# FERRIS STATE UNIVERSITY

## POLYMER ENGINEERING TECHNOLOGY PROGRAMS

## INTERNSHIP MANUAL FOR SPONSOR COMPANIES

Ferris State University is very proud of its Plastics and Rubber Polymer Engineering Technology Programs. The curriculum being taught to our students includes the requirement for two individual and specific internship classes /experiences. These experiences have proven invaluable to the student over the history of the programs.

The education that this type of support from industry gives our students is what helps set them apart from others. Enclosed within this packet is information that will help your company get involved with the internship experiences of our programs. Your company will receive innumerable benefits from hosting a Ferris Polymer Program intern. Ferris appreciates your ongoing support.

There is a need for trained technicians in the plastics and rubber industry. Ferris State University has established an innovative program to provide students with an intensive hands-on experience in plastics and rubber technology. Students in these programs learn how to set up, operate and troubleshoot sophisticated processing equipment, testing equipment and tooling. Students also learn problem solving strategies related to statics and strengths of materials, fluid power, and electricity. The BS in Plastics also learn advanced processing, product design, project management, and decorating and assembly. In addition, the Rubber BS also learns to mix rubber compounds to customer specifications.

Plastics and rubber products are used in many fields including automotive, aerospace, recreation, and medical. Related course work in physical sciences, polymer chemistry, motion and time study, CAD, quality control, cost estimating and plant layout, tool design, hydraulics and electronics is also a part of the programs. Laboratory experiences are used to provide practical applications for the concepts presented in lectures.

Classes are very hands-on oriented with over half of the technology course time spent in the lab. Included in this education is a 400-hour industrial internship, where students are placed in actual jobs so they can learn first hand more about their chosen field of study.

## Following is a list of courses in the Plastics and Polymer Engineering Technology:

**First Year**:
**PPET 100** Survey Plastics/Elastomer Technology
**PPET 115** Plastics Product Manufacturing
**PPET 120** Plts & Polymer Material Selection 1
**PPET 127** Introduction to Processing
ETEC 140 Engineering Graphics
MATH 115 Intermediate Algebra
MATH 120 Numerical Trigonometry
CHEM 121 General Chemistry
COMM 121 Fund. of Public Speaking
ENGL 150 English 1

**Second Year:**
**PPET 211** Intro Injection Molding
**PPET 212** Plastics Product Dev 1
**PPET 223** Plastics Testing
**PLTS/RUBR** Major Elective
MECH 250 Fluid Power w/Controls
EEET 201 Electrical Fundamentals
CHEM 211 Fund Organic/Polymer Chemistry
PHYS 211 Intro Physics 1
ENGL 250 English 2

## Plastics Engineering Technology BS Degree Courses:

**Third Year**:
**PLTS 300** Plastics Engineering Mgmt Systems
**PLTS 312** Plastics Product & Tool Design 2
**PLTS 320** Plastics & Elastic Materials
**PLTS 321** Advanced Injection Molding
EEET 301 Controls for Automation
MECH 340 Statics & Strengths of Materials
ENGL 311 Advanced Technical Writing

**Fourth Year:**
**PLTS 410** Plts Costing, Pkging, & Econ Issues
**PLTS 411** Plastics Decorating & Assembly
**PLTS 499** Plastics Career Skills
MFGE 351 Intro Industrial Engineering
MFGE 353 Statistical Quality Control
MFGE 451 Intro to Plant Engineering

## Rubber Engineering Technology BS Degree Courses:

### Third Year:
**PLTS 300** Plastics Eng. Mgmt Systems
**RUBR 312** Rubber Product Design
**RUBR 321** Rubber Compounds
MECH 340 Statics & Strengths of Materials
EEET 301 Controls of Automation
STQM 311 Continuous Improvement Tools
MFGE 351 Intro Industrial Engineering
ACCT 201 Principles of Accounting 1
ENGL 311 Advanced Technical Writing

**Fourth Year:**
**PLTS 410** Plts Costing, Pkging, & Econ Issues
**PLTS 320** Plastics & Elastic Materials
**RUBR 411** Advanced Rubber Processing
**PLTS 499** Plastics Career Skills
MFGE 353 Statistical Quality Control
MFGE 451 Intro to Plant Engineering

## PPET Course Descriptions

**PPET 100 Survey of Plastics and Elastomer Technology**

This is a survey course designed to acquaint potential Plastics Majors and NON Plastics Majors with basic concepts of Plastics and Elastomer Technology. Students will become familiar with history, basic materials, application/design, processing, markets, and future of Plastics and Elastomer Technology. Students require no previous background in the subject.

**PPET 115 Plastics Product Manufacturing**

This course assumes the student has little or no prior knowledge of the manufacturing activities of plastics or rubber products. The course is directed toward providing the student with an "awareness" level of the basics of making polymer based products.

**PPET 127 Introduction to Processing**

This is a more advanced polymer processing course which focuses on the top 4 key processing methods for producing polymer products. The course includes components of career definition, material differences for processing, and a concise look at pre and post molding activities.

**PPET 193 Industrial Internship**

This course places students into an industrial setting for ten weeks of supervised, on-the-job training with a plastics/rubber manufacturer, processor, or related firm. The professional experience that the student will receive is a combined effort of the training site, university, and student. Students will be involved in the production of polymeric products and the daily activities of engineers in the plastics/rubber industry.

**PPET 211 Intro Injection Molding**

This course will provide the student with knowledge and experience in solving common problems encountered in running injection molding production equipment. The course seeks to relate the machine control parameters to their effects on the process and ultimately to the final part quality. The student will set-up processes for production runs. Added emphasis will be placed on primary troubleshooting and process optimization.

**PPET 212 Plastics Product Development 1**

This course will provide the student with the knowledge of plastics product and tool design as it pertains to successful production tooling. Special emphasis will be given to understanding the role of the following critical elements in Plastic Product and Tool Design: plastic material selection, mold filling analysis, mold components and their functions.

**PPET 220 Intro to Medical Devices**

Medical Device and technologies is seeing a boom period of growth due to surging innovation, from start-ups to very large corporations, in spite of a down market and economy. The viewpoint of this course is that innovation is a new leadership challenge. This challenge can only be faced with skills and a solid understanding in the problems of understanding markets, and appeasing difficult and complex customer needs.

This course is designed to provide an introductory overview of the medical device industry, and its unique design and manufacturing challenges. The course first examines the industry itself, reviewing basic industry statistics, current trends, and the many types of products that make up the medical device industry.

The course is focused on defining and understanding of medical devices in the growing medical market. The other accompanying theme is to gain an understanding of device design and how to innovate to create and then sustain a medical product.

**PPET 223 Plastics Testing**

This course acquaints students with concepts of Procedures used in evaluating plastic materials, test samples, and molded parts, Standard testing methods used for evaluation of plastic materials, in particular ASTM and ISO. Interpretation of testing results with respect to raw materials selection, processing parameters, and part design considerations. Basic quality control/quality assurance techniques related to plastics testing.

**PPET 225 Intro to Plastics Packaging**

This is an introductory course which introduces the student to the packaging industry. It focuses on the wide use of plastics and the many segments of this expanding industry that use polymers. The topics of packaging design trends, the applications of plastics materials, product processing methods, performance criteria

**(PPET 225 continued)**

and issues will be taught. The course will also expose the student to the career possibilities within the plastics packaging industry.

**PPET 280 Intro to Rubber Technology**

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 the rubber industry, end-use applications of rubber products, the basic processing techniques utilized and safety procedures applicable to the rubber industry.

**PPET 284 Intro to Thermoplastic Elastomers(TPE)**

This course acquaints students with various categories of TPE, such as thermoplastic olefins (TPO), thermoplastic urethanes (TPU), ionomers, and thermoplastic vulcanizates (TPV). Students will learn the unique properties of TPE's because of their morphology and processability so that they behave like "rubber" while being able to be processed list thermoplastics. In addition to the characterization and fabrication of different TPE's, students will also learn the "dynamic vulcanization" to prepare different TPV's.

## PLTS & RUBR BS Course Descriptions

**PLTS 300 Plastics Engineering Management Systems**

This course provides the student with the current business related skills needed to accomplish the job duties typical to the engineering job classifications within a plastics manufacturing company. It assumes the student has had little exposure to these skills on a direct, participatory level. It explores and enhances those tools which assure success in a manufacturing environment. It provides the skills which make the implementation of the engineer's knowledge of (and with) products, processes, tooling, and materials both evolve and continuously improve. It provides management tools which assist in completing programs and projects, helping to optimize processes, setting up systems to assure customer satisfaction, and by which individual and company success can be measured.

**PLTS 312 Plastics Product and Tool Design 2**

The student will study the concepts of part design starting with defining the "Customer/End-Use Requirements", through the "Design Cycle" guideline and product application. Special emphasis will be given to understanding the role of these critical elements: material selection, prototyping and modeling, product drawing, review of basic design rules, form, fit and function in product application, part quality, relationship of tool design to part design, advanced tooling concepts, process factors, and mechanical design with plastic.

**PLTS 320 Plastics & Elastic Materials and Their Additives**

This survey course will review all the major polymeric material currently commercially available. Major attributes, manufacturers and applications will be discussed. The student will learn correct materials handling methods, including safety with respect to drying, storage, regrinding (reuse), and compounding or blending and additives. Students will be shown the advantages of recycling. The learner will be presented with a historical perspective on each material and its chemical structure.

**PLTS 321 Advanced Injection Molding**

This course takes a theoretical approach to injection molding. Plastics processing is examined from a molecular perspective. Various engineering plastics are described in rheological terms of flow response to forces applied. Advanced troubleshooting and process optimization is dealt with in terms of process monitoring and cavity pressure sensing. The relationships between the varying of process parameters and the resulting cycle times along with the effects on final part dimensions and part properties are explored both theoretically and practically. The effects of moisture on the processing of hygroscopic polymers and its effects on the final part are also covered. Various types of injection molding techniques are introduced.

**PLTS 393 Industrial Internship 2**

Ten weeks (400 hours) of approved, supervised employment at one firm that manufactures polymers, processes plastics or deals with the plastics industry. The intern will work on-the-job under the guidance of both the university and the firm personnel in a position that will broaden and

**(PLTS 393 Continued)**

reinforce the knowledge of plastics processing, production tooling, quality control, engineering, sales, design and production supervision. The level of the position will require some degree of decision making by the intern and direct implementation of the results of these decisions. Machine operator positions, testing positions without decision making authority and materials handling positions **will not** qualify.

**PLTS 410 Plastics Costing, Packaging & Economic Issues**

This class covers the current topics relative to the business operational aspects of a company within the plastics industry. It focuses on the economic aspects relative to profitability and to making sound financial decisions. It also includes topics relative to modern part packaging technology. Discussions include concepts related to company ownership, financial risks, fiscal responsibility, ca0pital purchases, quoting, cost structures, and the principle cost and practical implantation issues of packaging.

**PLTS 411 Plastics Decorating and Assembly**

This course will provide the student with the basic knowledge and awareness of the decorating and assembly processes associated with plastic product manufacturing. The student will learn the product design, process, and tooling technology associated with each process. The course is designed to complement existing courses in plastic product design, plastics process, and mold design. The course will expand the students processing "portfolio" allowing him/her to understand the complete plastic manufacturing process which includes assembly, decorating, and packaging of plastic parts.

**PLTS 499 Plastics Career Skills**

This course will consist of a series of special presentations designed to prepare the prospective Plastics Engineering Technology graduate for entry into the plastics industry work force. Verbal 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 will be addressed.

**RUBR 312 Rubber Product Design**

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 of rubber product design: material selection, prototyping, part drawing, rubber part design basics, part quality, relationship of tool design to part design, part costing and others.

**RUBR 321 Rubber Compounding**

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 ex0plored. This includes 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.

**RUBR 393 Rubber Internship 2**

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.

**RUBR 411 Advanced Rubber Processing**

This course will provide the student with exposure to the following advanced rubber processing concepts nd technologies: cure control parameters and charts, automatic cure controllers, feedback control systems, connecting processes, constraint management , quick change tooling concepts and continuous mixing of rubber.

## On-Campus Facilities

Students have an excellent opportunity to use modern equipment and apply what they have learned. The National Elastomer Center is located on the Big Rapids, Michigan campus and includes laboratories for material testing, quality control, compounding and mixing and processing. The processing laboratories include injection molding, compression molding, thermoforming, extrusion molding, and blow molding equipment. Much of the processing equipment is new and has the latest computer control systems. This equipment is either donated or consigned by industry for the program use. Some of the equipment is updated often to afford the students access to current technology.

## Placement Services

Manufacturers may acquire interns either directly through the National Elastomer Center office or through the Ferris State Career Services Office. Each year, many potential employers schedule campus recruiting visits through FSU's Career Services Office. Organizations planning a recruiting visit are asked to schedule at least three weeks in advance. Employers interested in prescreened interviews should forward job descriptions and other appropriate materials prior to the visitation date. The Career Services Office functions as a facilitating agency to put intern employers in touch with the respective faculty coordinators. In addition, many employers find it convenient to use this office for scheduling on-campus interviews with intern candidates.

## Job Listing Service

The Career Services Office maintains a website, Bulldog CareerLink. Employers are invited to list their permanent, seasonal, and internship opportunities at any time throughout the year. Campus recruiting visits are also announced on the site. To contact the Career Services Office, call (231) 591-2685.

## Interviewing Information Facilities

The Career Services Office occupies an area in the Rankin Center, directly across the street from the National Elastomer Center. Comfortable interview rooms offer pleasant and private settings for interviewing candidates. Employers can leave informational materials on file at the Career Services Office, but are asked to keep their materials in ample supply and up-to-date. Employers who have produced a VHS video tape for recruiting purposes are invited to forward a copy to this office.

*Interview Periods:*
*Fall Sept. 27 - Dec. 8*
*Winter Jan. 24 - April 27*
*Summer June 1- July 22*

Scheduling Arrangements:
Career Services Office
(231) 591-2685
Rankin Center, Room 135
Office Hours: 8 a.m. – 5 p.m. weekdays
Ferris State University
805 Campus Drive
Big Rapids, MI 49307-2226

### Overnight Accommodations

- Holiday Inn Hotel & Conference Center
  1005 Perry Ave, Big Rapids
  (231) 796-4400, ask for "corporate rate" when booking.
- Country Inn & Suites
  15344 Waldron Way
  Big Rapids 231-527-9000
- Super 8 Motel
  845 Water Tower Rd
  Big Rapids 231-796-1588

## Useful Phone Numbers

**Plastics and Rubber Department**
**Secretary (231) 591-2640**
**Fax: (231) 591-2642**

**Career Services Office**
**(231) 591-2685**

## Internship Intent

It is hoped that a decision to offer an internship is accompanied by a specific itinerary. The itinerary should include projects and experiences which will mutually benefit the intern and your company.

It is believed that a predetermined schedule of projects will better enable you to utilize your intern's talents. This will also teach the intern how manufacturing facilities are run in an industrial setting.

## Company Expectations

When companies hire students for the purpose of internship, the main qualities they can and should expect from a Ferris student are:

1. Total willingness to work hard and get the job done.
2. A basic understanding of the processing theory for first time interns and a thorough understanding for second interns.
3. A good math background.
4. The ability to use and apply computers in the work force.
5. The composition of materials and their applications.
6. A team worker, resourceful, motivated with a desire to learn.

## School Expectations

When the school releases students to companies for internships they expect the companies to expose the students to the following educational experiences:

1. Expand upon processing theory and application.
2. Become familiar with quality assurance methodology.
3. Exposure to the different machines and services used in the production and testing of rubber in industry.
4. Exposure to print reading, product design along with mixing and compounding if applicable to the company.
5. The basic operating techniques of a rubber production company, learning teamwork, organizational structure, and leadership.
6. Work which will help the students apply his or her education to the practical aspects of manufacturing.
7. A special project, if possible, for which the student takes full responsibility.
8. 400 hours of employment.

## Invitation

You are invited to come visit our campus any time and tour the National Elastomer Center or contact us for more information on our Plastics and Rubber Programs.

**Internship Skill Levels**

**Course Title: XXXX-193:**
COURSE DESCRIPTION: Ten weeks of supervised, on-the-job training with a plastic, rubber, or polymer manufacturer, processor, or related firm.

**Course Title: XXXX-393**:
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 plastics or rubber materials, processing, production tooling, quality control, engineering sales, design, and production supervision. The level of the position will require some degree of decision-making by the student and direct implementation of the results of these decisions. The position will require a level of authority that allows the intern's decisions to be directly implemented. Machine operator positions, testing without decision-making authority, and materials handling positions will not qualify. Ten weeks supervised employment at a firm that manufacturers, processes, or deals with plastics. The internship coordinator must approve these positions.

## Comments from Past Interns

Your company's choice to host an intern can lead to a great deal of learning for students and add a fresh point-of-view to a company. Here are some examples of what students have learned in a past internship.

*I learned things that can't be taught in the classroom. I have learned how to deal with people, how to solve problems rationally, how to act professionally, how to back up and obtain good facts before presenting a problem or solution. I have learned that teamwork, good communication, striving for a common goal, and patience will help a company succeed and remain competitive.*

*I have had many opportunities to both learn and apply my knowledge. The scope of this assignment was to work with engineering to develop mold run cards for each new tool in various presses. Some of the goals we aimed for were substantial reductions in scrap, improved quality, and faster cycle times. To begin this project the study group (two engineers and myself) chose a press and tool and examined each for areas and items in need of attention before a process could be developed. This included checking the tool for adequate and proper venting, verifying machine calibrations, analyzing moisture concentrations in material, etc. With all of the items of concern addressed, we then proceeded to develop a process set-up.*

*I did my first rubber internship in Ann Arbor, Michigan. I was involved in research and development, testing, and many different rubber related jobs. I feel the internship was an integral part of my first year at Ferris State University, and gave met a valuable experience out in the industry. I also believe internships are one of the major reasons that make this degree a very worthwhile experience.*

*Working as an intern in the rubber industry was a great learning tool. While an intern, I was able to apply the material that was learned in school. Working as an intern has made me understand the class work better because I am able to see how it is applied in industry before I look for a full time job.*

*I did my internship at a major automotive and industrial sealant supplier. This internship provided substantial hands-on experience in many different parts of their production and testing operations. I learned how to assemble, replace, and tear down molds, including Dual Action Spring Molds. I also acquired valuable experience in quality control analyzing parts for common flaws such as flow lines, excess flash, and proper size (cross-sectional tolerances). I spent a week in the testing lab, performing numerous cold tests, as well as hardness tests, tensile tests, and heat aged/oil immersed tensile tests.*

*During my internship I helped deliver a successful project to the company with a greater than anticipated savings. Working at a structural foam injection molding facility allowed for a great learning experience. Completing a Lean project reinforced what was learned in classes and put concepts and ideas to use. I gained confidence by working in various departments for the first few weeks of my internship.*

*Overall, my intern experience was very positive. The internship was very informative on how to develop and successfully complete a cost-reducing project. I learned other valuable information such as how gas-assist injection molding works and how the structural foam process works. The skills I learned will help me later in my career in plastics engineering.*

*During my internship I was able to observe many sides of the plastics industry. These experiences have helped me identify which jobs and industries I might pursue for my career. I learned there is a lot more to the plastics industry than just running an injection press or extrusion line. There are jobs that cover a wide range of events throughout the work day and job titles from program manager to manufacturing engineer.*

*During my internship I was involved in several projects in the automotive industry to make vehicles lighter and provide better fuel economy. Several tests were done on various materials to insure that they met a given set of parameters. The Design of Experiments aspect of my internship was very interesting and was able to solve real-world problems.*

## COMPANY SURVEY

**There are students available for an internship work experience from the Ferris State University Plastics and Rubber programs. Each student is required to complete an internship for the Associate of Applied Science degree in Plastics, Rubber, or Polymer Technology and an additional internship for the Bachelor of Science in Plastics Engineering Technology or Rubber Engineering Technology. Each internship is ten (10) weeks in length and requires that the student be registered at FSU for an internship class.**

**We encourage companies to join us in partnership, uphold our quality plastics and rubber education, challenge the abilities of our students, and provide a learning environment. If your company is interested in employing an intern, please contact:**


**The National Elastomer Center**
**Ferris State University**
**919 Campus Drive, NEC 211**
**Big Rapids, MI 49307-2977**
**(231) 591-2640; FAX: (231) 591-2642**


## Please return the following questionnaire.

**COMPANY NAME _____**
**ADDRESS _____**
**CITY _____ STATE _____ ZIP CODE _____**
**COMPANY PHONE: _____**
**PRIMARY PROCESSING METHOD _____**
**HR CONTACT _____**
**HR PHONE: _____ HR FAX: _____**
**HR EMAIL: _____**
✓ **LEVEL(S) OF INTERN DESIRED: FIRST _____**
**SECOND _____**
✓ **TERM DESIRED: *few interns available**
**May – Aug _____**
**Sept – Dec* _____**
**Jan – Apr* _____**
**PROGRAM: Plastics _____ Rubber _____**

## OTHER COMMENTS: