed to high school teachers **Gatt**
33. Pursue NSF grant for articulation agreements
34. *FSU cable TV announcement **Muccio/Schult**
35. *Upgrade displays on first floor **Muccio/Schult**
36. *Develop technical electives that create interest **Muccio/Schult**
37. *Local news features **Muccio/Schult**
38. *Coordinate activities of RMA & West MI Rubber Group **Marsh, Gatt**
39. *Introduce interested FSUS-100 undecided students to the Plastics Programs **Muccio**

Conti	**24, 31**	**Muccio**	**18, 34, 35, 36, 37, 39**
Gatt	**8, 32, 38**	**Pierce**	**3, 6, 7, 9, 10**
Gregory	**2, 27, 28**	**Schult**	**5a & b, 18, 34, 35, 36, 37**
Langell	**3, 19**	**Speirs**	**3, 8, 11, 12**
Marsh	**1, 2, 3a & b,5a&b, 6, 8, 10, 14, 27, 28, 30, 38**	**Wolfer**	**13**
		Yang	**3, 4, 8**

RUBBER TECHNOLOGY (AAS)

RUBBER ENGINEERING TECHNOLOGY (BS)

ACADEMIC PROGRAM REVIEW

SEPTEMBER 26, 2002

Program Review Panel Members:

Program review chair: Matthew Yang
Program director: Bob Marsh
Program faculty: Auggie Gatt
Individuals with special interests:
Stan Smith (Federal-Mogul Corp.)
Kevin Ott (Rubber Manufacturers Association)
Faculty member from outside the College of Technology:
Bill Killian (College of Art and Science)

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SECTION I

Rubber (Engineering) Technology
AAS/BS Overview

Rubber (Engineering) Technology Overview

September 10, 1998 is a big milestone for the rubber industry. After raising 4.5 million dollars from the Michigan State government and 2 million dollars from the rubber industry to construct the National Elastomer Center (NEC), Rubber Programs started to serve the industry with 25 students enrolled in the first class at Ferris State University (FSU).

Rubber Programs offer a two-year technology (AAS) degree and a four-year rubber engineering technology (BS) degree. The rubber industry wants a program that focus on real-world hands-on training. Based on the experiences from the nationally renowned Plastics Programs, the rubber curriculum is also designed with the input from the Industrial Advisory Board. Students in the programs are trained in computer-aided design, statistical quality control, electronics and machine control, rubber compounding and advanced rubber processing concepts.

Rubber Manufacturers Association (RMA) and the rubber industry also make great efforts in recruiting students. RMA has been offering one thousand dollars scholarship to the program freshmen as the sign-up incentive. For the year of 2002, various scholarships with total of $61,000 are given to the programs. Each year during the national technical meeting, the Rubber Division of the American Chemical Society (ACS) offers Ferris State University a booth in the Rubber Expo™ to boost the program reputation. As a service to the industry, FSU started to host the annual technical seminar for the West Michigan Rubber Group at NEC since 2001. Rubber students hold an open house during the meeting to raise the program visibility.

In 1998, the programs started with an adjunct professor and used field trips to serve as the lab activities. It is now staffed with two assistant professors, Auggie Gatt and Matthew Yang. The programs also share a department director, Robert Marsh, a full time Administrative assistant and an Administrative technician with the plastics programs. The lab is fully equipped with various processing machine and test equipment. Visitors from the industry are quite impressed with the capability of the program lab.

Ferris State University is the first university to offer the rubber programs in the nation. At the end winter semester, 2002, there were 47 students enrolled. Ferris Student Rubber Group, sponsored by the West Michigan Rubber Group, has the honor to be the first student chapter to the Rubber Division of the ACS. The internship program is well received. Winter, 2002 completed the 4th year of the programs with 24 AAS and 7 BS graduates. To date, one AAS graduate has entered the workforce and the rest continue their training in the BS program. All the BS graduates have obtained positions from the east coast in New Jersey to the west coast in California.

The great support and recognition of the programs from the industry are reflected this year that the Rubber Division of ACS has awarded two students with scholarship and a title of "Rubber Division, ACS scholar". There are only three winners each year nation-

wide to receive the honor because of their "outstanding undergraduate record and will be an excellent candidate for employment in the rubber industry".

With the tremendous support from the industry and university, great job done by the program staff, and many good things happening to the program during the last four years, the enrollment has come down during the last 2 years. Recruiting high school students is the top priority and the biggest challenge the programs have to overcome.

SECTION II

Administrative Review

ADMINISTRATIVE PROGRAM REVIEW: 2001

(final version – 10/24)

Program/Department: **Rubber Technology/Rubber Eng. Technology** Date Submitted: November, 2001

Please provide the following information:

Enrollment

	Fall 1997	Fall 1998	Fall 1999	Fall 2000	Fall 2001
Tenure Track FTE	NA	0	2.0	2.0	2.0
Overload/Supplemental FTEF	NA	.13	0	.04	0
Adjunct/Clinical FTEF (unpaid)	NA	0	0	0	0
Enrollment on-campus total*	NA	13/0	42/0	53/6	42/8
Freshman	NA	9/0	29/0	23/0	5
Sophomore	NA	3/0	10/0	22/0	14
Junior	NA	1/0	1/0	7/2	19/1
Senior	NA	0/0	2/0	1/4	4/7
Masters	NA	0	0	0	0
Pre-Tech	NA	0	0	1/0	1/0
Pre-Professional Students	NA	0	0	0	0
Enrollment off-campus*	NA	0	0	0	0
Traverse City	NA	0	0	0	0
Grand Rapids	NA	0	0	0	0
Southwest	NA	0	0	0	0
Southeast	NA	0	0	0	0

*Use official count (7-day)

If there has been a change in enrollment, explain why:

Capacity:

Estimate program capacity considering current number of faculty, laboratory capacity, current equipment, and current levels of S&E.

42/30 students

What factors limit program capacity?

Financial

Expenditures*	FY 97	FY 98	FY 99	FY 00	FY 01
Supply & Expense	NA	NA	$1,547	$17,765	$39,789
Faculty Prof. Development					
General Fund					$1,870
Non-General Fund					-0-
UCEL Incentives					-0-
FSU-GR Incentives					-0-
Equipment					
Voc. Ed. Funds	NA	NA	NA	NA	NA
General Fund	NA	NA	-0-	-0-	$2,950
Non-General Fund	NA	NA	$13,000	NA	$15,510
UCEL Incentives					-0-
FSU-GR Incentives					-0-

*Use end of fiscal year expenditures.

ADMINISTRATIVE PROGRAM REVIEW: 2001

If you spent UCEL and FSU-GR incentive money for initiatives/items other than faculty professional development and equipment, what were they? Explain briefly. Please also include amounts spent on each initiative/item.

Revenues	FY 97	FY 98	FY 99	FY 00	FY 01
Net Clinic Revenue	NA	NA	NA	NA	NA
Scholarship Donations	NA	NA	NA	$11,000	$20,900
Gifts, Grants, & Cash Donations	NA	$100,500	$971,020	$225,634	$1000.
Endowment Earnings					NA
Institute Programs/Services					NA
In-Kind	$6000	$486,665	$807,270	$142,922	$164,150

Other

	AY 96/97	AY 97/98	AY 98/99	AY 99/00	AY 00/01
Number of Graduates* - Total	NA	NA	NA	4/0	6/0
- On campus	NA	NA	NA	4/0	6/0
- Off campus	NA	NA	NA	NA	NA
Placement of Graduates	NA	NA	NA	NA	NA
Average Starting Salary	NA	NA	NA	NA	NA
Productivity - Academic Year Average	NA	NA	182	168	252
- Summer	NA	NA	NA	54	101
Summer Enrollment	NA	NA	NA	8/0	18/1

* Use total for full year (S, F, W)

1. a) Areas of Strength:
   - Larger of 2 undergraduate Rubber programs in the U.S. (U Mass Lowell has 5 students)
   -Outstanding laboratory facilities support
   -Outstanding support from Rubber industry
   -BS grads complete two summer internships, greatly supporting career preparation

   b) Areas of Concern and Proposed Action to Address Them:
   Enrollment must be built to 24 incoming freshmen/year.
   Marketing activities include:
   - **Student mailings**
   - **Visits to High Schools**
   - **High School visits to Ferris State University**
   - **Continued scholarships**
   - **Marketing by industry supporters**

2. Future goals (please give time frame)
   Fill freshman class capacity starting in 02F
   70% Retention to AAS degree by 04W
   50% retention to BS degree by 07W

3. Other Recommendations:
   Continue to work with UCEL to create summer seminar series at National Elastomer Center
   Work with UCEL and FSU-GR to offer off-campus learning experiences as justified by need.

4. Does the program have an advisory committee? **YES**

   a) If yes, when did it last meet? **11/7/01**

   b) If no, why not? By what other means do faculty receive advice from employers and outside professionals?

   c) When were new members last appointed? **11/7/01**

   d) Are there non-alumni/ae on the committee? How many? **13 (entire committee)**

5. Does the program have an internship or other cooperative or experiential learning course? **YES**

   a) If yes, is the internship required or recommended? **Required**

   b) If no, what is the reason for not requiring such an experience?

6. Does the program offer courses through the web? **NO**

   a) Please list the web-based (fully delivered through the internet) courses the program offered last year?

   b) Please list the web-assisted (e.g., WebCT) courses the program offered last year.

7. What is unique about this program?

   a) For what distinctive characteristics is it known in the state or nation?
   Only significant undergraduate rubber program in the U.S.
   Great support from industry to build the program.

   b) What are some strategies that could lead to (greater) recognition?
   Build enrollment to create major Ferris presence of grads in the industry.
   Support student projects for presentation at national technical meetings.

8. Questions about Program Outcomes Assessment (attach additional sheets, if necessary):

   a) What are the program's learning outcomes?
   Graduates will have a broad understanding of the materials, processes, design principles and engineering systems utilized in the rubber industry. They will also have well-rounded general education skills.

   b) What assessment measures are used, both direct and indirect?
   Percent job placement and starting salaries.
   Feedback from employers on interns and graduates.

   c) What are the standards for assessment results?
   100% placement with salaries at or above COT average.
   Employers that are well-satisfied with our students' career preparation.

d) What were the assessment results for 2000-01?
No graduates, as the program completed its 3rd year in 00-01.
Good feedback from internship employers, requests to give the students a better business and management background.

e) How will / how have the results been used for pedagogical or curricular change?
ACCT 201, Principles of Accounting and MGMT 305, Supervision and Leadership added to curriculum.

9. Questions about Course Outcomes Assessment:

a) Do all multi-sectioned courses have common outcomes? **YES**

b) If not, how do you plan to address discrepancies?

c) Do you keep all course syllabi on file in a central location? **YES**

*If you have questions about the outcomes assessment portions of this survey, please contact Laurie Chesley (x2713).

Form Completed by R. Marsh, Department Director
Name and Title

Reviewed by Dean_____
Name and Date

SECTION III

Rubber Program
Alumni Survey Summary

RUBBER ALUMNI SURVEY

Since the 2000 – 2001 school year was the fourth for this program, our first rubber graduates just entered the work force. These individuals completed student questionnaires in their last semester. As a result, there were only 2 responses on the graduate surveys, from the 7 people who earned their B.S. degrees.

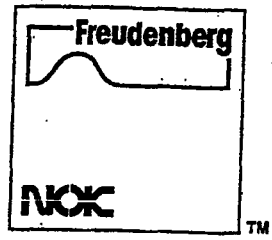
The detailed response from Ryan Schook gives many suggestions for material that could be added to the rubber courses. These will be considered by the Rubber Curriculum Committee. It must be noted that Ryan's title is "Associate Chemist II." This position is somewhat different from the central thrust of the program, which emphasizes processing and design. The Rubber Advisory Board has specifically stated strongly that they don't want our product to be rubber chemists. Ongoing contact with Freudenberg-NOK, Ryan's employer, gives us the understanding that Ryan, other graduates and interns (6 interns in 02S) are meeting or exceeding their expectations. Freudenberg is at the theoretical end of the job skill spectrum, so we are probably achieving our educational intent.

Russ Kraft's response indicates overall satisfaction, but he has concerns about the economy and its affect on job prospects. The recent recession makes this completely understandable.

Conclusions

It is too early to have a realistic assessment of graduate feedback on the direction of the program.

Freudenberg-NOK
General Partnership



August 27, 2002

919 Campus Drive
NEC 211
Big Rapids, MI 49307-2277

Dear Mr. Robert Marsh,

After spending the following 4 months in the rubber industry a few ideas and procedures have arose that I use on an everyday basis. I feel these ideas should become a critical tool in the curriculum of the Ferris State Rubber program. The following are only suggestions that I feel would be helpful upon graduation from the program.

Brand Names; chemical names are the best way to learn additives but brand names and equivalencies are a very time consuming and pain staking chore to master. I spend a lot of time just looking up brand names and chemical equivalents in various books and charts. This subject could easily be tailored into a few days worth of class time.

ASTM; I know that we have a testing class but I think it has to be emphasized more. I have had to look up many ASTM line callouts as well as SAE J-2000 line callouts and that is very difficult to do. We spent time on it in at least one class but I feel the time spent was inadequate. Line callouts should be emphasized more because it is used in by professionals in all aspects of the rubber industry.

The Future of Rubber; the future of rubber is always hard to see, but since I have entered the work force, and I know my former classmates would agree that, we had no idea what the future looked like. I have found that technologies developed a few years back are fresh to us. We didn't receive the most update knowledge we could. What updated knowledge we did receive was limited to the persons who attend the tech seminars at the West Michigan Rubber Group, and the ACS Rubber Expos.

Liquid Rubber; this goes along with the last topic, but it is a major up and coming business in the rubber industry. Silicone has been a liquid for a very long time, but we never were introduced to it, or even the differences it has with traditional silicones.

Liquid Raw Materials vs. Dry Liquid Concentrates; this seems trivial but it is valuable compounding information that should be taught. There is a major difference between the two types.

Bonding; this is something that I knew was going to be an issue before I even graduated. I visited many facilities and everyone had bonding in one way or another. I know absolutely nothing about bonding. This is another topic that a guess speaker could really

help with. I know that our professors are not experts in all of these fields but I think Ferris has some very good resources to find the right people for superior knowledge in very specific fields.

Analytical Testing; in my current position, I personally do not work with all of these tests but there are a wide range of analytical tests that are ran and can tell you so many different answers it is unimaginable. I don't feel this is above the students level because my interns have spent summers running these test. This is a subject that is taught thoroughly at the University of Akron, and I got the opportunity to look over a student's notes once. I was amazed at the amount of information they collected on analytical science.

Applications; this is taught to a great extent but it can always be emphasized more.

Delegation, Leadership, and Multitasking are three things that can't be taught, but can form a solid ground for a student to build upon.

I have noticed I am treated differently than the interns in our facility and that is for good reason, but they also expect more out of me, than an intern. These are tools and subjects that I feel I am lacking. A few of these items are 1-day class items, but a few are major issues that may take awhile. Please take these suggestions and try us them because if I were to hire an intern I would like them to know these critical ideas.

Sincerely,

Ryan J. Schook

Ryan J. Schook

Associate Advanced Materials Chemist

Ferris State University
Rubber Program Review – Alumni survey

1. When did you receive your "Rubber" degree(s) from Ferris?
   A. A.A.S. W01
   B. B.S. W02

2. Are you currently employed in the Rubber industry?
   (A) Yes B) No

   If you are not in the Rubber industry, why not?

   _____

3. Check the following which best describes the function you perform
   A) Sales and Marketing
   B) Process/production engineering
   C) Management Title: _____
   (D) Product design and development
   (E) Technical service
   F) Education and training
   (G) Project management
   H) Quality control/ quality assurance
   I) Cost estimating
   J) Purchasing
   K) Mold design
   L) Mold making
   M) Mold repair and maintenance
   N) Partner/owner
   O) Contract engineer

4. Check the title that is closest to yours
   A) Engineer
   B) Senior engineer
   C) Engineering supervisor/manager
   D) Engineering consultant
   E) Sales and marketing representative
   F) Sales and marketing management
   G) Production manager
   H) Plant manager
   I) Vice president
   J) President
   K) Owner
   L) Other: Application Technologist

5. Check all the processes your company has in-house
   (A) Compounding B) Injection molding C) Compression molding
   D) Transfer molding E) Extrusion F) Steam curing
   G) LCM curing H) Microwave curing I) Decorating
   J) Assembly (K) Other Packaging L) Other _____

6. Check all the processes your company uses externally to satisfy its customers
   A) Compounding B) Injection molding C) Compression molding
   D) Transfer molding E) Extrusion F) Steam curing
   G) LCM curing H) Microwave curing I) Decorating
   J) Assembly K) Other _____ L) Other _____

7. What is your employment location? City/State? Trenton, NJ

8. What industry segment do you work in?
   (A) Automotive
   B. Furniture
   C. Medical
   D. Computers/electronics
   E. Recreational products
   F. Household goods
   G. Packaging
   (H) Other (specify) General Goods

9. Would you be interested in a continuing education course offered by FSU plastic or rubber? If yes, what subject(s) would you like covered?

(A) Yes B) No Course/seminar title: _____
Course/seminar title: _____
Course/seminar title: _____
Course/seminar title: _____

10. How would you rate the following? (Circle)

1= Very Good 2= Good 3=OK and improving 4=OK but worsening 5= Poor

A). 1 2 3 (4) 5 The economy
B). 1 2 (3) 4 5 Environmental issues affecting your company
B). 1 2 3 (4) 5 Ability to hire additional technical employees
C). 1 (2) 3 4 5 Salaries
D). 1 (2) 3 4 5 Benefits
E). (1) 2 3 4 5 Career choice
F). 1 (2) 3 4 5 Health of the rubber industry
G). 1 (2) 3 4 5 Job change opportunities within the industry
H). (1) 2 3 4 5 Career growth opportunities

11. Please address the following issues, which are being discussed as possible changes at FSU and give them a rating.

1= Strongly agree 2= Agree 3= No opinion 4= Oppose 5= Strongly oppose

a) 1 2 (3) 4 5 Increasing the global focus of the curriculum
b) 1 (2) 3 4 5 Increasing the entrance requirement for all incoming Freshmen
c) 1 2 (3) 4 5 Increasing the entrance requirements for all "Rubber" freshmen
d) 1 2 (3) 4 5 Reduce the entrance requirements for all "Rubber" freshmen
e) 1 2 3 (4) 5 Reduce or eliminate the GPA requirements to advance from the A.A.S. program into the B.S. program

12. Please review the following methods to support the rubber programs and identify those areas which you are willing to help with by rating each area.

Would you like us to contact you? Yes No (If yes, we need the contact information below.)

1= Willing to help 2= Will help if arm is twisted 3= Not willing

a) 1 (2) 3 Influence employer to make a financial donation
b) 1 (2) 3 Influence employer to make an equipment donation
c) (1) 2 3 Assist in developing student scholarships
d) 1 (2) 3 Assist in recruiting local perspective students
e) 1 (2) 3 Improve increased rubber program visibility on campus
f) (1) 2 3 Improve increased rubber program visibility in your region

13. In reviewing the attached course check sheet, which courses would you add or expand? Which would you delete?

14. We have seen declining enrollment for the past 2 years. Most of our students choose rubber because of personal referrals. Are you less likely to recommend the Ferris Rubber Program than you were two years ago? Yes (No)

If "Yes", why? ___ Lack of employment security
___ Too much stress in this industry
___ Concerns regarding the quality of the Ferris Rubber Program
___ _____

15. What other recommendations do you have on curriculum, (not just rubber courses), facilities, student recruitment, etc.?

Cuccriculum is good as long as it continues to grow independantly of the plastics progcam. I've noticed Electronic's classes have been. changed (good). Increased Technical Staff is needed. Recruitment should be pciority #1. As well as inccecased exposuce in rubber industcy theough FSRG, seminars, training, meetings at Ferris.

Optional – address (Database for alumni to contact past classmate)

Personal information:

Name: Russell Kraft

Address: 1008 Whitehead Rd. Ext.
Trenton, NJ 08638

E-mail: Russell.Kraft.b@bayer.com

Phone: (609) 530-7836

Thank you in advance for your assistance!

Robert D. Marsh, Director-Plastics and Rubber Department, FSU

SECTION IV

Student Evaluation of the Rubber Programs

Student Evaluation of the Rubber Programs
Student Survey Summary

The survey for the student perceptions of the program was given across all current rubber classes for the Winter, 20002 Semester. A total of 47 students are currently enrolled for this semester in classes (including internship). A total of 37 surveys were collected for this self-evaluation study. This represents a participation rate of 79%.

Attached are copies of the survey itself with the individual responses totaled per statement from the following 7 groups:

1. Total population, 37 returns.
2. Freshmen (no internship), 3 returns.
3. Sophomore (no internship), 9 returns.
4. Sophomore (with internship), 7 returns.
5. Juniors (no internship), 3 returns.
6. Juniors (with internship), 11 returns.
7. Seniors (with internship), 4 returns.

The categorization method was meant to allow students to indicate their class status *within the Rubber Program.* It appears that some of them have given their status *within the University.*

Based on the more obvious numeric reactions and issues, some perceptions are listed as follows:

1. Twelve(12) out of sixteen(16) survey items received very positive responses.
   - High overall rating of this program
   - Students would choose this program over again
   - They would recommend this program to others
   - Consistent information was being delivered
   - Teaching methods help student understanding
   - Hands-on experiences are paced well
   - Instructors are available to students
   - Subject matter is interesting and meaningful
   - There is a positive environment for learning
   - Internships are meaningful and worthwhile

2. Dissatisfaction with the elective/support classes required for the program:
   - Lower scores on being taught by instructors who know the rubber industry
   - Lower scores on the classes being "in-step' with the core classes of the program

3. Other areas needing improvement are:
   - Not enough state-of-the-art equipment is used in the lab
   - Not enough work stations for class size

Conclusions:

To a great extent, students' concerns on our facilities are being addressed as the program and laboratories evolve. We also need to better communicate with the students on why they don't and won't, see some of the very specialized equipment they have seen on their internships. We cover a broad range of topics, and cannot cover each to great depth, with the most advanced equipment. We need to explain to our students that computer controlled equipment is crucial to the productivity while some "old fashioned" has its value as well for them to better understand those important basic principles.

Better communication should help the students understand why they are required to take their elective and support classes. The curriculum has been extensively reviewed with the Rubber Advisory Board, and we do not agree with the perspective of some of the students.

Total Population **(37 returns)**

COLLEGE OF TECHNOLOGY
RUBBER PROGRAM

STUDENT PERCEPTIONS OF TECHNOLOGY PROGRAMS

Rubber Program Only

Fill out only once.

Check the statement that best describes your objective for attending college: (Check the one most appropriate.)

-Prepare to get a job.....__33__
-Improve my job skills for present occupation...__5_
-Personal interest.....__5__
-Other (Describe).....__1___

Check the statement that best describes why you picked the Ferris Rubber Program for a curriculum:

-Availability of a job upon graduation.....__20_
-I wanted to work in the rubber industry.....__4__
-Published pay rates of the industry/career.....__9__
-Reputation of the program.....__2__
-Other students excited about the program.....__5__
-Hands-on education.....__15___
-Scholarship.....__16___
-Recommendations of others (check all that apply)
-Other students.....__9__
-Relative or friend.....__3__
-High school counselor/teacher.....__1__
-Ferris faculty/administrator.....__6__
-Someone in the industry..... __4__
-Other (Describe).. _____2_____

Check your current student status in the Rubber Program:

Freshman ____3_ Sophomore _____16 Junior _____14 Senior _____4

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
1. Courses in the Rubber Program are: - Based on realistic industry requirements		1	2	15	17	2	
- Up-to-date in their content	1		4	13	13	5	
- A "value" to me at their current tuition cost	1	4	9	10	11	2	
2. The courses taught in Rubber Program have a syllabus which will tell me what I will learn		3	11	10	11	1	
3. The course content taught is: - Up-to-date with the practices of industry	1		4	13	13	6	
- In line with my needs and interests	1		3	19	14		
- Understood by the professors teaching	1	1	4	10	20	1	

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
4. The teaching methods used in the course: - Utilize technologies which help me understand	1		8	13	15		
-Apply knowledge from instructor experience		1	2	9	21	1	
5. When laboratory activities accompany lecture: -State-of-the-art equipment is utilized	3	2	16	10	5	1	See summary
-Experiences parallel the lecture topics		2	6	16	7	1	
-Hands-on experiences are "paced" well	1	1	6	13	14		
6. Aside from the structured class topics/sessions: -I find the instructor's experience meaningful		1	2	11	22	1	
-I can gain insight into future positions		1	1	17	19		
-I am given consistent information		1	4	13	19	1	
7. Other Rubber Industry information: -Is attainable from extra-curricular activities presented by and supported through the instructors		4	4	16	13		
-Opportunities are available through the instructors	2	1	8	17	8		
8. The program instructors: -Know the subject matter and occupational reqmts.	1	1	3	12	19	1	
-Are available to provide help when I need it		1	2	10	22	2	
-Provide interesting & meaningful subject matter		1	4	9	21	2	
-Are fair and equal with students in general	1	1	3	10	18		
9. Instructional lecture and laboratory facilities: -Are up-to-date and kept that way	1	5	9	15	7		
-Provide a positive environment for learning		3	3	16	15		
-Are safe, functional, and well maintained		1	6	17	12		
-Include enough work stations for class size	5	7	10	8	6		See summary
10. Instructional equipment such as: -Text books are good, clear, and meet class needs	2	2	7	8	17		
-Sufficient lab equipment & materials for class		4	11	11	11		
-Lab equipment is safe, functional, and maintained			10	13	14		
11. The elective/support classes required are: -Meaningful and worth-while	1	4	10	16	6		
-Fitting choices for the overall program and degrees	2	3	7	13	8		
-Taught by instructors who can relate to rubber	9	3	12	5	7		See summary
-Are "in-step" with the core classes in the program	2	6	9	11	9		See summary

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
12. The "internship" requirements of the program: -Internship is accessible	3	1	7	12	13	2	
-Are meaningful and worth-while (1st & 2nd)			2	8	21	6	
-Give insight into the expectations of the industry			3	9	20	5	
-Are faculty assisted and followed up by them	2	1	4	8	15	7	
-Are appropriate in quantity, time, or requirements.		1	2	8	21	5	
13. I am given adequate individual attention: -By my instructor in the laboratory (student ratio)			5	8	23	1	
-By my instructor in the classroom (student ratio)			4	12	20		
14. My classroom experiences include: -Adequate "challenges" given by professor	2		6	12	17		
-Adequate availability of computers		1	4	13	19		
-Adequate access to the internet			3	12	22		
-Adequate reference materials available	2	3	6	12	14		
15. I receive proper advising from program advisor.	4	1	8	6	16	1	
16. Overall, I would: -Choose this program again as I first did	1	3	4	6	22		
-Recommend the program to another	2	2	2	6	25		
-Rate the program	1		4	12	20		

How did you view your career potential when you came into the program?..._____

How do you view your career potential now?_____

ADDITIONAL COMMENTS SPACE: (Use back of sheet if necessary.)

Freshmen(No internship)--- **Total 3 Returns**

COLLEGE OF TECHNOLOGY
RUBBER PROGRAM

STUDENT PERCEPTIONS OF TECHNOLOGY PROGRAMS

Rubber Program Only

Fill out only once.

Check the statement that best describes your objective for attending college: (Check the one most appropriate.)

-Prepare to get a job.....__3_
-Improve my job skills for present occupation..._1__
-Personal interest.....__1__
-Other (Describe).....____

Check the statement that best describes why you picked the Ferris Rubber Program for a curriculum:

-Availability of a job upon graduation.....____
-I wanted to work in the rubber industry.....____
-Published pay rates of the industry/career....._1__
-Reputation of the program.....____
-Other students excited about the program.....____
-Hands-on education.....____
-Scholarship.....__1__
-Recommendations of others (check all that apply)
-Other students....._1__
-Relative or friend.....____
-High school counselor/teacher.....____
-Ferris faculty/administrator.....____
-Someone in the industry.....____
-Other (Describe)..____

Check your current student status in the Rubber Program:

Freshman _____ Sophomore _____ Junior _____ Senior _____

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
1. Courses in the Rubber Program are: - Based on realistic industry requirements				1	2		
- Up-to-date in their content				1	1	1	
- A "value" to me at their current tuition cost					3		
2. The courses taught in Rubber Program have a syllabus which will tell me what I will learn			1	1	1		
3. The course content taught is: - Up-to-date with the practices of industry				2	1		
- In line with my needs and interests				2	1		
- Understood by the professors teaching					3		

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
4. The teaching methods used in the course: - Utilize technologies which help me understand				1	2		
-Apply knowledge from instructor experience				1	2		
5. When laboratory activities accompany lecture: -State-of-the-art equipment is utilized			1		2		
-Experiences parallel the lecture topics				2	1		
-Hands-on experiences are "paced" well				1	2		
6. Aside from the structured class topics/sessions: -I find the instructor's experience meaningful					3		
-I can gain insight into future positions				1	2		
-I am given consistent information			1	1	1		
7. Other Rubber Industry information: -Is attainable from extra-curricular activities presented by and supported through the instructors				3			
-Opportunities are available through the instructors				3			
8. The program instructors: -Know the subject matter and occupational reqmts.				1	2		
-Are available to provide help when I need it				1	2		
-Provide interesting & meaningful subject matter					3		
-Are fair and equal with students in general					3		
9. Instructional lecture and laboratory facilities: -Are up-to-date and kept that way				2	1		
-Provide a positive environment for learning				1	2		
-Are safe, functional, and well maintained				2	1		
-Include enough work stations for class size			2		1		
10. Instructional equipment such as: -Text books are good, clear, and meet class needs					2		
-Sufficient lab equipment & materials for class				2	1		
-Lab equipment is safe, functional, and maintained				1	2		
11. The elective/support classes required are: -Meaningful and worth-while			1	1	1		
-Fitting choices for the overall program and degrees			1	1	1		
-Taught by instructors who can relate to rubber	1	1		1			
-Are "in-step" with the core classes in the program		1	1	1			

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
12. The "internship" requirements of the program: -Internship is accessable				1		2	
-Are meaningful and worth-while (1st & 2nd)					1	2	
-Give insight into the expectations of the industry				1		2	
-Are faculty assisted and followed up by them					1	2	
-Are appropriate in quantity, time, or requirements.				1	1	1	
13. I am given adequate individual attention: -By my instructor in the laboratory (student ratio)					3		
-By my instructor in the classroom (student ratio)					3		
14. My classroom experiences include: -Adequate "challenges" given by professor				1	2		
-Adequate availability of computers				2	1		
-Adequate access to the internet				1	2		
-Adequate reference materials available				1	2		
15. I receive proper advising from program advisor.			1		2		
16. Overall, I would: -Choose this program again as I first did				1	2		
-Recommend the program to another					3		
-Rate the program				1	2		

How did you view your career potential when you came into the program?...No idea about the program: 1.

Good:2.

How do you view your career potential now?_____

Good:1. Even better:1, Very pleased: 1.

ADDITIONAL COMMENTS SPACE: (Use back of sheet if necessary.)

Sophomore (No internship)--- **Total: 9 Returns**

COLLEGE OF TECHNOLOGY
RUBBER PROGRAM

STUDENT PERCEPTIONS OF TECHNOLOGY PROGRAMS

Rubber Program Only

Fill out only once.

Check the statement that best describes your objective for attending college: (Check the one most appropriate.)

-Prepare to get a job.....__8__
-Improve my job skills for present occupation...__1_
-Personal interest.....__1_
-Other (Describe).....Parent__

Check the statement that best describes why you picked the Ferris Rubber Program for a curriculum:

-Availability of a job upon graduation.....__7__
-I wanted to work in the rubber industry.....__3__
-Published pay rates of the industry/career.....__1__
-Reputation of the program.....__2_
-Other students excited about the program.....__3_
-Hands-on education.....__5__
-Scholarship.....__5__
-Recommendations of others (check all that apply)
-Other students.....__4__
-Relative or friend.....__1_
-High school counselor/teacher.....__1__
-Ferris faculty/administrator.....__2_
-Someone in the industry.....__3__
-Other (Describe)..

Check your current student status in the Rubber Program:

Freshman _____ Sophomore _____ Junior _____ Senior _____

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
1. Courses in the Rubber Program are: - Based on realistic industry requirements				4	4	1	
- Up-to-date in their content				2	5	1	
- A "value" to me at their current tuition cost			4	3	2		Waste a lot of time due to organization.
2. The courses taught in Rubber Program have a syllabus which will tell me what I will learn				3	5		
3. The course content taught is: - Up-to-date with the practices of industry			1	2	5	1	
- In line with my needs and interests				4	5		
- Understood by the professors teaching				2	7		

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
4.The teaching methods used in the course: - Utilize technologies which help me understand				4	5		
-Apply knowledge from instructor experience				2	7		
5.When laboratory activities accompany lecture: -State-of-the-art equipment is utilized		2	3	4			
-Experiences parallel the lecture topics		1		6	2		
-Hands-on experiences are "paced" well		1	2	3	3		
6. Aside from the structured class topics/sessions: -I find the instructor's experience meaningful			1	2	6		
-I can gain insight into future positions		1		2	6		
-I am given consistent information		1		3	5		
7. Other Rubber Industry information: -Is attainable from extra-curricular activities presented by and supported through the instructors			1	5	3		
-Opportunities are available through the instructors	1		2	4	2		
8. The program instructors: -Know the subject matter and occupational reqmts.			1	1	7		
-Are available to provide help when I need it		1		2	6		
-Provide interesting & meaningful subject matter			1	1	7		
-Are fair and equal with students in general			1	1	7		
9. Instructional lecture and laboratory facilities: -Are up-to-date and kept that way		1	2	4	2		
-Provide a positive environment for learning		1		4	4		
-Are safe, functional, and well maintained		1	1	4	3		
-Include enough work stations for class size	2	1	2	2	2		
10. Instructional equipment such as: -Text books are good, clear, and meet class needs			1	2	6		
-Sufficient lab equipment & materials for class		1	1	3	4		
-Lab equipment is safe, functional, and maintained			1	2	6		
11. The elective/support classes required are: -Meaningful and worth-while	1	1		4	3		
-Fitting choices for the overall program and degrees	2			3	3		
-Taught by instructors who can relate to rubber	2		2	1	4		
-Are "in-step" with the core classes in the program	1			2	6		

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
12. The "internship" requirements of the program: -Internship is accessable	2		4	2	1		
-Are meaningful and worth-while (1st & 2nd)			1	1	5	2	
-Give insight into the expectations of the industry			1	1	5	2	
-Are faculty assisted and followed up by them		1		1	4	3	
-Are appropriate in quantity, time, or requirements.		1			5	3	
13. I am given adequate individual attention: -By my instructor in the laboratory (student ratio)			1	3	5		
-By my instructor in the classroom (student ratio)				4	5		
14. My classroom experiences include: -Adequate "challenges" given by professor				3	6		
-Adequate availability of computers				5	4		
-Adequate access to the internet				3	6		
-Adequate reference materials available	1		1	4	3		
15. I receive proper advising from program advisor.		1	1	1	5	1	
16. Overall, I would: -Choose this program again as I first did		1		2	6		
-Recommend the program to another		1		1	7		
-Rate the program			1		8		

How did you view your career potential when you came into the program?...Uncertain: 1. Pretty good: 2. Good: 1.

Average: 1. Very good: 1. High: 2

How do you view your career potential now?

High: 2. Better: 2. Very good:1. Excellent: 2

Very positive:1

ADDITIONAL COMMENTS SPACE: (Use back of sheet if necessary.)

More work and less lecture in lab.

Sophomore(With internship)--- **Total: 7 Returns**

COLLEGE OF TECHNOLOGY
RUBBER PROGRAM

STUDENT PERCEPTIONS OF TECHNOLOGY PROGRAMS

Rubber Program Only

Fill out only once.

Check the statement that best describes your objective for attending college: (Check the one most appropriate.)

-Prepare to get a job.....5___
-Improve my job skills for present occupation...__1_
-Personal interest.....____
-Other (Describe).....__1__
Change job to more lucrative field.

Check the statement that best describes why you picked the Ferris Rubber Program for a curriculum:

-Availability of a job upon graduation.....__5__
-I wanted to work in the rubber industry.....____
-Published pay rates of the industry/career.....__4__
-Reputation of the program.....____
-Other students excited about the program.....__2__
-Hands-on education.....2___
-Scholarship.....2__
-Recommendations of others (check all that apply)
-Other students.....__2__
-Relative or friend.....__1_
-High school counselor/teacher.....____
-Ferris faculty/administrator.....__1__
-Someone in the industry..... ____
-Other (Describe).. _____
_____

Check your current student status in the Rubber Program:

Freshman _____ Sophomore _____ Junior _____ Senior _____

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
1. Courses in the Rubber Program are: - Based on realistic industry requirements				3	4		
- Up-to-date in their content			2	2	3		
- A "value" to me at their current tuition cost		1	1	2	2	1	
2. The courses taught in Rubber Program have a syllabus which will tell me what I will learn			2	2	2	1	
3. The course content taught is: - Up-to-date with the practices of industry			1	2	4		
- In line with my needs and interests			1	3	3		
- Understood by the professors teaching		1	1	1	4		

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
4. The teaching methods used in the course:			2	1	4		
- Utilize technologies which help me understand							
-Apply knowledge from instructor experience		1	1	1	4		
5. When laboratory activities accompany lecture:			2	2	3		
-State-of-the-art equipment is utilized							
-Experiences parallel the lecture topics		1	1	1	3		
-Hands-on experiences are "paced" well			1	1	5		
6. Aside from the structured class topics/sessions:				2	5		
-I find the instructor's experience meaningful							
-I can gain insight into future positions				3	4		
-I am given consistent information			2	1	4		
7. Other Rubber Industry information:							
-Is attainable from extra-curricular activities presented by and supported through the instructors			2	2	3		
-Opportunities are available through the instructors			1	2	3	1	
8. The program instructors:				3	4		
-Know the subject matter and occupational reqmts.							
-Are available to provide help when I need it				2	5		
-Provide interesting & meaningful subject matter				1	6		
-Are fair and equal with students in general				2	5		
9. Instructional lecture and laboratory facilities:			2	3	2		
-Are up-to-date and kept that way							
-Provide a positive environment for learning				2	5		
-Are safe, functional, and well maintained			1	4	3		A lot of equipment not in use.
-Include enough work stations for class size		1	1	2	2		
10. Instructional equipment such as:	1			1	5		
-Text books are good, clear, and meet class needs							
-Sufficient lab equipment & materials for class		1	3	1	2		
-Lab equipment is safe, functional, and maintained			2	3	2		
11. The elective/support classes required are:			2	4	1		
-Meaningful and worth-while							
-Fitting choices for the overall program and degrees		1	1	3	2		
-Taught by instructors who can relate to rubber		1	3	1	2		
-Are "in-step" with the core classes in the program		1	1	3	2		

RUBBER TECHNOLOGY (AAS)

RUBBER ENGINEERING TECHNOLOGY (BS)

ACADEMIC PROGRAM REVIEW

September 26, 2002

Program Review Panel Members:

Program review chair: Matthew Yang
Program director: Bob Marsh
Program faculty: Auggie Gatt
Individual with special interest: Kevin Ott (Rubber Manufacturers Association)
Faculty member from outside the College of Technology: Bill Killian (College of Art and Science)

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
12. The "internship" requirements of the program: -Internship is accessable				4	3		
-Are meaningful and worth-while (1st & 2nd)				3	4		
-Give insight into the expectations of the industry			1	2	4		
-Are faculty assisted and followed up by them			1	3	3		
-Are appropriate in quantity, time, or requirements.				3	4		
13. I am given adequate individual attention: -By my instructor in the laboratory (student ratio)			1		6		
-By my instructor in the classroom (student ratio)			1	2	4		
14. My classroom experiences include: -Adequate "challenges" given by professor			1	2	4		
-Adequate availability of computers				1	6		
-Adequate access to the internet				3	4		
-Adequate reference materials available		1	2	2	2		Need "Rubber World".
15. I receive proper advising from program advisor.				3	3		
16. Overall, I would: -Choose this program again as I first did				2	5		
-Recommend the program to another				1	6		
-Rate the program				1	6		

How did you view your career potential when you came into the program?...Good: 5. Very good:1. Excellent: 1.

How do you view your career potential now?_____

Not so good: 1. Good: 1. Very good: 1. Excellent: 2

Great: 2

ADDITIONAL COMMENTS SPACE: (Use back of sheet if necessary.)

More money from the college instead of depending on the donations.

Junior (No internship)--- **Total: 3 Returns**

COLLEGE OF TECHNOLOGY
RUBBER PROGRAM

STUDENT PERCEPTIONS OF TECHNOLOGY PROGRAMS

Rubber Program Only

Fill out only once.

Check the statement that best describes your objective for attending college: (Check the one most appropriate.)

-Prepare to get a job.....__3__
-Improve my job skills for present occupation...____
-Personal interest.....____
-Other (Describe).....____
_____

Check the statement that best describes why you picked the Ferris Rubber Program for a curriculum:

-Availability of a job upon graduation.....__1__
-I wanted to work in the rubber industry.....____
-Published pay rates of the industry/career.....____
-Reputation of the program.....____
-Other students excited about the program.....____
-Hands-on education.....____
-Scholarship.....__2__
-Recommendations of others (check all that apply)
-Other students.....____
-Relative or friend.....____
-High school counselor/teacher.....____
-Ferris faculty/administrator.....__1__
-Someone in the industry.....____
-Other (Describe).. _____
_____

Check your current student status in the Rubber Program:

Freshman _____ Sophomore _____ Junior _____ Senior _____

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
1. Courses in the Rubber Program are: - Based on realistic industry requirements			1		1	1	
- Up-to-date in their content			1	2			
- A "value" to me at their current tuition cost		2	1				Repetitive course work.
2. The courses taught in Rubber Program have a syllabus which will tell me what I will learn		1	1	1			Syllabus was not followed.
3. The course content taught is: - Up-to-date with the practices of industry				2		1	
- In line with my needs and interests				3			
- Understood by the professors teaching				2	1		

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
4. The teaching methods used in the course:			2	1			
- Utilize technologies which help me understand							
-Apply knowledge from instructor experience				1	2		
5. When laboratory activities accompany lecture:			3				
-State-of-the-art equipment is utilized							
-Experiences parallel the lecture topics				3			
-Hands-on experiences are "paced" well			1	2			
6. Aside from the structured class topics/sessions:				1	2		
-I find the instructor's experience meaningful							
-I can gain insight into future positions				3			
-I am given consistent information				3			
7. Other Rubber Industry information:							
-Is attainable from extra-curricular activities presented by and supported through the instructors				2	1		
-Opportunities are available through the instructors			2	1			
8. The program instructors:				3			
-Know the subject matter and occupational reqmts.							
-Are available to provide help when I need it				2	1		
-Provide interesting & meaningful subject matter			1	1	1		
-Are fair and equal with students in general			1	1	1		
9. Instructional lecture and laboratory facilities:		2		1			
-Are up-to-date and kept that way							
-Provide a positive environment for learning			1	2			
-Are safe, functional, and well maintained			1	2			
-Include enough work stations for class size	1		1	1			
10. Instructional equipment such as:			3				
-Text books are good, clear, and meet class needs							
-Sufficient lab equipment & materials for class				3			
-Lab equipment is safe, functional, and maintained				3			
11. The elective/support classes required are:		1	1	1			
-Meaningful and worth-while							
-Fitting choices for the overall program and degrees		1	1	1			
-Taught by instructors who can relate to rubber	1		1	1			
-Are "in-step" with the core classes in the program		1	1	1			

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
12. The "internship" requirements of the program: -Internship is accessable		1	1	2			
-Are meaningful and worth-while (1st & 2nd)				1		2	
-Give insight into the expectations of the industry				1	1	1	
-Are faculty assisted and followed up by them				1		2	
-Are appropriate in quantity, time, or requirements.			1	1		1	One internship is enough.
13. I am given adequate individual attention: -By my instructor in the laboratory (student ratio)				2	1		
-By my instructor in the classroom (student ratio)				2	1		
14. My classroom experiences include: -Adequate "challenges" given by professor			1	2			
-Adequate availability of computers				2	1		
-Adequate access to the internet				2	1		
-Adequate reference materials available		1		1	1		
15. I receive proper advising from program advisor.			1	1	1		
16. Overall, I would: -Choose this program again as I first did	1	1	1				
-Recommend the program to another		1	1	1			
-Rate the program		1	2				

How did you view your career potential when you came into the program?...Know nothing about the rubber industry: 1

Good: 1

How do you view your career potential now?_____

Positive: 1. Undecided: 1

ADDITIONAL COMMENTS SPACE: (Use back of sheet if necessary.)

- Haven't run any equipment in the processing lab after been here for 6 semesters.
- Lab work is repetitive and becoming useless.
- Books are way too expensive.
- Need more instructors with various expertise.
- A lot of equipment in the lab that is not used. Why?
- The teachers are too forgiving. It has made most of the students lazy.

Juniors(With internship)--- **Total: 11 Returns**

COLLEGE OF TECHNOLOGY
RUBBER PROGRAM

STUDENT PERCEPTIONS OF TECHNOLOGY PROGRAMS

Rubber Program Only

Fill out only once.

Check the statement that best describes your objective for attending college: (Check the one most appropriate.)

-Prepare to get a job.....11
-Improve my job skills for present occupation... 1
-Personal interest.....2
-Other (Describe).....____

Check the statement that best describes why you picked the Ferris Rubber Program for a curriculum:

-Availability of a job upon graduation.....__4__
-I wanted to work in the rubber industry.....____
-Published pay rates of the industry/career.....__3__
-Reputation of the program.....____
-Other students excited about the program.....____
-Hands-on education.....__7__
-Scholarship.....__5__
-Recommendations of others (check all that apply)
-Other students.....__1__
-Relative or friend.....__1__
-High school counselor/teacher.....____
-Ferris faculty/administrator.....__2__
-Someone in the industry.....__1__
-Other (Describe).. Know the industry before: 1. Don't know why: 1

Check your current student status in the Rubber Program:

Freshman _____ Sophomore _____ Junior _____ Senior _____

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
1. Courses in the Rubber Program are: - Based on realistic industry requirements		1	1	5	4		
- Up-to-date in their content	1		1	5	4		
- A "value" to me at their current tuition cost	1		3	4	3		
2. The courses taught in Rubber Program have a syllabus which will tell me what I will learn		1	6	2	2		A lot of adjustment.
3. The course content taught is: - Up-to-date with the practices of industry	1		2	4	3	1	
- In line with my needs and interests	1		2	5	3		
- Understood by the professors teaching	1		3	3	3	1	

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
4. The teaching methods used in the course: - Utilize technologies which help me understand	1		4	4	2		
-Apply knowledge from instructor experience			1	4	5	1	
5. When laboratory activities accompany lecture: -State-of-the-art equipment is utilized	2		5	3		1	
-Experiences parallel the lecture topics			5	4	1	1	
-Hands-on experiences are "paced" well	1		2	5	3		Experiments are changed constantly.
6. Aside from the structured class topics/sessions: -I find the instructor's experience meaningful			1	5	4	1	
-I can gain insight into future positions			1	6	3		
-I am given consistent information			1	4	6	1	
7. Other Rubber Industry information: -Is attainable from extra-curricular activities presented by and supported through the instructors		3	1	4	3		
-Opportunities are available through the instructors	1	1	1	5	3		
8. The program instructors: -Know the subject matter and occupational reqmts.	1		2	2	5	1	Need instructors with more specific expertise.
-Are available to provide help when I need it			2	1	6	2	
-Provide interesting & meaningful subject matter		1	2	4	2	2	
-Are fair and equal with students in general	1		1	5			
9. Instructional lecture and laboratory facilities: -Are up-to-date and kept that way	1	1	5	3	1		
-Provide a positive environment for learning		2	1	5	3		
-Are safe, functional, and well maintained		1	2	4	3	1	
-Include enough work stations for class size	2	3	4	2			Lab is backed up.
10. Instructional equipment such as: -Text books are good, clear, and meet class needs	1	1	2	4	3		Too expensive.
-Sufficient lab equipment & materials for class		2	4	2	3		
-Lab equipment is safe, functional, and maintained			3	4	4		
11. The elective/support classes required are: -Meaningful and worth-while		1	4	5	1		
-Fitting choices for the overall program and degrees		1	5	3	2		Need material course.
-Taught by instructors who can relate to rubber	2	2	5		1		
-Are "in-step" with the core classes in the program		2	4	4	1		

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
12. The "internship" requirements of the program: -Internship is accessable	1		2	2	6		
-Are meaningful and worth-while (1st & 2nd)			1	3	7		
-Give insight into the expectations of the industry			1	3	7		
-Are faculty assisted and followed up by them	2		3	3	3		
-Are appropriate in quantity, time, or requirements.			1	2	8		
13. I am given adequate individual attention: -By my instructor in the laboratory (student ratio)			3	3	4	1	
-By my instructor in the classroom (student ratio)			3	4	3	1	
14. My classroom experiences include: -Adequate "challenges" given by professor	2		4	1	4		
-Adequate availability of computers		1	3	2	5		
-Adequate access to the internet			2	3	6		
-Adequate reference materials available		1	2	2	6		
15. I receive proper advising from program advisor.	2		4	1	4		
16. Overall, I would: -Choose this program again as I first did		1	3		6		Double majored with plastics to make up the deficiency in rubber program.
-Recommend the program to another	2		1	2	6		
-Rate the program	1		2	6	2		

How did you view your career potential when you came into the program?...No clue/unsure: 3. Good: 5. Fair: 2.

Wanted to become an engineer: 1.

How do you view your career potential now?

Good: 1. Excellent: 4. Not so good: 1. Who knows:1

Very knowledged in how the system works.

Very good with continued education.

I will be an engineer.

Economy makes me nervous.

ADDITIONAL COMMENTS SPACE: (Use back of sheet if necessary.)

- I'm going into real estate. People always need a place to live.
- Additional instructor with tooling background is needed.
- More instructors to reduce the lab size.
- Need better and newer equipment.
- This is a very good program.

Senior (With internship)--- **Total: 4 Returns**

COLLEGE OF TECHNOLOGY
RUBBER PROGRAM

STUDENT PERCEPTIONS OF TECHNOLOGY PROGRAMS

Rubber Program Only

Fill out only once.

Check the statement that best describes your objective for attending college: (Check the one most appropriate.)

-Prepare to get a job.....__3__
-Improve my job skills for present occupation...__1_
-Personal interest.....__1__
-Other (Describe).....____

Check the statement that best describes why you picked the Ferris Rubber Program for a curriculum:

-Availability of a job upon graduation.....__3__
-I wanted to work in the rubber industry.....__1__
-Published pay rates of the industry/career.....____
-Reputation of the program.....____
-Other students excited about the program.....____

-Hands-on education.....__1__
-Scholarship.....__1__

-Recommendations of others (check all that apply)
-Other students.....__1__
-Relative or friend.....____
-High school counselor/teacher.....____
-Ferris faculty/administrator.....____
-Someone in the industry.....____
-Other (Describe)..

Check your current student status in the Rubber Program:

Freshman _____ Sophomore _____ Junior _____ Senior _____

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
1. Courses in the Rubber Program are: - Based on realistic industry requirements				2	2		Fairly realistic.
- Up-to-date in their content				1		3	
- A "value" to me at their current tuition cost		1		1	1	1	
2. The courses taught in Rubber Program have a syllabus which will tell me what I will learn		1	1	1	1		Lectures need to follow the syllabi better.
3. The course content taught is: - Up-to-date with the practices of industry				1		3	
- In line with my needs and interests				2	2		
- Understood by the professors teaching				2	2		

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
4. The teaching methods used in the course: - Utilize technologies which help me understand				2	2		
-Apply knowledge from instructor experience					3		
5. When laboratory activities accompany lecture: -State-of-the-art equipment is utilized	1		2	1			Need to improve the testing equipment.
-Experiences parallel the lecture topics			1	2	1		
-Hands-on experiences are "paced" well			1	2	1		
6. Aside from the structured class topics/sessions: -I find the instructor's experience meaningful		1		1	2		
-I can gain insight into future positions				2	2		
-I am given consistent information				1	3		
7. Other Rubber Industry information: -Is attainable from extra-curricular activities presented by and supported through the instructors		1			3		Need more support on the Ferris Student Rubber Group.
-Opportunities are available through the instructors			2	2			
8. The program instructors: -Know the subject matter and occupational reqmts.		1		2	1		They have great knowledge. Just have to present it better.
-Are available to provide help when I need it				2	2		
-Provide interesting & meaningful subject matter				2	2		
-Are fair and equal with students in general		1		1	2		Not always.
9. Instructional lecture and laboratory facilities: -Are up-to-date and kept that way		1		2	1		
-Provide a positive environment for learning			1	2	1		
-Are safe, functional, and well maintained			1	1	2		
-Include enough work stations for class size		2		1	1		
10. Instructional equipment such as: -Text books are good, clear, and meet class needs		1	1	1	1		Some books are not used.
-Sufficient lab equipment & materials for class			3		1		
-Lab equipment is safe, functional, and maintained			4				
11. The elective/support classes required are: -Meaningful and worth-while		1	2	1			
-Fitting choices for the overall program and degrees			2	2			
-Taught by instructors who can relate to rubber	3		1				Very bad.
-Are "in-step" with the core classes in the program	1	1	2				

PLACE AN "X" IN THE BOX THAT APPLIES A "comments" column is provided if you wish to explain your answer and use the "Don't Know" column for items you are unsure about.	POOR 1	FAIR 2	AVERAGE 3	PRETTY GOOD 4	GOOD 5	DON'T KNOW	COMMENTS
12. The "internship" requirements of the program: -Internship is accessible				1	3		Students show how they can and can't get a job.
-Are meaningful and worth-while (1st & 2nd)					4		
-Give insight into the expectations of the industry				1	3		
-Are faculty assisted and followed up by them					4		
-Are appropriate in quantity, time, or requirements.				1	3		
13. I am given adequate individual attention: -By my instructor in the laboratory (student ratio)					4		Need more faculty.
-By my instructor in the classroom (student ratio)					4		
14. My classroom experiences include: -Adequate "challenges" given by professor				3	1		
-Adequate availability of computers			1	1	2		
-Adequate access to the internet			1		3		
-Adequate reference materials available	1		1	2			
15. I receive proper advising from program advisor.	2		1		1		Very bad. No help.
16. Overall, I would: -Choose this program again as I first did				1	3		Very proud of our program. It just need a few updates.
-Recommend the program to another				1	3		
-Rate the program				2	2		

How did you view your career potential when you came into the program?...Good: 2. Very good: 1. Quite high: 1.

How do you view your career potential now?_____

Same: 1. Good : 1. Very good: 1. Even better: 1.

ADDITIONAL COMMENTS SPACE: (Use back of sheet if necessary.)

Incorporate more plastics into program.

SECTION V

Employer Evaluation Summary

Summary of Employer Evaluation of Ferris State Rubber Students

Check the main classification of your company:
_5__ Injection Molding
_5__ Extrusion
_2__ Compression/Transfer
_2__ Compounding & Formulating
_2__ Custom Mixing
_2__ Research & Development

Instructions: For each of the following scales, please circle the work that best fits the Ferris State Graduate's performance in the corresponding category.

	Poor				Superior
	1	**2**	**3**	**4**	**5**
Intern/Graduate(s) problem solving skills		1	1	4	
Intern/Graduate(s) technical writing skills			4	2	
Intern/Graduate (s) presentation skills			4	2	
Intern/Graduate (s) interpersonal skills		1	2	2	1
Intern/Graduate (s) technical competency		1	2	3	
Intern/Graduate (s) time management skills			2	4	
Intern/Graduate (s) accuracy in job performance			1	5	
Intern/Graduate (s) speed in job performance			2	4	
Intern/Graduate (s) understanding of rubber equipment			1	4	1
Intern/Graduate (s) contribution towards the operation's goals			2	3	1
Intern/Graduate (s) understanding of rubber terminology			1	4	1

Would you hire another Ferris Student? Yes __6__ No _____
Please Comment on Employee(s) Strengths and Weaknesses:

Employer comments:

"Major strength is awareness of laboratory analysis and equipment. Major weakness was process trouble shooting. Suggestions: 1) Add some additional traditional business course work. 2) Provide additional process trouble shooting to the curriculum. Note: intern performed extremely well given the difficult nature of his assignment. He thinks well on his feet and has an excellent work ethic. I would recommend him as an excellent candidate for permanent employment."

"Although the intern had no previous manufacturing experience his main goal for us was to capture tabulated document process data form extrusion process. The intern's information helped us identify (with data) where our process needed controls and what data was meaningful in keeping our process under control. We were very satisfied with his results."

"Interns/graduates have strong equipment and rubber terminology. Their weaknesses would center around theoretical knowledge to draw on when faced with problem solving in uncharted territory."

"We have one graduate and one intern currently. The graduate needs development in the area of interpersonal skills and his personal presentation skills. Intern has been developing very well. Overall we have been very pleased with both."

Employer Assessment

As the Rubber Engineering Technology program is only just beginning its fifth year and the first group of students received their B.S. in May 2001, employer responses to questionnaires were limited to only six (6). Survey questionnaires were sent to all employers who have participated in the internship program.

Probably the most notable, positive feedback from employers is their satisfaction with students' technical skills and work habits. A majority rated our students above average (a score of 4 or 5 on a scale of 1-5) in the areas of problem solving skills, time management, accuracy, speed, and understanding of rubber equipment and terminology. All verbal and written communication with employers over the last four years has been overwhelmingly positive and most employers return for interns year after year. All of the survey respondents indicated they will continue to hire Ferris graduates or interns. All the program graduates have found employment in the industry.

The more negative comments on the survey concern communication skills; both written and verbal/presentation skills. A mean score of 3 (out of the possible 5) was achieved. We have received additional feedback comments through the internship program that corroborates this data. Students coming into the program have poor communication skills (see faculty perceptions). A change currently being considered is allowing students to take English 211 (Technical writing) rather than English 250 (composition). This will be proposed to the Advisory Board.

Employers feel the students/graduates make a real contribution. As stated previously, most employers want additional students/graduates and new internship employers are being added each year due to positive reports about the program. Many undergraduate students are already being offered employment pending graduation.

SECTION VI

Perceptions of the Rubber Programs Faculty

Faculty Perceptions

The faculty consists of assistant professors Matthew Yang and Auggie Gatt. Both have masters degrees. Mr. Yang's background is Polymer Science while Mr. Gatt is well versed in equipment application and processing. Both feel this is an ideal match-up for the Rubber program due to the nature of the products which begin with material formulation and continue through manufacturing processing.

The faculty are very aware of the tremendous industry support enjoyed by this program. There is considerable monetary support. There is abundant supply of material (all donated) whenever we ask. Several industry leaders have volunteered time as guest presenters. The Rubber Industrial Advisory Board is well attended and very participative. Lab and classroom facilities are more than adequate and above average.

Most incoming students have the basic math and science skills to be successful in the program. Entry level communication skills (particularly written) are below average and are not acceptable to the faculty. Additionally, these skills do not seem to improve to industry-acceptable levels in students graduating from the program with a B.S. degree.

Curriculum is very appropriate to the goal of developing "generalist" technologists who can then be further developed along more specific lines by employers. Such specific areas would be: process engineer, project engineer, compounding chemist, sales engineer, or product design engineer. Some changes have been made to the curriculum as a result of having been proposed by the faculty and concurred with by the Rubber Industrial Advisory Board. These include the deletion of Chemistry 311, the addition of Physics 211, the addition of Accounting 201, and the addition of Management 305 (Supervision and Leadership). Future changes worth considering are the deletion of English 250 substituting English 211 (Technical writing).

The major shortfall in the program is the recruiting function. Bachelor and associate graduates are immediately hired by industry and participation the internship program is active and growing. The problem is attracting students to the program at the freshmen level. While appeals have been made to the Rubber Manufacturers Association and the American Chemical Society Rubber Division, no substantive results in the form of recruited students have been achieved. More recruiting at the high school level must be done.

PERSONAL RÉSUMÉ

AUGGIE R. GATT
165 Elm Boulevard
Cadillac, MI 49601
Phone: (616) 775-1967

EDUCATION: B.S. Mechanical Technology,
Bradley University, 1969
M.S. Industrial Technical Education
Bradley University, 1971

BIRTH DATE: 5-25-47
PERSONAL STATUS: Married, 2 grown children
HOBBIES: Snowmobiling, fishing

CAREER EXPERIENCE:

1989 to Present	Cadillac Rubber & Plastics, Cadillac, MI
1989 - 1991	General Manager, Cadillac Plant
1991 - 1994	Vice President Operations
1994 - 1996	President Cadillac Rubber & Plastics, A Wholly owned Subsidiary of Avon Rubber p.l.c.
1996 - 1997	Managing Director Worldwide Operations - Avon Automotive Division of Avon Rubber p.l.c.
Oct. 97' to Present	President, Avon Automotive, North & South America

During my tenure with Avon/Cadillac the company has grown from $71MM annual sales and 7% PBIT to FY98 sales of $178MM and 14% PBIT with ROCE of 42%. Almost all growth has been organic. Considerable organizational development, training, strategic planning and structured capital spending have accompanied and enabled this growth, largely under my direction. Currently I am responsible for seven factories in North America (including Mexico) with total employees in excess of 2,500.

1984 - 1989 General Manager - Morenci Engineered Rubber Products Division of Champion Spark Plug Co. Morenci, MI

This company had not been profitable since 1979. Through Quality and Process improvements and development and implementation of a strategic business plan, sales were increased from $16MM/yr. to $27MM/yr. in five years and profitability regained in 1987. Acquired new business segment which resulted in opening a new Injection Molding facility in Kendallville, Indiana, in 1986.

1982 - 1984 Engineering Manager, General Tire Industrial Products Division of General Tire, Wabash, IN (now Gencorp)

Responsible for Engineering and maintenance activities of this 700,000 ft^2 factory. Department consisted of over 70 people. Upgraded many processes including mixing and earned President's Award for Energy conservation. Frequently performed special Engineering assignments at other group factories and participated in joint technical exchanges with other companies in Japan and Germany.

1978 - 1982 Engineering Manager - Newbern Rubber Division of Cadillac Rubber & Plastics, Newbern, TN

Oversaw four major plant expansions taking this facility from 28,000 ft^2 to 150,000 ft^2 culminating in installation of a state-of-the art F-270 banbury mixer with microprocessor control. Installed extruders, autoclaves, presses and various specialized equipment.

1975 - 1978 Electrical Maintenance Supervisor - Gates Rubber Company, Galesburg, IL

Responsible for electrical maintenance 2nd shift in this 600,000 ft^2 hose manufacturing facility. Conceived and implemented many cost-saving and production enhancing projects.

1971 - 1975 Instructor, Automotive Technology - Galesburg Area Vocational Center, Galesburg, IL

During my tenure, enrollment in this curriculum grew from 35 students to approximately 100 necessitating addition of another instructor and physical facilities.

REFERENCES: Furnished upon request.

Robert D. Marsh
10163 105th Ave.
Stanwood, MI 49346
(231) 972-7999
marshr@Ferris.edu

September 24, 2002

EMPLOYMENT HISTORY

1999 to present: Ferris State University College of Technology, Department Director, Interim Associate Dean
Served as Director of the Plastics and Rubber Engineering Technology Department, including organization management, resolving student issues, recruiting faculty and students, class scheduling, upgrading facilities, coordinating 100+ internships per year, managing budget and many other tasks. Also took on Associate Dean responsibilities during 01 – 02 AY, such as conducting faculty searches, evaluating non-tenured faculty and coordination of extended learning programs.

1990 to 1999: M. A. Hanna Color, Automotive Division, Director of Sales and Marketing
Responsible for sales, marketing, technical service, production scheduling, customer service and strategic planning. Increased sales by 62% and gross margin by 79% in 6 years, continually pushing the capacity limitations of the manufacturing operations. Changed the focus away from "all things to all people" to a sound, strategic market approach. Upgraded the skills of sales and professional staff into the "PC age" and greatly improved the professionalism of sales associates. Also initiated and chaired the M. A. Hanna Company Automotive Industry Council, coordinating the activities of $300 million sales in plastics compounding, distribution and coloring in the U.S. and Europe.

1986 to 1990: M. A. Hanna Color, Automotive Product Manager
Established professional marketing approach to opportunistic business. Nurtured O.E.M. contacts, evaluated and pursued attractive business segments and established pricing practices that substantially improved profitability. Prepared and maintained detailed market analysis.

1984 to 1986: E. I. DuPont, Senior Development Specialist
Introduced the use of amorphous nylon to the automotive market for use in exterior body panels. Laid the groundwork for the commercial use of this material in Chrysler minivans through comprehensive solutions to plastic manufacturing, vehicle assembly and painting operations.

1980 to 1984: United Plastics Division, ITT Corp, Director of Research and Development
Lead successful entry into reaction-injection molding and sheet molding compound for automotive applications. Managed technical service to 5 plastics molding plants in materials selection, plastics processing, painting and electroplating. Also personally responsible for environmental affairs: all permitting and reporting, closing of hazardous waste sites and air pollution remedial action program.

1976 to 1980: OXY Metal Industries, Occidental Petroleum, Process Engineering Manager
Process design for chemical waste facilities which were built primarily for customers with extensive electroplating operations. Personally managed design and construction of waste facility in Sidi-bel-Abbes, Algeria, one of only two subcontractors (out of 36) to GTE Corp. that successfully met all criteria for project completion and received final 15% holdback.

1974 to 1976: BASF Corp., Senior Project Engineer
Equipment specification, facilities design, installation and start-up for a variety of capital expansions related to the manufacture of chlorine, caustic and soda ash. Consistently kept projects within budget and on schedule.

1969 to 1974: E. I. DuPont, Process Engineer, Project Engineer
Improved polymerization of Teflon FEP to increase throughput by 20% at higher yield. Optimized design of new nylon intermediates facility through complete computer simulation. Provided project management of distillation train portion of new adipic acid manufacturing facility.

EDUCATION
B.S. Chemical Engineering (Magna cum Laude), University of Detroit, 1969
M.S. Engineering, Plastics Concentration, University of Detroit, 1969

PROFESSIONAL AFFILIATIONS
Society of Plastics Engineers
Registered Professional Engineer, Michigan

Matthew M-S. Yang

Rubber Program
National Elastomer Center
Ferris State University
919 Campus Drive, NEC 213
Big Rapids, MI 49307-2277

Yangm@ferris.edu

(231)591-5263
(231)591-2642 FAX

Education:

May 1982: Master of Science, Polymer Science, The University of Akron, Akron, Ohio.
June 1970: Bachelor of Science, Chemistry,
National Taiwan Normal (Teachers) University, Taipei, Taiwan.

Professional Experience:

December 1998 to present: Assistant Professor, Rubber Engineering Technology, Ferris State University, 919 Campus Drive, Big Rapids, MI 49307-2277.
September 1987 to December 1998: Staff Scientist, AlliedSignal, Inc., 101 Columbia Road, Morristown, NJ, 07962.
April 1984 to September 1987: Senior Research Group Leader, Alco Chemical Corporation, Chattanooga, TN.
February 1981 to April 1984: Research Chemist, Combustion Engineering Inc. Cast Division, Pittsburgh, PA.
May 1973 to August 1978: Manager of Research and Development, Chan Sieh Chemical Corporation, Taipei, Taiwan.
September 1970 to June 1973: Chemistry Teacher, Yang Ming High School, Taipei, Taiwan.

Thesis:

"Synthesis of poly (vinyl alcohol-g-acrylic acid) and its application as the emulsifier for poly (vinyl acetate), **Master's Thesis,** Polymer Science, Department of Polymer Science, The University of Akron, May 1982.

Patents and Publication:

US Patent 4,659,793 and five related patents from other countries, "Preparation of aqueous solutions of copolymers of dicarboxylic acids having a low dicarboxylic acid monomer content", April 12, 1987.
US Patent 5,453,477, "Process of polymerizing chlorotrifluoroethylene with alkyl hydroperoxide and metal metabisulfite", September 26, 1995.
T. F. McCarthy, R. Williams, M. S. Yang, and F. Mares, "Surfactant-free emulsion polymerization of chlorotrifluorethylene with vinyl acetate or vinylidene fluoride", **J. of Applied Polymer Science,**70, 2211-2225, (1998).

SECTION VII

FSU Rubber Advisory Board Perceptions

RUBBER ADVISORY COMMITTEE SURVEY

The compiled results of the survey are attached. The Advisory Board Survey gave the program high marks (4.0 or above) for:

- Balance of hands-on vs. theory education
- Meets health and safety standards
- Adequate student to instructor ratio
- Board meeting agendas are appropriate for giving direction
- Board is provided adequate and proper direction to function efficiently

Poorer scores (3.5 and below) were given for:

- Satisfies a broad range of industries (auto, furniture, household, etc.)
- Equipment is sufficient for the number of students enrolled
- Is appropriately funded by the University

The lower-ranked items are somewhat of a surprise. The rubber industry in Michigan, Ohio and Indiana is strongly automotive. While this is somewhat reflected in our coursework, the skills gained by our students are applicable to most industries. This concern has not been raised at advisory board meetings.

The status and plans for laboratory equipment is reviewed at each advisory board meeting, and we always have felt that there has been buy-in by the board.

A very poor score of 3.0 was given for University support. This has to be related to student recruiting. Board members are well aware that the student to faculty ratio is low while the program is being built, and concerns have never been raised about the amount of S & E funding.

Specific additional comments address the following:

- Highlighting the need for more students and suggestions for better recruiting
- Offering web courses and seminars to extend our reach to industry
- A suggestion for 2 additional pieces of lab equipment
- A statement that our students have unrealistic salary expectations (This comment is also occasionally made about our plastics grads. The market determines this, and some companies do not hire our students because they are unwilling to offer the market price.

Conclusions

No changes are suggested to our core curriculum. The items given low scores will be addressed in the next advisory board meeting.

Ferris State Rubber Program Advisory Board Survey — SURVEY RESULTS

How many years have you served on the advisory board? _____

Has your company hired rubber graduates or interns from Ferris? YES (1) NO (2)

INSTRUCTIONAL PROGRAM CONTENT & QUALITY:						MEAN SCORE
1. Is keeping with industry trends and changes	1	2	3	4	5	**3.75**
2. Satisfies a broad range of industries (auto, furniture, household, etc.)	1	2	3	4	5	**3.50**
3. Has a good balance of hands-on vs. theory education	1	2	3	4	5	**4.42**
INSTRUCTIONAL EQUIPMENT AND MACHINERY:						
1. Is updated to reflect latest technology used in industry	1	2	3	4	5	**3.58**
2. Is maintained in good running condition	1	2	3	4	5	**3.80**
3. Is sufficient for the number of students enrolled (students/machine in lab, number of rooms, etc.)	1	2	3	4	5	**3.50**
4. Meets health and safety standards	1	2	3	4	5	**4.00**
5. Is appropriately funded by the university (excluding grants and gifts from industry)	1	2	3	4	5	**3.00**
6. Represents sound industry standards (house keeping, procedures, etc.)	1	2	3	4	5	**3.60**
THE PLACEMENT SERVICES FOR THIS PROGRAM:						
1. Knows the level of need for professionals in the rubber industry	1	2	3	4	5	**3.67**
2. Are valuable to the student for finding employment and help students evaluate good vs. bad positions/companies	1	2	3	4	5	**3.67**
3. Shows that industry comes to FSU looking for students	1	2	3	4	5	**3.67**
STAFF:						
1. Is adequate in student to instructor ratio	1	2	3	4	5	**4.17**
2. Has sufficient opportunity to grow with industry (technology, etc.)	1	2	3	4	5	**3.83**
3. Is represented by strong leadership practices and has a voice in the university operations	1	2	3	4	5	**3.75**
ADVISORY BOARD:						
1. Time is used wisely and input is considered/utilized	1	2	3	4	5	**3.83**
2. Meeting agendas are appropriate for giving direction	1	2	3	4	5	**4.00**
3. Meets often enough to help keep program on track	1	2	3	4	5	**3.86**
4. Is provided adequate and proper direction to function efficiently	1	2	3	4	5	**4.14**

PLEASE USE THE REVERSE SIDE TO MAKE ANY RECOMENDATIONS YOU HAVE FOR THE FERRIS RUBBER PROGRAM.

SECTION VIII

Labor Market Analysis

Labor Market Analysis
Rubber Program Review

Industry Background & Forecast

The "rubber products" sector of the economy approaches $40 billion in annual sales. The applications of rubber as an engineering material are ubiquitous. Demand for quality rubber components in a variety of applications will continue, due to the unique, proven and cost-effective performance of rubber in demanding engineering settings, as well as in consumer and medical products. The near-term demand outlook for engineers with a specialty in elastomers is above average, and will embrace a wide range of companies – industrial, automotive and chemical. Long term, the demand for rubber engineers could increase rapidly.

Size of the Rubber Products Industry

There are more than 800 manufacturers of rubber products in the United States. 31% of these companies operate in the Midwest, to include Michigan, Ohio, Indiana, Wisconsin and Illinois.

There are 73 rubber companies involved in the manufacture of industrial, aircraft, agricultural, recreational and passenger/truck tires. There is some overlap between those companies manufacturing industrial products and those manufacturing tires. Many of these companies operate multiple plants in the United States, and many have overseas operations.

There is a large supplier base that supports the manufacture of finished rubber products. This supplier base includes large multi-national chemical companies, ingredient suppliers, press and mixing machine makers, and test equipment manufacturers. *All of these businesses can use the type of graduate Ferris produces in its rubber program.* Job titles encompassed here would include industrial engineer, sales engineers, operations manager, plant manager, quality control director, production supervisor, general manager, and even president and CEO.

Rubber Industry Customers

To a significant extent, the sustainability of the finished rubber products industry is tied to the automotive sector. There is an average or 54 pounds of rubber in a typical car or SUV. This number is not inclusive of tires. Domestic automakers predict the sale of 17 million domestic automobile units in 2002.

Besides autos, rubber products are used in an extremely wide array of products, being used in virtually all other industries (aerospace, defense, computing, appliances, medical...) as well as being supplied to consumers (footwear, gloves, hoses, roofing....) So, the rubber industry is not going away, and its need for workers will continue.

Workforce Situation Today

Historically, the rubber industry has not done a good job in grooming its future workforce. Since is not seen as a particularly glamorous or high-paying career (although it offers competitive salaries) there are long-standing unfilled engineering and chemistry jobs in many rubber-related facilities.

Now, with the recent grounding of many high flying "techno wizards", coupled with a tight job market and a new recognition that steady work might beat stock options, there may be perception shift among college age persons as to the value of an engineering/manufacturing curricula or career. This shift, if there is one, will not solve industry's short-term talent shortage, however. Jobs will remain unfilled.

Demand for Workers

So, given the current demands and uses for rubber products, the unique nature of rubber as an engineered material, the lack of substitute materials with the spectrum of performance characteristics found in rubber, and the current hiring needs of the rubber industry (in spite of the current economy) it would be logical to assume that there will be a stable, consistent demand for quality rubber engineers well into the foreseeable future.

Overall Prospects for Ferris Rubber Graduates

On the demand side, as least in the case of "Rubber Engineers" (of which Ferris State University has the monopoly) it is a very safe assumption that the rubber industry will seek to hire all the Rubber Engineers that can be graduated. And, the interest in Ferris' rubber graduates will extend into related disciplines and companies, further enhancing job prospects. As a well-respected member of the rubber community recently stated: " It is easier to teach polymer chemistry to an engineer, than it is to teach engineering to a chemist."

Specific Outlook for Ferris Graduates: 2002-2007

Anecdotal evidence, backed by conversations with rubber industry executive who belong to RMA, and further backed by 2002 RMA Benchmarking Data, indicates that there will continue to be a demand for all of the engineers being graduated by Ferris States rubber program, with demand perhaps increasing beyond 2007. This increase in demand can be predicted by the fact that the rubber industry (anecdotally) is a "graying" industry; the rubber industry will not be capable of attracting large numbers of interested operators, engineers and supervisors in the near term; and, due to economic factors, many long-term experienced employees are now nearing retirement, or are being "encouraged" to retire early, as a cost saving measure. Should the rubber economy return to the strength it had in the mid-to-late 1990's, such a scenario would create a huge vacuum, forcing companies to recruit and offer top pay to qualified engineering graduates. This bodes well for graduates in a position to take advantage of such a hiring climate.

Summary Conclusion

Through 2007, graduates of the Ferris State Rubber Degree Program will be in demand. Beyond 2007, depending upon the size of the graduating class and the state of the manufacturing economy, demand for Ferris graduates will be either good, or excellent. In either case, it is clear that the Rubber Engineering Technology Program at Ferris State University is critical, and industry is more that ready to assimilate its graduates into the business of rubber-product manufacture, offering technical challenges, job stability and competitive compensation for those willing to make the commitment to this program. The challenge for both Ferris and industry is to work together to insure that freshman enrollment in the rubber program is adequate to both sustain the program, and provide this steady stream of capable new talent into the rubber industry.

Kevin D. Ott
Vice President
General Products Group
Rubber Manufacturers Association
September 25, 2002

Labor Market Analysis - Addendum
Rubber Technology
Rubber Engineering Technology

Bachelor of Science, Plastics Engineering Technology

Only one other U.S. college offers a bachelors program similar to ours. The University of Massachusetts at Lowell has started a B.S. in Rubber Engineering. They had 6 students enrolled during the 2001 – 2002 academic year.

The attached "2000 Rubber Employment & Salaries" show the career opportunities for our rubber graduates. The shaded positions are entry-level, but the incomes are not starting salaries. Positions are defined by the Bureau of Labor Statistics for all industries. The "Industrial Engineer" and "Mechanical Engineer" titles are closest to the positions of process engineer and project engineer that are more commonly used in the rubber industry.

It is likely that at least 10% of the entry-level positions are vacated each year, as the incumbents move to more responsible positions. This suggests that at least 400 positions are available annually for our graduates. Because there have not been true B.S.-level rubber graduates, companies have filled their needs with people who have related (i.e. engineering) degrees or unrelated degrees. In either case, considerable on-the-job training is needed to allow these "others" to perform at the level of Ferris rubber graduates. In the past, this industry has filled some of their needs with Ferris plastics graduates at their typical salaries. The 2000/2001 plastics graduates averaged $47,840[8], the 3rd highest of bachelors degrees at Ferris, behind Pharmacy and Welding Engineering Technology. All 2001/2002 rubber graduates are employed in industry.

Common early-career positions for our B.S. graduates will include process engineer, project engineer, technical service representative, manufacturing supervisor/manager, and technical sales representative (see the attached "Job Descriptions for Graduates..."). Our curriculum closely follows the background needed for the first three of these positions and is good preparation for the others. As in any profession, long-term career paths may require considerable additional training and education.

Rubber is a global industry. Daily contact with business associates in other countries is common in many positions. The countries our graduates will often deal with are Mexico, France, Germany, Italy, Great Britain and, increasingly, China. Foreign language skills, which must be obtained outside our curriculum, can be very valuable.

Associate of Applied Science, Plastics Technology

There are no other schools that offer a degree similar to our A.A.S. in Rubber Technology.

The attached "2000 Rubber Employment & Salaries" shows that there are almost 12,000 total positions suitable for our A.A.S. grads, all of which can be considered entry-level. Normal turnover of at least 10% suggests that there should be at least 1,200 openings annually for our A.A.S. graduates. The majority of the positions appropriate for A.A.S. grads are filled with experienced, non-degreed personnel. We expect the majority of our students to continue into the B.S. program because the long-term career prospects are far greater.

Common early-career positions for our A.A.S. graduates include laboratory technician, process set-up associate (who changes production machinery to run different products), and production foreman/supervisor. Our graduates are well-prepared for the first two positions, and have the technical and some of the business skills for the third. It is often very difficult for A.A.S. graduates to advance to professional-level positions.

Summary

The rubber industry will continue to be a major employer, and the long-term employment prospects for our graduates are excellent. The number of available positions far exceeds the number of graduates available. There are no industry trends that require program or facilities changes. As our graduates each follow their diverse career paths, they are well-prepared to obtain the additional skills they will need.

R. Marsh
9/5/02

2000 RUBBER EMPLOYMENT & SALARIES

(source: U.S. Department of Labor, Bureau of Labor Statistics)

SIC 301 - Tires & Inner Tubes
SIC 305 - Gaskets, Packing & Sealing Devices
SIC 306 - Fabricated Rubber Products

	SIC 301		SIC 305		SIC 306		Industry Total	
Position for B.S. Graduate	**Employment**	**Mean Salary**	**Employment**	**Mean Salary**	**Employment**	**Mean Salary**	**Employment**	**Mean Salary**
General and Operations Manager	470	87250	1000	87550	1610	84590	3080	85957
Marketing Manager	--	--	90	76560	200	77960	290	77526
Sales Manager	70	66420	160	76960	300	70020	530	71640
Engineering Manager	200	80620	230	75360	390	75920	820	76909
Industrial Engineers	350	51860	650	50440	670	49740	1670	50457
Materials Engineer	--	--	130	55960	--	--	130	55960
Mechanical Engineers	380	58550	410	57490	630	54770	1420	56567
Sales Representative	30	54360	320	59340	120	49900	470	56612
Sales Engineer	--	--	230	55370	120	66940	350	59337
Totals	**1500**	**69208**	**3220**	**68150**	**4040**	**70359**	**8760**	**69350**
				Entry-Level Position Total			**4040**	

	SIC 301		SIC 305		SIC 306		Industry Total	
Position for A.A.S. Graduate	**Employment**	**Mean Salary**	**Employment**	**Mean Salary**	**Employment**	**Mean Salary**	**Employment**	**Mean Salary**
Cost Estimator	--	--	140	39760	130	43530	270	41575
Industrial Engineering Technician	30	41450	250	32380	370	36210	650	34979
Mechanical Engineering Technician	370	48060	100	41280	300	39090	770	43685
Chemical Technician	70	34050	250	32080	460	28440	780	30110
First-Line Production Supervisor	2470	43590	2610	36590	4230	37060	9310	38661
Totals	**2940**	**43904**	**3350**	**36212**	**5490**	**36545**	**11780**	**38287**

JOB DESCRIPTIONS FOR GRADUATES OF PLASTICS ENGINEERING TECHNOLOGY RUBBER ENGINEERING TECHNOLOGY FERRIS STATE UNIVERSITY

PROCESS ENGINEER
Develops new plastics or rubber processes, products and technologies. Performs studies to improve the cost and quality of plastic or rubber products. May develop new manufacturing methods and materials. Will often be called upon to solve manufacturing problems. Usually works at a manufacturing facility.

PROJECT ENGINEER
Manages projects to manufacture a new product, install a new process or expand manufacturing operations. Coordinates the activities of the sales department (including working with customers), materials suppliers, equipment suppliers, mold manufacturers and the plant process engineer to assure that the project is completed on time and within budget. May work in an engineering center, sales office or manufacturing facility.

DESIGN ENGINEER
Designs new products based on in-depth knowledge of manufacturing processes, tooling capabilities, materials properties and test methods. May perform computer simulations of the manufacturing process to maximize quality and minimize cost. May work in an engineering center or in a manufacturing facility.

MANUFACTURING SUPERVISOR/MANAGER
Responsible for day-to-day production operations. Hourly workers and foremen work for the Manufacturing Supervisor, who in-turn work for the Manufacturing Manager/Plant Manager. Recent graduates will typically hold supervisory positions, while more experienced graduates may become Plant Managers. Works at a manufacturing facility.

TECHNICAL SALES REPRESENTATIVE
May work for a manufacturer of plastic or rubber products, processing equipment or raw materials. Interacts with engineering, manufacturing management, purchasing, quality assurance and other functions at current or potential customers. Uses verbal and written communications skills to convince customers that your company's products are technically and economically superior to those of competitors. May work out of a sales office or an office in your home. Travel may be local, regional or international.

TECHNICAL SERVICE REPRESENTATIVE
Usually works for a materials or equipment manufacturer. Helps customers solve technical problems in using your company's products and helps them prepare for the use of new products. May work out of an engineering office, manufacturing facility, sales office or your home. Travel may be local, regional or international.

MID-CAREER POSITIONS

Senior Engineer
Engineering Manager/Director
Manufacturing Manager/Director
Project Manager
Plant Manager
Account Manager
Sales Manager/Director
Senior Designer
Technical Manager/Director

INDUSTRIES NEEDING THE SKILLS OF OUR GRADUATES
Plastic and rubber are critical to many products, so there is an opportunity to work for thousands of companies in many different industries, almost anywhere in the world. Automotive, furniture, medical, sporting goods, computers, soft drinks, cosmetics, toys and aerospace are just a few of the industries that need plastics or rubber technical graduates.

SALARIES
In the 2000 – 2001 school year, our bachelor degree graduates earned an average of approximately $45,000 per year. It is common for experienced professionals in the plastics and rubber industries to make $75,000 per year, and higher-level positions can exceed $100,000 per year.

SECTION IX

Evaluation of Facilities and Equipment

Equipment Summary

The Rubber laboratory is, by and large, very adequate. The capability exists for recipe preparation and mixing in small (3 lb.) batches for physical properties testing as well as lager (30 lb.) batches for processing or production size equipment.

The recent acquisition of a vacuum vented extruder rounds out the spectrum of processes employed. Students can now be exposed to mixing, compression, transfer, and injection molding and conventional and continuous extrusion.

There is ample capacity in terms of the number of key types of equipment. The one exception is the area of injection molding where we have only three operable machines. This precludes enough student "hands on" time. We have an older Desma machine which could be made operable for about $25k but we are currently pursuing the possibility of consignment of a new Rutil machine. Another area that needs upgrading is the mill used for the 30 lb. Banbury. This mill is too small and should be replaced with a 30 lb. Machine. The existing 20" mill could then be used with our 1 ½" hot feed extruder.

It is worth mentioning that four (4) years ago, at the inception of the program, virtually no machines were operable. Since then, we have acquired a new Rep injection molder, tooling for three injection presses, and an additional 3 lb. mixer, a 30 lb. Mixer, a hot feed extruder, and vented extruder. Most test equipment has been upgraded to computer control. The laboratory, when viewed by industry visitors is described as "quite comprehensive".

Rubber Engineering/Technology
Equipment Summary

Mixing:	origin	condition
Size 1 mixer	used	rebuilt
2 BR mixers	used	rebuilt
2 lab mills	used	rebuilt
20 inch mill	used	rebuilt
Molding:		
Dieffenbacher Injection Molder	new	excellent
Rep Injection Molder	new	excellent
2 Desma Injection Molders	used	good/poor
Wabash vacuum press	new	excellent
Wabash compression press	used	good
Extrusion/Curing:		
Lab Autoclave	new	excellent
1.5 inch extruder	used	rebuilt
2.5 inch vented extruder	used	rebuilt
20 ft. salt bath	used	good
Testing:		
2 hot presses	new	good
1MDR rheometer	new	good
3 ODR rheometers	used	good
2 Mooney viscometers	used	good
2 tensometers	new/used	good
Brabender Plasticorder	used	good
Capillary rheometer	used	good
Cold retraction(TR10) tester	new	good

SECTION X

Curriculum Evaluation

The Rubber Programs Curricula

The Rubber Programs are defined as a 2 + 2 progression. Students apply for entry into Rubber Technology which is a two-year curriculum that terminates with an Associate of Applied Science (A.A.S.) degree. The entry criteria are:

1. 2.0 GPA
2. High School Algebra and MATH ACT=19.
3. Students have to take CHEM 103 during the first semester for those without High School chemistry

Students that receive an A.A.S. degree in Rubber Technology, and meet the entrance requirements for progression, can apply for entrance in Rubber Engineering Technology program which is a two-year curriculum that terminates with a Bachelor of Science (B.S.) degree. The other entry criteria are:

1. 2.70 GPA in Rubber classes
2. 2.5 GPA in Math classes
3. 2.5 GPA overall.

When the Rubber Programs were first created, the curricula were designed parallel to the successful FSU Plastics Programs which emphasize a broad understanding of processes, design principles, engineering systems, and materials. Through several Advisory Board meetings, it was decided that the students with business and leadership training would be more desirable by the rubber industry. A physics course was also recommended to be included in the curricula. The curriculum change also includes Supervision and Leadership (MGMT 305) and Principles of Accounting (ACCT 201). These changes became effective starting from the fall semester, 2001.

Table of curriculum analysis, Programs check sheet, and course syllabi are attached.

Rubber Curriculum Analysis

	A.A.S. Rubber Technology (2 years, 69 credits total)	B.S. Rubber Engineering Technology (4 years, 134 credits total)
1. Rubber	29% (20 credits)	32% (43 credits)
2. English	13% (9 credits)	9% (12 credits)
3. Math	12% (8 credits)	6% (8 credits)
4. Technology	14% (10 credits)	25% (34 credits)
5. Science	19% (13 credits)	10% (13 credits)
6. Business	4% (3 credits)	4% (6 credits)
7. General Education	9% (6 credits)	13% (18 credits)
Total	100%	99%

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

RUBBER CURRICULUM GUIDE SHEET
ASSOCIATE IN APPLIED SCIENCE (A.A.S.)
RUBBER TECHNOLOGY
FALL SEMESTER

First Year Fall Semester (16 credits)			Credits
RUBR	110	Introduction to Rubber Technology	3
ETEC	140	Engineering Graphics	3
MATH	116	Algebra & Numerical Trigonometry	4
ENGL	150	English 1	3
____	____	Cultural Enrichment	3

First Year Winter Semester (17 credits)			Credits
RUBR	121	Rubber Processing 1	3
MFGT	150	Manufacturing Processes	2
MATH	126	Algebra & Analytic Trigonometry	4
CHEM	121	General Chemistry	5
____	____	Social Awareness	3

Summer Semester - Freshman/Sophomore

RUBR 193 Industrial Internship 4

Second Year Fall Semester (16 credits)			
RUBR	211	Rubber Processing 2	4
ENGL	250	English 2	3
RUBR	212	Rubber Tool Design & Construction	2
PHYS	211	Introductory Physics	4
COMM	121	Fundamentals of Public Speaking	3

Second Year Winter Semester (16 credits)			
RUBR	223	Rubber Measurement & Testing	4
EEET	201	Electrical Fundamentals	3
CHEM	211	Fundamentals of Organic/Polymer Chem.	4
MECH	250	Fluid Power with Controls	2
MGMT	305	Supervision and Leadership	3

Total semester hours required for AAS graduates: 65 (69 with internship)

Meeting the requirements for graduation indicated on this sheet is the responsibility of the student. The student is also responsible for meeting all FSU General Education requirements as outlined in the university catalog. Your advisor is available to assist you.

BACHELOR OF SCIENCE (B.S.)
RUBBER ENGINEERING TECHNOLOGY
FALL SEMESTER

Third Year Fall Semester (14 credits)			
PLTS	300	Engineering Management Systems	4
MECH	340	Statics & Strength	4
ENGL	311	Advanced Technical Writing	3
EEET	301	Controls for Automation	3

Third Year Winter Semester (17 credits)			
RUBR	312	Rubber Product Design	4
RUBR	321	Rubber Compounds/Compounding	4
MFGE	353	Statistical Quality Control	3
STQM	311	Continuous Improvement Tools	3
____	____	Cultural Enrichment	3

Summer Semester - Junior/Senior

RUBR 393 Industrial Internship 4

Fourth Year Fall Semester (16 credits)			
PLTS	320	Plastics and Elastic Material	3
RUBR	411	Advanced Rubber Processing	4
ACCT	201	Principles of Accounting	3
____	____	Social Awareness	3
____	____	Cultural Enrichment (200+)	3

Fourth Year Winter Semester (15 credits)			
RUBR	499	Rubber Senior Seminar	1
MFGE	451	Intro. to Plant Engineering	3
MFGE	423	Engineering Economics	2
MFGE	351	Intro. Industrial Engineering	3
____	____	Technical Elective	3
____	____	Social Awareness (300+)	3

Total Semester hours required for BS graduate: 127 (135 with internships)
Meeting the requirements for graduation indicated on this sheet is the responsibility of the student. The student is also responsible for meeting all FSU General Education requirements as outlined in the university catalog. Your advisor is available to assist you.

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FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

CURRICULUM REQUIREMENTS
Rubber Technology (RT)
Associate in Applied Science (AAS)
FALL SEMESTER

ENTRY CRITERIA:

1. 2.0 GPA (High School or College Transfer GPA)
2. High School Algebra (or MATH 110 or equivalent) and MATH ACT = 19: MATH 116 placement

TECHNICAL			CREDIT HOURS
RUBR	110	Introduction to Rubber	3
RUBR	121	Rubber Processing 1	3
RUBR	193	Rubber Technology Internship	4
RUBR	211	Rubber Processing 2	4
RUBR	212	Rubber Tool Design & Construction	2
RUBR	223	Rubber Measurement & Testing	4
Technical Related			
EEET	201	Electrical Fundamentals	3
ETEC	140	Engineering Graphics Comprehensive	3
MECH	250	Fluid Power with Controls	2
MFGT	150	Manufacturing Processes	2
MGMT	305	Supervision and Leadership	3

GENERAL EDUCATION			CREDIT HOURS
Communication Competence			
ENGL	150	English 1	3
ENGL	250	English 2	3
COMM	121	Fundamentals of Public Speaking	3
Scientific Understanding			
CHEM	121	General Chemistry 1	5
CHEM	211	Fund. of Organic/Polymer Chemistry	4
PHYS	211	Introductory Physics	4
Quantitative Skills			
MATH	116	Intermediate Algebra & Num. Trig.	4
MATH	126	Algebra & Analytical Trigonometry	4
Cultural Enrichment			
Elective			3
Social Awareness			
Elective			3

Bachelor of Science (BS)
Rubber Engineering Technology (RET)
Fall Semester

ENTRY CRITERIA:

1. Application by March 1 prior to Fall term requested.
2. AAS in Rubber Technology
3. 2.70 GPA in Rubber (RUBR) classes.
4. 2.5 GPA in MATH classes including MATH 116 & 126.
5. 2.50 GPA overall.

TECHNICAL			CREDIT HOURS
PLTS	300	Plastics Engineering Management Systems	3
PLTS	320	Plastics & Elastomeric Systems	3
RUBR	312	Rubber Product Design	4
RUBR	321	Rubber Compounds	4
RUBR	393	Rubber Internship	4
RUBR	411	Advanced Rubber Processing	4
RUBR	499	Rubber Senior Seminar	1
Technical Related			
ACCT	201	Principles of Accounting 1	3
EEET	301	Controls of Automation	3
MECH	340	Statics & Strengths of Materials	4
MFGE	351	Intro to Industrial Engineering	3
MFGE	353	Statistical Quality Control	3
MFGE	423	Engineering Economics	2
MFGE	451	Intro to Plant Engineering	3
STQM	311	Continuous Improvement Tools	3
ELECTIVE		Technical Elective	3

GENERAL EDUCATION			CREDIT HOURS
Communication Competence			
ENGL	311	Advanced Technical Writing	3
Scientific Understanding			
(Taken in Associate Degree)			
Quantitative Skills			
MATH	126	Algebra & Analytic Trig (taken in AAS degree)	
Cultural Enrichment			
Electives (3 cr. hr. must be at 200 level or higher)			6
Social Awareness			
Elective (3 cr. hr. must be at 300 level or higher)			6

B.S. Degree Minimum General Educational Requirements in Semester Hours (including AAS degree):

Cultural Enrichment Credits - 9
Communication Credits - 12
Social Awareness Credits - 9
Scientific Understanding Credits - 7/8

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FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY
DESIGN, MANUFACTURING & GRAPHIC ARTS

Course Syllabus

Course Title: RUBR-110 Introduction to Rubber Technology

Course Description: This course assumes that the student has no prior knowledge of rubber, chemistry, or manufacturing. The course will provide an awareness of the following: rubber industry terminology, the nature of rubber industry, end-use applications of rubber products, the basic processing techniques utilized and safety procedures applicable to the rubber industry. Similarities and differences between rubber and plastics industries will be explored. This course is intended to be the technical foundation on which the remainder of the curriculum is built.

Credit Hours: 3 Semester Hours

Contact Hours:

Lecture:	Two Hours/Week
Lab:	Three Hours/Week
Field Trip:	Three one-day field trips to Michigan rubber processing companies.

Prerequisites: An interest in exploring the field of rubber processing technology.

Textbook Required: "Rubber Technology" Morton, Third Edition

Units of instruction and student learning goals for each unit:

I. Course Introduction
   A. Know and understand the course objectives
      - Grading
      - Testing
      - Labs
      - Field trips
   B. Safety rules and emergency procedures

II. Introduction to the rubber industry
   A. Name the major end-use markets
   B. Name the types of rubber associated with each market
   C. Name the major suppliers and their global locations
   D. Understand the key properties of rubber and their measurement used in the rubber industry

III. Introduction to Rubber Materials
- A. The history of rubber
- B. The types of rubber
  1. Natural rubber
  2. Synthetic rubber
- C. Introduction to polymer science and technology
  1. Natural polymer
  2. Synthetic polymer
- D. Differences between rubber and plastics
  1. Thermoplastics
  2. Thermosets
  3. Thermoplastic elastomers
- E. The curing of rubber
  1. Molecular structure
  2. Chemistry of curing
  3. Mechanical analogy
- F. Rubber compounds

IV. Introduction to rubber properties and testing
- A. Some important properties of rubber
  1. Elasticity
  2. Rebound
  3. Strength
  4. Stiffness
  5. Resistance to temperature extremes
  6. Resistance to chemicals and fluids
  7. State-of-cure
- B. Rubber property measurement
  1. Tensile
  2. Modulus
  3. Stress relaxation
  4. Compression set
  5. Low temperature stiffness
  6. Aging tests
  7. Rheology
- C. Classification system for rubber compounds

V. Rubber Handling and Processing Methodes
- A. Rubber compound mixing
  1. Recipes for compounding
  2. Weighing ingredients
  3. Internal mixers
  4. Roll mill mixing
  5. Finaling
- B. Rubber compound batch testing

1. Rheometer
2. Hardness
3. Specific Gravity
4. Tensile

C. Rubber preforming
1. Barwell Preformer
2. Extruder

D. Rubber molding methods
1. Compression
2. Transfer
3. Injection

E. Other forming methods
1. Extrusion of shapes
2. Calendaring
3. Mandrel molding

VI. Manufacture of Rubber Product
A. Major rubber product categories and the processes used to produce them
B. Describe the product design for each category
C. Describe the types of tooling

VII. Basic Rubber Product Cost Elements
A. Rubber material (compound)
B. Tooling
C. Processing steps and time
D. Packaging

VIII. Field Trip Activities

Three one-day field trips will be utilized to expose the students to a broad range of processes used and products produced in the rubber industry. Details of these field trips will be communicated to the students as they are finalized.

Each student will prepare a field trip report for each trip. This will be due one week after each trip. The following information is to be included in each report:

A. Companies visited
B. Rubber processes employed at each location visited
C. Rubber products or materials produced at each location
D. Polymers/Elastomers used by each location
E. Process flow charts for each product line
F. Housekeeping at each location

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY
DESIGN, MANUFACTURING & GRAPHIC ARTS

Course Syllabus

Course Title: RUBR-121 Rubber Processing 1

Course Description: This course provides knowledge of ingredients, equipment and methods used to create uncured rubber of consistent quality. This includes: evaluation of ingredient quantities for a batch of rubber, mixing techniques for optimum consistency and heat history and putting the rubber into a form that can be utilized for various types of part fabrication. Methods for evaluation of mixed material are explored.

Credit Hours: 3 Semester Hours

Contact Hours: Lecture: Two hours per week
Lab: Three hours per week

Prerequisite: RUBR 110

Textbooks Required: (1) "Rubber Technology" Morton, Third Edition.
(2) "The Vanderbilt Rubber Handbook" Ohm, Thirteenth Edition.

Units of instruction and student learning goals for each unit:

I. Course Introduction
- A. Know and understand the course objectives
  1. Testing
  2. Grading: quizzes, exams, final exam
  3. Lab and Research Reports.
- B. Safety and conduct in lab, rubber mill, Banbury mixer
  1. Safety guidelines from the College of Technology and Plastics and Rubber Programs
  2. Chemicals --- MSDS
  3. Handling chemicals --- chemical hygiene, personal protective equipment, etc.
  4. Equipment and instruments
- B. Expectation

II. Types of ingredients in a formulation
- A. History of rubber compounding
- B. Introduction to rubber chemistry

III. Evaluation of ingredients
- A. The elastomer (natural or synthetic).
- B. Vulcanizing agents.
- C. Accelerators.

D. Accelerator activators and retarders.
E. Antioxidants and antiozonants.
F. Processing aids.
G. Reinforcing pigments and resins.
H. Inert fillers and diluents.
I. Special purpose materials.

IV. Types of mixing equipment
A. Internal mixers---Banbury
B. Roll mills
C. Others.
D. Prepare standard operation procedures (SOP).

V. Weighing and measuring of ingredients
A. General chemistry lab practice.
B. Housekeeping and cross-contamination.
C. Determine the optimum batch size.

VI. Batch mixing techniques
A. Go over the SAFETY PROCEDURE.
B. Understand SOP for Banbury mixer and roll mill.
C. Compound ingredients into raw rubber and mixing schedule.
D. Practice compounding technique --- Banbury mixer and roll mill.
E. Check the batch mass and record.
F. Compare differences between Banbury and roll mill.

VII. Evaluation of mixed rubber
A. Mooney Viscometer
B. Measure vulcanization (curing) rate by Monsanto Rheometer
C. Analyze data from Mooney Viscometer and Monsanto Rheometer
D. Prepare vulcanizates (rubber slabs)
E. Properties of vulcanizates.
1. Density of cured and uncured rubber
2. Tensile strength
3. Rebound test
4. Low-temperature tests.
5. Oil resistance.
6. Other aging tests.
F. Properties of different rubbers
G. Effects of fillers and carbon black.

VIII. Other processes for different rubber products
IX. Evaluations

X. Lab clean-up.

Revised by A. Gatt 12/21/99

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

COURSE: RUBR 193

Plastics & Rubber Engineering Technology Department

COURSE SYLLABUS

COURSE TITLE: Rubber Technology Internship

COURSE DESCRIPTION: Ten weeks of supervised on-the-job training with a rubber polymer producer, rubber custom mixer or rubber product manufacturer.

CREDIT HOURS: Four semester hours

CONTACT HOURS: Ten weeks or 400 hours minimum on-the-job

PREREQUISITE: RUBR 110, RUBR 121 plus approval of Internship Coordinator

TEXTBOOK: None

UNITS OF INSTRUCTION, STUDENT LEARNING GOALS AND COURSE REQUIREMENTS:

I. Ten weeks approved, supervised employment at a firm, which produces rubber polymers, mixes rubber compounds or manufactures rubber products.

II. Ten weekly reports while on-the-job.
- A. **Complete and return information sheet with or before first weekly report.**
- B. Report should be at least one page in length, diary or narrative style
- C. Report cover page to contain the following information:
  1. Date submitted
  2. Week for which report is written (dates)
  3. RUBR 193
  4. Term and year
  5. Intern's name
  6. Report number
  7. Company name and location
  8. Shift assignment (days, evenings, nights and/or hours)
- D. Reports accepted no later than 11 school days after end of week covered by report.
- E. Report to be signed by supervision or responsible company representative.

III. On-the-job visit by the Intern Coordinator or designee. Note: this visit cannot be scheduled without the coordinator receiving the information sheet.

IV. Written evaluation by supervisor

V. Final Report
   A. Five pages in length, exclusive of materials not written by the intern and a resource page.
   B. Typed, double spaced
   C. Due the last day of term in which registered
   D. May include company organizational and product line information
   E. For each Weekly Report not completed by the Final Report due date, two pages are to be added to the Final Report.
   F. For each week report is late past the beginning of the following term, two pages will be added to the length requirements.

VI. Student must be registered in RUBR 193 for the term in which the internship work is done. Student will be dropped from course if no communication is received by the end of the tenth week of the term.

GRADING CRITERIA

	POINTS
Completed information sheet (with directions)	10
Ten weeks of work at 3 points per week	30
Ten weekly reports at 2 points per report	20
Intern Supervisor Evaluation	15
Final Report (5 pages minimum)	25
TOTAL	100

100 points required for Credit (CR).

An incomplete (I) is to be corrected by end of the following term, unless other arrangements are made between the student and the instructor.

Satisfactory completion of course requirements will result in a CREDIT (CR) GRADE. And INCOMPLETE (I) grade will be issued only if at least 60% of the course requirements have been completed by the final day of the term and a request for an "I" has been received from the student. A NO CREDIT (NC) grade will be given if less than 60% of the course requirements have been met.

WITHDRAWAL (W) GRADES: Any registered intern who has not submitted an information sheet, first report or other communication by the end of the seventh week of the term will be withdrawn (dropped) from the course with a W grade and will not be eligible for a tuition reimbursement.

Submitted by: Stanley N. Smith

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY
DESIGN, MANUFACTURING & GRAPHIC ARTS

Course Syllabus

Course Title: **RUBR 211 Rubber Processing II**

Course Description: This course will provide the student with comprehensive knowledge of physical and chemical properties of different kinds of rubber. The student will learn to correlate rubber properties to those control parameters in rubber compounding and manufacturing. After completion of this course, the student will be able to solve common problems encountered during the operation of instruments and equipment used in the rubber industry.

Credit Hours: 4 Semester Hours

Contact Hours: Lecture 2 hours/week
Lab 6 hours (two three-hour labs)/week

Prerequisites: RUBR 110 and RUBR 121

Textbook Required: "Rubber Products Manufacturing Technology", by Bhowmick

Units of Instruction and Student learning goals for each unit:

I. Course Introduction
   A. Know and understand the course objectives
      1. Grading
      2. Testing
      3. Lab and reports
   B. Safety and conduct in rubber lab and using rubber mill
      1. Review Safety Guideline from the College of Technology and Plastics and Rubber Programs.
      2. Review Safety Measures for handling rubber chemicals, mixers, and other equipment.

II. Laboratory Components
   A. Rubber compound design and mixing
      1. Compound design with different elastomers
      2. Curatives
      3. Fillers—reinforcing and non-reinforcing fillers
      4. Effects of different mix cycles
   B. Vulcanized compound properties and testing
   C. Mixing rubber compounds

D. Preforming
   1. Barwell
   2. Calendering
E. Techniques of vulcanization
   1. Autoclave
   2. LCM
   3. Fluidized bed
   4. Microwave
   5. Hot air
F. Lab final
G. Lab clean up

III. Lecture Components
A. Review commercial elastomers
   1. Manufacturing of elastomers
   2. Chemical properties of elastomers
   3. How the chemical properties affect processing and application of rubber
B. Mixing
   1. Machinery
   2. Processing
C. Injection Molding
   1. Theory
   2. Machinery
   3. Tooling
   4. Processing
D. Vulcanization
   1. Chemistry of crosslinking reaction
   2. Curing agents
   3. Curing temperature and time
   4. Testing
E. Preforming
   1. Extrusion
   2. Calendering
F. Rubber-to-metal bonding
   1. Adhesives
   2. Metal preparation
   3. Molding
G. Rubber in automotive applications
   1. Material for automotive hose
   2. Hose technology
   3. Gaskets
H. Coated fabic
I. Developments in tire technology
J. Rubber-covered rolls
K. Sealing technology
L. Hard rubber

M. Pressure sensitive adhesive
N. Latex and foam products
O. Reclaimed rubber
P. Tests and quizzes
Q. Final

IV. Field trips and Guest speakers.

FERRIS STATE UNIVERSITY
COLLEGE OF TECHNOLOGY

COURSE: RUBR 212

Plastics & Rubber Engineering Technology Department

COURSE SYLLABUS

COURSE TITLE: Rubber Tooling Design and Construction

COURSE DESCRIPTION: This course will provide the student with knowledge of rubber processing tooling design and fabrication. Designs for extrusion dies, compression, transfer and injection molds plus trim and deflash tooling will be reviewed. Tooling for rubber products will be designed. They will become familiar with material selection for best machining time, optimum tool life and accuracy. Instruction on the correct and safe operation of machine tools used in the fabrication of rubber process tooling will be given.

CREDIT HOURS: Two semester hours
CONTACT HOURS: Lecture – One hour per week
Lab – Three hours per week

PREREQUISITE: RUBR 211
TEXTBOOK: TBA

UNITS OF INSTRUCTION:

I. Introduction, Orientation, Conduct and Safety

II. Determination of shrinkage for rubber compounds

III. Extrusion die design and materials

IV. Mandrel mold designs and materials

V. Compression mold design and materials

VI. Transfer mold design and materials

VII. Injection mold design and materials

VIII. Trim and deflash tools and materials

IX. Machine tool operation and safety

X. Design and fabricate a compression mold

XI. Examinations

~~XII. Cleanup~~

FERRIS STATE UNIVERSITY COURSE: RUBR 223
COLLEGE OF TECHNOLOGY DATE: 01-05-2002
PLASTICS AND RUBBER DEPARTMENT

COURSE OUTLINE

COURSE TITLE: Rubber Measurement and Testing

COURSE DESCRIPTION: This course will provide students with exposure to methods of measuring a number of rubber and rubber product parameters. They will become familiar with standard ASTM test methods for rubber compounds and with the standard ASTM/SAE material classification system. The use of standard rubber test methods and the preparation of proper test reports will be taught.

CREDIT HOURS: Four semester hours

CONTACT HOURS: Lecture – Two hours per week
Lab – Six hours per week

PREREQUISITES: MATH 116, RUBR 110

TEXTBOOK:
1. Rubber Technology, 3rd edition, Morton
2. The Vanderbilt Rubber Handbook, 13th edition.
3. Manual for Rubber Measurement and Testing,

UNITS OF INSTRUCTION:

	Lecture	Lab
I.	Introduction, orientation, course goals, project and grading. *Week 1*	Orientation: 1.House-keeping 2. SAFETY and MSDS. 3. Writing reports *Week 1*
II.	1. Review: Terminology 2. ASTM Standards D 1349, 1418, 3182, and 3767 *Weeks 1 &2*	EXP. 1 Statistical analysis 1. Mooney Viscometer 2. ODR 3. Statistical analysis *Weeks 1 and 2*
III.	Application of basic statistics 1. Accuracy, bias, and precision. 2. Averages --- mode, median, and mean 3. Quantitative measures of variability 3.1. Range 3.2. Variance 3.3. Basic analysis of variance 3.4. Standard Deviation 4. Distribution 5. Application of Std. Dev.(SD) 6. Correlation coefficient *Weeks 3&4*	

Lecture	*LAB*
VIII. Thermal Stability of Rubber 1. Heat aging (D 573 and D 865) 2. Environmental properties of rubber 2.2. Oxidative aging 2.3. Ozone aging 2.4. Weather resistance and Outdoor testing 3. TGA, D 6370 *Week 11*	**EXP. 5** Rubber properties at extreme temperatures 1. Tension tests after heat aging 2. Tear resistance test after heat aging 3. Cold box and hardness test by ISO 3387. 4. TR test. Weeks 11 & 12
IX. Cold Tests 1. Glass-transition temperature, T_g, of polymers. 2. DSC 3. Cold box tests (Compression set at low temperature). 4. Retraction at lower temperature (TR test, D 1329) 5. Gehman torsional stiffening resistance (D 1053) *Weeks 12 & 13*	
X. Abrasion Resistance and Adhesion of Rubber 1. Abrasion resistance 1.1. Footwear Abrader (D 1630) 1.2. Pico Abrader (D 2228) 2. Adhesión of rubber to rigid substrates (D429) *Week 13*	**EXP. 6** Chemical analysis and Reverse Engineering (ASTM 297) 1. FTIR 2. Surface area of carbon black by iodine number Weeks 13 & 14
XI. Dynamic Properties of Rubber 1. Rubber deterioration due to dynamic fatigue (D 430) 2. Standard guide for dynamic testing (D 5992) Week 14	
XII. Identification of Rubber and Chemical Analysis 1. Infrared Analysis and FTIR 1.1. Types of rubber 1.2. Composition of comonomers in EPM/EPDM and SBR (D 3900) 1.3. Type of diene in EPDM(D 6047) 2. HPLC for accelerators (D 5297) *Week 14*	
XIII ASTM/SAE Material classification System *Week 15*	
XIV Measurement of Processing Properties Using Capillary Rheometry (D 5099) *Week 16*	**EXP. 7** Processing properties by capillary rheometry. *Weeks 15 & 16*

Laboratory Report Format

- The reports must follow the format outlined below.
- The reports are due at the next regular lab session or meeting.
- A lab report must be turned in for each student.
- If your lab partner is not doing his/her share of the lab work or the report writing, do not share your report with them.
- The required lab report format is shown below:
    - **Cover Page**: Title of the experiment, the course number, section number, and the date when the experiment is finished.
    - **Summary:** A brief statement of the experiment, instruments, and the materials used.
    - **Introduction:** A brief statement of the objectives and general procedures.
    - **Appparatus:** Instruments and equipment.
    - **Materials:** Rubber and chemicals used.
    - **Data:** Tabulate all your data. Also attach your original graphs generated by the instrument/recorder.
    - **Results and Discussion:**
        1. Explain your graphs and tables. Highlight the main findings from your data.
        2. Include your statistical analysis here: Mean and Standard deviation, deviation of your results from standard/reference values.
        3. Research into the process. No lab report will get an A unless there is some research into the theoretical background and applications of the experiment included in the report.
    - **Conclusion:** Draw your conclusions here in this section.
    - **Bibliography:** List your references.

Feel free to discuss your reports with me before you finish them or hand them in. I will be happy to help improve them before grading.

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Office hours as posted on bulletin board.

FERRIS STATE UNIVERSITY **COURSE:** RUBR 312
COLLEGE OF TECHNOLOGY
PLASTICS & RUBBER ENGINEERING TECHNOLOGY DEPT.

COURSE SYLLABUS

COURSE TITLE: Rubber Product Design

COURSE DESCRIPTION: In this course, the student will study the concepts of part design beginning with the definition of the "Customer/ End-Use Requirements", through the "Design Cycle" guidelines and product application. Special emphasis will be given to understanding the role of the following elements in Rubber Product Design:

- Material Selection
- Prototyping
- The Part Drawing
- Rubber Part Design Basics
- Form, Fit and Function in the application
- Part Quality – what is acceptable
- Relationship of Tool Design to Part Design
- Relationship of Process Factors to Part Performance
- Part Costing and Design to Cost
- End-use factors that impact rubber part performance

CREDIT HOURS: Four semester hours
CONTACT HOURS: Lecture – Three hours per week
Lab – Three hours per week

PREREQUISITES: Rubber Processing 2 (RUBR 211)
Engineering Graphics Comprehensive (ETEC 140)
Rubber Tool Design and Construction (RUBR 212)
Rubber Testing (RUBR 223)

TEXTBOOK: "Engineering with Rubber", Gent
"Rubber as an Engineering Material", Nagdi

UNITS OF INSTRUCTION:

I. Introduction, Orientation, Course Goals and Grading
II. Introduction to Rubber Product Design
III. Definition of Product Requirements
IV. Selecting a Rubber Material
V. Rubber Product Design Concepts
VI. Process Selection
VII. Advanced Part Design Concepts
VIII. Part Costing / Value Analysis
IX. Examinations

GRADING CRITERIA:
QUIZZES
FOUR EXAMS INCLUDING MID-TERM AND FINAL
LAB PROJECT REPORTS
TERM PAPER (8-10 PAGES)

FERRIS STATE UNIVERSITY **COURSE:** RUBR 321
COLLEGE OF TECHNOLOGY **DATE:** 01-07-02
PLASTICS AND RUBBER ENGINEERING TECHNOLOGY DEPARTMENT

COURSE OUTLINE

COURSE TITLE: Rubber Compounds / Compounding

COURSE DESCRIPTION: This course will provide the student with knowledge of the basic polymers used in rubber products. The physical and rheological properties of these materials will be examined. The composition of rubber compounds will be explored. This will include the effect of each type of ingredient on the processing and performance of the material. The basics of compound modification to improve processing of the material and /or performance of the product will be taught.

CREDIT HOURS: Four semester hours

CONTACT HOURS: Lecture – Two hours per week
Lab – Six hours per week

PREREQUISITES: Rubber Processing I and II (RUBR 121 and 211)

TEXTBOOK: 1.Rubber Technology,Compounding and Testing for Performance, Edited by John Dick
2. Vanderbilt Rubber Handbook

UNITS OF INSTRUCTION:

	Lecture	***Lab***
I.	Introduction, orientation, course goals, textbook and grading. *Week 1*	Orientation: 1. Safety 2. MSDS 3. **House keeping** and lab policy 4. Writing reports 5. Project *Week 1*
II.	Rubber compounding 2-1. Classification of compounding ingredients 2-2. Diversity of rubber recipes---composition of 14 tire compounds 2-3. General industrial product compound *Weeks 1 & 2*	**Experiment 1**: EV and Semi-EV of NR and SBR 1. NR carbon black master batch with Banbury 2. Using Brabender to prepare Sulfur curing, EV and Semi-EV compounds 3. Report property differences, including heat resistance. *Weeks 1 & 2*
III.	Rubber compound economics 3-1. Base recipe and batch factor 3-2. Density (Specific Gravity, sp.gr.) 3-3. Cost calculation 3-4. Compound design and compound cost reduction. *Week 3*	

	Lecture	*LAB*
IV.	Elastomer selection 4-1. R class 4-2. M class 4-3. Low volume specialty elastomers 4-4. Thermoplastic elastomers(TPE) 4-5. Fluid resistance 4-6. Heat aging and weather aging *Weeks 4 & 5*	**Experiment 2:** Organic accelerators for Sulfur Cure System *Weeks 3 & 4*
	General purpose elastomers and blends 5-1. Diene rubbers 5-2. Polymer effect on mixing 5-3. Polymer effect on curing 5-4. Visco-elasiticity 5-5. Stress-strain and hysteresis 5-6. Fatigue and dynamic properties *Weeks 6 & 7*	**Exp.3:** Processability of Rubber Compounds with Processing oils, Processing Aids and Plasticizers • Mooney scorch • MDR with frequency sweeping • Capillary Rheometer *Weeks 5 & 6*
VI.	Specialty elastomers 6-1. HNBR 6-2. IIR, CIIR, AND BIIR 6-3. ACM, CR, CM, and CSM 6-4. CO, ECO, MQ, and PU 6-5. FKM 6-6. Cure systems of Specialty Elastomers *Weeks 8 & 10*	**Exp. 4:** Metal Oxides Cure System *Week 7* **Exp. 5:** Peroxides Cure System *Weeks 8 & 10*
VII.	Carbon black and Non-black fillers 7-1. Reinforcing and non-reinforcing fillers, Surface treatment of fillers 7-2. Carbon Black(CB) 7-2-1. What is carbon black(CB) 7-2-2. Mixing CB 7-2-3. Compounding CB 7-3. Silica 7-4. Clay and other fillers 7-5. Compound applications *Weeks 11 & 12*	**Exp. 6:** Phenolic Resin and Bisphenol AF Cure Systems *Week 11* **EXP. 7:** Rubber Compounds with Different Fillers *Weeks 12 & 13*
VIII	Compounding with oil, ester plasticizers, adhesion promoters, and processing additives 8-1. Compatibility issues 8-2. Application trends 8-3. Processability 8-4. Compounding for brass wire adhesion *Week 13*	**Exp. 8:** Activators, Retarders, PVI, and Anti-Degradants *Weeks 14 & 15*
IX.	Sulfur cure systems and Accelerators *Week 14*	**Presentation and Clean-up** *Week 16*
X.	Peroxide cure systems *Weeks 15*	
XI.	Tackifying, curing, and reinforcing resins *Week 16*	
XII.	Antidegradants ~~*Week 16*~~	

POLICIES

ATTENDANCE:

- Arrange / call-in prior to missed class THEN bring proof..
- Any missed lab days must be made up.

ASSIGNMENTS:

- All work (*lecture/ lab*) due at beginning of day's class. 20% per calendar day deduction for late work.
- Excused late work due by next class meeting.

TESTS and Quizzes:

- No make-up for tests with unexcused absence.
- "0" for cheating.
- Responsible for information on screen, lecture, and handouts.
- No make-up on any quizzes.
- Two of the lowest weekly quizzes will be dropped during the grading.

LAB REPORT DEDUCTIONS:

- **Poor / no clean-up.**
- Leaving lab early.
- Improper use of time / tools.
- Improper report format.
- Copied work from "diskette files".

PROJECT:

- **Each student will be required to design a**
  - **Co-vulcanization system, or**
  - **A vulcanizate that consists of at least two different rubbers/polymers blend, or**
  - **A dynamic vulcanizate system**
- **Develop a product/sample.**
- **Document and conduct tests.**
- **Turn in the project report and present your project and your results/finding to the class.**

RUBBER TECHNOLOGY (AAS)

RUBBER ENGINEERING TECHNOLOGY (BS)

ACADEMIC PROGRAM REVIEW

September 26, 2002

Program Review Panel Members:

Program review chair: Matthew Yang
Program director: Bob Marsh
Program faculty: Auggie Gatt
Individual with special interest: Kevin Ott (Rubber Manufacturers Association)
Faculty member from outside the College of Technology: Bill Killian (College of Art and Science)

Laboratory Report Format

- The reports must follow the format outlined below.
- The reports are due at the next regular lab session or meeting.
- A lab report must be turned in for each student.
- If your lab partner is not doing his/her share of the lab work or the report writing, do not share your report with them.
- The required lab report format is shown below:
    - **Cover Page** : Title of the experiment, the course number, section number, and the date when the experiment is finished.
    - **Summary:** A brief statement of the experiment, instruments, and the materials used.
    - **Introduction:** A brief statement of the objectives and general procedures.
    - **Appparatus:** Instruments and equipment.
    - **Materials:** Rubber and chemicals used.
    - **Data:** Tabulate all your data. Also attach your original graphs generated by the instrument/recorder.
    - **Results and Discussion:**
        1. Explain your graphs and tables. Highlight the main findings from your data.
        2. Include your statistical analysis here: Mean and Standard deviation, deviation of your results from standard/reference values.
        3. Research into the process. No lab report will get an A unless there is some research into the theoretical background and applications of the experiment included in the report.
    - **Conclusion:** Draw your conclusions here in this section.
    - **Bibliography:** List your references.
- Feel free to discuss your reports with me before you finish them or hand them in. I will be happy to help improve them before grading.

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FERRIS STATE UNIVERSITY **COURSE:** RUBR 393
COLLEGE OF TECHNOLOGY

Plastics & Rubber Engineering Technology Department

COURSE SYLLABUS

COURSE TITLE: Internship in Rubber Engineering Technology

COURSE DESCRIPTION: The student will work on-the-job with one cooperating firm under the guidance of both the university and the firm personnel in a position that will broaden and reinforce knowledge of rubber materials, processing, production tooling, quality control, engineering, sales, design and production supervision.

CREDIT HOURS: Four semester hours

CONTACT HOURS: Ten weeks or 400 hours minimum on-the-job

PREREQUISITES: Acceptance into the Rubber Engineering Technology B.S. Program and approval of Internship Coordinator

TEXTBOOK: None

UNITS OF INSTRUCTION, STUDENT LEARNING GOALS AND COURSE REQUIREMENTS:

I. Ten weeks approved, supervised employment at a firm which produces rubber polymers, mixes rubber compounds or manufactures rubber products.

II. Ten weekly reports while on-the-job.
- A. **Complete and return information sheet with or before first weekly report.**
- B. Report should be at least one page in length, diary or narrative style
- C. Report cover page to contain the following information:
  1. Date submitted
  2. Week for which report is written (dates)
  3. RUBR 393
  4. Term and year
  5. Intern's name
  6. Report number
  7. Company name and location
  8. Shift assignment (days, evenings, nights and/or hours)
- D. Reports accepted no later than 11 school days after end of week covered by report.
- E. Report to be signed by supervision or responsible company representative.

III. On-the-job visit by the Intern Coordinator or designee. Note: this visit cannot be scheduled without the coordinator receiving the information sheet.

IV. Written evaluation by supervisor

V. Final Report
- A. Five pages in length, exclusive of materials not written by the intern and a resource page.
- B. Typed, double spaced
- C. Due the last day of term in which registered
- D. May include company organizational and product line information
- E. For each Weekly Report not completed by the Final Report due date, two pages are to be added to the Final Report.
- F. For each week report is late past the beginning of the following term, two pages will be added to the length requirements.

VI. Student must be registered in RUBR 393 for the term in which the internship work is done. Student will be dropped from course if no communication is received by the end of the tenth week of the term.

GRADING CRITERIA

	POINTS
Completed information sheet (with directions)	10
Ten weeks of work at 3 points per week	30
Ten weekly reports at 2 points per report	20
Intern Supervisor Evaluation	15
Final Report (5 pages minimum)	25
TOTAL	100

100 points required for Credit (CR).

An INCOMPLETE (I) is to be corrected by end of the following term, unless other arrangements are made between the student and the instructor.

Satisfactory completion of course requirements will result in a CREDIT (CR) grade.

An INCOMPLETE (I) grade will be issued only if at least 60% of the course requirements have been completed by the final day of the term and a request for an "I" has been received from the student.

A NO CREDIT (NC) grade will be given if less than 60% of the course requirements have been met.

WITHDRAWAL (W) GRADES: Any registered intern who has not submitted an information sheet, first report or other communication by the end of the seventh week of the term will be withdrawn (dropped) from the course with a W grade and will not be eligible for a tuition reimbursement.

FERRIS STATE UNIVERSITY **COURSE:** RUBR 411
COLLEGE OF TECHNOLOGY
Plastics & Rubber Engineering Technology Department

COURSE SYLLABUS

COURSE TITLE: Advanced Rubber Processing

COURSE DESCRIPTION: This course will provide the student with exposure to the following advanced rubber processing concepts and technologies:

- Cure control parameters and charts
- Automatic cure controllers
- Feedback control systems
- Connecting processes / Constraint management
- Quick change tooling concepts
- Continuous mixing of rubber

CREDIT HOURS: Four semester hours

CONTACT HOURS: Lecture – Two hours per week
Lab – Six hours per week

PREREQUISITES: Rubber processing I (RUBR 121)
Rubber processing II (RUBR 211)
Rubber Testing (RUBR 223)

TEXTBOOK: TBA

UNITS OF INSTRUCTION:

I. Introduction, Orientation, Course Goals and Grading

II. Determination of cure parameters and construction of manual cure charts

III. Determination of Processability of Polymers and rubber compounds

IV. Automatic cure controllers and determination of required constants

V. Feedback control systems for various equipment

VI. Connecting Processes

VII. Constraint Management

VIII. Quick change tooling concepts

IX. Continuous mixing of rubber

X. Examinations

FERRIS STATE UNIVERSITY **COURSE:** RUBR 499
COLLEGE OF TECHNOLOGY

Plastics & Rubber Engineering Technology Department

COURSE SYLLABUS

COURSE TITLE: Rubber Senior Seminar

COURSE DESCRIPTION: This course will consist of a series of special presentations, designed to prepare the prospective Rubber Engineering Technology graduate for entry into the Rubber Industry work force. Oral and written communications, interviewing and job search techniques, social interaction, industry structure, professional organizations, peer relationships and supervisor relations supported through discussion, role playing and case studies are examples of some of the subjects which are addressed.

CREDIT HOURS: One semester hour

CONTACT HOURS: Lecture – One hour per week

PREREQUISITE: Graduating senior

TEXTBOOK: Texts used in previous RUBR courses

UNITS OF INSTRUCTION:

I. Introduction and presentation of course objectives

II. The student will demonstrate oral and written communications through satisfactory completion of instructor oral and written assignments

III. The student will demonstrate through role playing, Class discussions, case studies and research, knowledge of the following;
   - A. Job search techniques, including job situation Negotiations: How to learn about company structure, Such as private versus public ownership.
   - B. Suggested types of social interaction, including interpersonal relationships and communications.
   - C. Rubber Industry structure, including working with suppliers, vendors and customers, with ethical relationships being highlighted:
     1. Global versus national organization
     2. Family, Foreign or shareholder owned
     3. Major competition efforts, i.e. JAPAN
     4. Marketing versus production considerations

D. Rubber Industry and Professional organizations: Benefits, drawbacks, obligations and perks
E. Problems and opportunities in peer relationships
F. Supervisor relations
G. Financial management
   1. Personal
   2. Corporate/Company
   3. "ETHICS"
H. Self evaluations

SECTION XI

Enrollment Trends

ENROLLMENT TRENDS

The rubber programs started in the fall of 1998. Due to considerable publicity and a $500 scholarship for all RUBR110 enrollees, there were 24 students enrolled in this first rubber class. Only 13 had declared rubber as their major. Most of the students who took the class for the scholarship money did not continue into the second class.

New student enrollment for the next 2 years was very promising, with 24 new full-time students in 1999 - 2000 and 28 in 2000 – 2001. Early program publicity and $1,000 scholarships for all new students (through the Rubber Manufacturers Association) greatly helped.

There was a big decline in new students in fall, 2001, with only 6 new rubber students. There are 8 new students for fall, 2002. While the $1,000 scholarships are still being offered, it has been very difficult to get the word to high school seniors. For example, when 85 high school students visited the Rubber Program, some said that they were impressed enough that they were going to enroll in the Plastics Program. The *Pioneer* had a front-page article on this event, and they also only talked about the Plastics Program.

There are no high schools or community colleges that have a rubber curriculum that might feed Ferris. Several rubber companies have offered scholarships to the children of employees, but there have been no applicants. We have also seen a decline in enrollment in the plastics program. The attached survey ("Plastics and Rubber Recruiting Questionnaire") shows that personal referral is the major factor in bringing students. The recent recession and employment uncertainty has likely greatly reduced the number of referrals.

Total class enrollments are higher than the above numbers, as there are plastics students are taking rubber classes. There are some dual plastics/rubber A.A.S. majors.

The requirements to enter the B.S. program are a 2.5 overall GPA, a 2.7 GPA in plastics classes and a 2.5 GPA in MATH116/126. This has generally not been enforced due to the enrollment problems. It is believed that the entrance requirements give a higher quality graduate, but there is no statistical basis for that assumption.

CONCLUSIONS

Student recruitment is the greatest need for the rubber programs. This is a focus for the current school year and beyond. A number of activities will be conducted by all members of the Department. The attached "Recruitment Plan Outline" will be refined into a detailed plan early in the fall, 2002 semester.

B.S. program entrance requirements should be reevaluated.

RUBBER COURSE ENROLLMENT

(Numbers in parentheses are rubber majors)

COURSE	98F	99W	99S	99F	00W	00S	00F	01W	01S	01F	02W	02S	02F	03W	03S
110	24 (13)			29** (17)	9 (7)		23 (22)	8 (6)		13** (6)			10 (8)		
121		14			20**			34							
193			9			16							1		
211				12			25			23			11		
212							15			19			4		
223					9			17							
297						2									
312							8								
321								8							
PLTS 300*							7			11			9		
PLTS 320*										10			18		
393													1		
411										9			16		
490							27						2		
499													3		
A.A.S. Grads				1	3		1	5	1	2	11				
TOTAL/YR						4			7			13			0
B.S. Grads									1	2	5				
TOTAL/YR									1			7			0
Pre-A.A.S.					3	3	1	2	1	1	1		1		
A.A.S.	13	12	8	34	33	15	53	47	22	42	38		28		
Pre-B.S.											1		7		
B.S.						1	6	5	4	8	8		11		
Off campus				8	7										
TOTAL	13	12	8	42	43	19	60	54		51	48		47		

(Number of rubber majors in parentheses)

** Main campus only

138 PLASTICS STUDENTS
30 RUBBER "

Fall, 2001

Plastics and Rubber Recruiting Questionnaire

We would like your help to target our efforts for the recruiting of new students. Please complete this form only once, even if you are asked to do so in more than one class.

Circle your program: **Plastics** **Rubber**

Circle the year you are in your program: **1** **2** **3** **4**

How did you first hear about your program? (√ all that apply, i.e. a relative who graduated from the program.)

% PLTS	% RUBR	% TOTAL		
33	40	34	Friend	____ } 60 % OF TOTAL % DUPLICATES
36	20	33	Relative	____ }
25	10	23	Current or former plastics/rubber student	____
13	30	16	Someone in this industry	____
12	0	10	High school teacher	____
9	0	8	High school councilor	____
24	47	28	Someone from Ferris	____ (who? _____)
6	7	6	Internet	____
			Other: _____	

After you learned about the program, how did you gather more information? (Check all that apply.)

31	20	29	Internet	____
50	23	45	Contacted Ferris	____
35	43	36	Contacted plts/rubr dept	____
42	57	45	Visited plts/rubr	____
14	3	12	Asked people in industry	____
17	17	17	Asked councilor	____
12	13	12	Asked teacher	____
			Other: _____	
			_____	

Why did you decide on this program? (Prioritize those that apply: 1, 2, 3 ....)

33	27	32	Exciting industry	____
47	43	46	Demand for grads	____
51	50	51	High salaries	____
29	10	26	I like this kind of job	____
40	37	39	I like hands-on education	____
			Other: Rubber scholarships	
			_____	

(over)

What are the best ways to attract students into the program? (Prioritize the best ones.)

21	27	22	Mail literature	____
13	13	13	Internet site	____
12	17	12	People in industry promote program to acquaintances	____
50	47	49	Ferris visits to high school	____
27	40	29	Industry to visit high schl	____
40	43	40	Current students visit their former high school	____

Other: _____

_____

_____

What high school classes should we visit to attract students?

74	87	76	Chemistry	____
42	23	39	Physics	____
71	57	68	Machine shop	____
32	30	32	Math	____
			Other _____	

What should we try to communicate to high school students that would encourage them to enter the Plastics or Rubber Programs?

Demand for grads
Salaries
Variety of jobs/companies
Hands-on
Rubber scholarships

What were your biggest concerns about coming into your program?

No previous knowledge
Difficulty

Name (optional): _____

Student Questionnaire

SECTION XII

Rubber Program Productivity/Cost

RUBBER PROGRAM PRODUCTIVITY/COST

Productivity

Because it is a new program with new courses, productivity of the Rubber Programs has been lower than College of Technology norms. As enrollment builds, productivity will increase. The long-term expectation is that it will have productivity comparable to the plastics program, after which it was modeled.

AY	RUBBER SCH/FTEF	PLASTICS SCH/FTEF	COT SCH/FTEF	FSU SCH/FTEF
98 – 99	182	267	331	457
99 – 00	168	303	332	455
00 – 01	252	364	344	451

Most rubber classes have both lecture and laboratory components. Multiple lab sections are taught in one lecture. Because of the number of stations available, the section limits are 10 to 15, depending upon the course. The length of the labs ranges from 3 to 6 hours.

We strongly believe that the "hands-on" emphasis of the rubber programs is key to the success of our graduates. Their entry-level positions require good knowledge of the design and manufacture of rubber products, which can only be really understood by "doing." This pedagogical approach is central to our very identity.

Productivity could be improved through the addition of more laboratory stations. This is generally an expensive proposition, with some equipment costing $100,000 or more. Much of our laboratory equipment is on consignment from industry, so we must continually work with our supporters to maintain the number of stations.

Program Cost

The most recent cost data are from the 1999 – 2000 academic year. The rubber A.A.S. and B.S. programs are more expensive than the average for FSU, but less expensive than the average for the College of Technology:

	Instructor Cost/SCH	Department Cost/SCH	Dean's Cost/SCH	Total Cost/SCH
Rubber Tech (A.A.S.)	$156.91	$37.25	$13.46	$207.62
Rubber Eng'g Tech (B.S.)	137.72	42.65	16.66	197.03
College of Technology	165.38	46.05	15.35	226.78
Total FSU	138.26	36.83	16.43	191.53

Conclusion

Increasing the enrollment is key to bringing productivity up to College of Technology norms. We will continue to look for cost reductions and efficiency improvements.

SECTION XIII

Conclusions

Conclusions

The Program Review Panel would like to conclude this review by the following criteria specified by the Academic Program Review manual.

1. **Centrality to FSU mission**
   The Rubber Programs are created to focus on hands-on training for the rubber industry. With excellent support from the industry, the programs prepare students to become skillful technologists to meet the needs of the industry. The programs fit well with the FSU and College of Technology missions.

2. **Uniqueness and visibility**
   The programs are the first and the larger of the only two in the nation to train rubber technologists at the undergraduate level. The other one is U. Mass at Lowell with only 6 students. Because of the unique curriculum and real-world training, the programs and the Ferris Student Rubber Group enjoy tremendous support from the two most important professional organizations in the rubber industry: Rubber Manufacturers Association and the Rubber Division of American Chemical Society. We are invited to the meetings and exhibitions at national and state levels. This year, two of program students have been awarded with scholarships and recognized as "Rubber Division, ACS scholar".

   The program staff and students are taking every opportunity to develop national reputation. More efforts, however, are needed to raise visibility in communities and high schools nationwide.

3. **Service to State and Nation**
   Our first rubber graduates have just entered the workforce and obtained their positions nationwide. There has been great interaction among the programs, industry, and national organizations. Ferris State University has started to host the technical seminars and give presentation for the West Michigan Rubber Group to serve the industry in Michigan, Ohio, and Indiana area. The industry also asks the programs to conduct student projects that will help develop the newest technologies.

4. **Demand by Students**
   The incoming student enrollment has dropped during the last two years. The goal for the programs is 24 freshmen each year. The top priority for the current school year is recruiting high school seniors and improving the recruiting results.

5. **Quality of instruction**
   Hands-on education is working well as reflected in the survey results. Better communication is needed to help the students understand why they are required to take elective and support classes.

6. **Demand for Graduates**
   The long-term employment prospects for the program graduates are excellent. We have been asked for more graduates by the rubber industry. A few students already have positions waiting for them pending their graduation. Many report that they have job offers after their second internship.

7. **Placement Rate and Average Salary of Graduates**
   All the first 7 B.S. graduates employed in the industry. Salaries exceed $40,000/year.

8. **Service to Non-Majors**
   The programs offer courses for the plastics students to pursue a dual major. We are also considering offering the entry level and rubber testing courses for other non-majors to obtain certificates.

9. **Facilities and Equipment**
   The facilities and equipment in the program lab are quite comprehensive. Students now can be trained in variety of processes such as mixing, compression, transfer, and injection molding and conventional and continuous extrusion. The lab is also equipped with quite a collection of different test instruments for the students to learn the common tests conducted in the industry.

   The main deficiency is that we need at least one more injection molding machine to eliminate over crowding.

10. **Library Information Resources**
    FLITE provides adequate Internet access to all of the ACS journals. With the donation of a whole set of "Rubber Chemistry and Technology", the official journal of the Rubber Division, students will be able to use it as the main reference after FLITE puts it in the catalog. The programs also subscribe "Rubber & Plastics News", a biweekly news journal which is available in the small reference room in NEC.

11. **Cost**
    According to the most recent cost data for the 1999 – 2000 academic year, the rubber programs are more expensive than the average for FSU, but less expensive than the average for the College of Technology. Increasing enrollment is the key to bring up the productivity. The cost of the program is comparable to the plastics program, after which it is modeled.

12. Faculty: Professional and Scholarly Activities

The faculty within the programs consists of assistant professors Auggie Gatt with extensive experience in equipment and processing and Matthew Yang with polymer material background. Both have master degrees and considerable working experience in the industry. It is an ideal combination to carry out our task.

13. Administration Effectiveness

The programs share a department director, administrative assistant and technician with the plastics programs. Keeping up the good work in the nationally renowned plastics programs while nurturing new rubber programs takes great administration effectiveness. Support from the College of Technology and Ferris State University also helps the programs stay on the track.

Recommendations

In reviewing the conclusions, it is quite obvious that the Rubber Programs meetthe philosophies and the missions of FSU and COT:

- A hands-on approach is the way to train technologists with skills desirable to the industry.
- Linking the lecture material to the lab experience: young people out of high school can be educated and transformed into highly marketable professionals.
- Internships allow the young men and women to appreciate the values of real-world education.

Several recommendations are proposed to reinforce our belief in the missions set up by the university and the college:

- Student recruitment focus
- Obtain an additional injection molding machine for the rubber lab
- Improve program interaction with technical support courses to improve revalency
- Communicate with students on the need and value of elective and support courses
- Improve communications with Advisory Board on the university's support and commitment
- Improved communications and writing skills are needed by the graduate
- Re-evaluate admission requirements into the BS program should be re-evaluated

APPENDIX

Program Review Panel Evaluation Summary

Program Review Panel Evaluation Form

(PRP: complete this form and include with your report)

Program: Rubber (Engineering) Technology — Summary

Instructions: Circle the number which most closely describes t he program you are evaluating.

1. Student Perception of Instruction Average Score 4

5 4 3 2 1

Currently enrolled students rate instructional effectiveness as extremely high.

Currently enrolled students rate the instructional effectiveness as below average.

2. Student Satisfaction with Program Average Score 4

5 4 3 2 1

Currently enrolled students are very satisfied with the program faculty, equipment, facilities, and curriculum.

Currently enrolled students are not satisfied with program faculty, equipment, facilities, or curriculum.

3. Advisory Committee Perceptions of Program Average Score 4.1

5 4 3 2 1

Advisory committee members perceive the program curriculum, facilities, and equipment to be of the highest quality.

Advisory committee members perceive the program curriculum, facilities, and equipment needs improvement.

4. Demand for Graduates Average Score 4.1

5 4 3 2 1

Graduates easily find employment in field.

Graduates are sometimes forced to find positions out of their field.

5 4 3 2 1

5. Use of Information on Labor Market Average Score 3.8

The faculty and administrators use current data on labor market needs and emerging trends in job openings to systematically develop and evaluate the program.

The faculty and administrators do not use labor market data in planning or evaluating the program.

Program Review Panel Evaluation Form (page 2)

6. Use of Profession/Industry Standards Average Score 3.8

5 4 3 2 1

Profession/industry standards (such as licensing, certification, accreditation) are consistently used in planning and evaluating this program and content of its courses.

Little or no recognition is given to specific profession/industry standards in planning and evaluating this program.

7. Use of Student Follow-up Information Average Score 2.7

5 4 3 2 1

Current follow-up data on completers and leavers are consistently and systematically used in evaluating this program.

Student follow-up information has not been collected for use in evaluating this program.

8. Relevance of Supportive Courses Average Score 3.8

5 4 3 2 1

Applicable supportive courses are closely coordinated with this program and are kept relevant to program goals and current to the needs of students.

Supportive course content reflects no planned approach to meeting needs of students in this program.

9. Qualifications of Administrators and Supervisors Average Score 4.5

5 4 3 2 1

All persons responsible for directing and coordinating this program demonstrate a high level of administrative ability.

Persons responsible for directing and coordinating this program have little administrative training and experience..

10. Instructional Staffing Average Score 4.1

5 4 3 2 1

Instructional staffing for this program is sufficient to permit optimum program effectiveness.

Staffing is inadequate to meet the needs of this program effectively.

Program Review Panel Evaluation Form (page 3)

11. Facilities Average Score 4

5 4 3 2 1

Present facilities are sufficient to support a high quality program.

Present facilities are a major problem for program quality.

12. Scheduling of Instructional Facilities Average Score 4.3

5 4 3 2 1

Scheduling of facilities and equipment for this program is planned to maximize use and be consistent with quality instruction.

Facilities and equipment for this are significantly under-or-over scheduled.

13. Equipment Average Score 4

5 4 3 2 1

Present equipment is sufficient to support a high quality program.

Present equipment is not adequate and represents a threat to program quality.

14. Adaption of Instruction Average Score 4

5 4 3 2 1

Instruction in all courses required for this program recognizes and responds to individual student interests, learning styles, skills, and abilities through a variety of instructional methods (such as, small group or individualized instruction, laboratory or "hands on" experiences, credit by examination).

Instructional approaches in this program do no consider individual student differences.

15. Adequate and Availability of Instructional Materials and Supplies Average Score 4.3

5 4 3 2 1

Faculty rate that the instructional materials and supplies as being readily available and in sufficient quantity to support quality instruction.

Faculty rate that the instructional materials are limited in amount, generally outdated, and lack relevance to program and student needs.