University of St. Thomas

ENGR 371 -- Manufacturing Processes (Section 01)

INSTRUCTOR: Dr. Frederick M. Zimmerman

LAB MANAGER: Mr. Karl Mueller

CLASS MEETS: 5:30 PM to 8:30 PM Tuesday (OSS LL54)

LAB MEETS: 8:00 AM to 11:35 AM Tuesday or Thursday (OSS LL17)

INSTRUCTORS OFFICE: Room 115 O'Shaughnessy Science & Engineering Hall
University of St. Thomas
Mail #OSS101
2115 Summit Ave.
St. Paul, MN 55105--1096
962--5751 OR 962--5750 Fax: 962--6419 or 962--6410

TEXTBOOKS and READINGS:
FUNDAMENTALS OF MODERN MANUFACTURING (second edition)

COURSE DESCRIPTION
ENGR 371 Manufacturing Processes provides an understanding of the fundamental technologies of manufacturing processes. This course covers such basic principles of manufacturing processes as metal forming, metal cutting, plastic molding and continuous processes. Students receive hands-on experience with modern production equipment.

EXPECTED COURSE OUTCOMES
The ability to function in teams.
The ability to design and conduct experiments and to apply and interpret measurements.
The ability to use computational tools and be aware of their shortcomings.
The ability to apply knowledge of science, engineering and mathematics.
The ability to communicate effectively orally and in writing.

COURSE OBJECTIVES:
The course has two objectives:
To familiarize the class members with important manufacturing processes in common use in manufacturing today.
To examine the approximate cost-effectiveness of manufacturing processes and to investigate some new exciting alternatives.
To familiarize the class members with important manufacturing terms.
To develop appropriate measurement and testing skills.
To develop a familiarity with the most important equipment vendors and suppliers.
To learn the attributes of good manufacturing equipment for particular manufacturing processes.
To prepare our students to excel in professional and engineering practice, graduate studies, and continuous learning.

To achieve these ends, we employ a format involving text material, hands-on experience, some guest speakers and plant tours. Class members will operate some manufacturing equipment to accumulate experience.

COURSE METHODOLOGY:
During the course, we will use the text material, lectures and many video tapes for about 40% of the material we cover. The additional material will come from plant tours, student experiments and special handouts.
DESCRIPTION OF MAJOR ASSIGNMENTS:
The major assignments for the course will be active participation in the discussions and projects, a completed series of Lab Reports, several in-class quizzes, one final examination, and one Major Lab Project Report due on the last day of class. The Major Lab Project Report should be a scholarly treatment of how to manufacture a product of your choice (but discussed with the instructor) using the manufacturing practices covered in class. This analysis should employ the principles and materials covered in class and cannot be a project used for another class. READING THE ASSIGNMENTS IS VERY IMPORTANT.

Working in teams, each student will participate in presenting to the rest of the class certain problems drawn from the text. There are nine problem sets and the dates of each presentation is shown from pages 3 to 7 in this syllabus.

At the end of the course, there will be an in--class examination involving both objective and subjective questions relating to all of the in--class and reading material covered and assigned as of the date of the test. Material presented in the individual reports by the class participants may be included on the examination. The test will be approximately one hour long. A sample of the kinds of questions included in the final exam is on page 8.

Participation in all discussions is strongly encouraged. There will be an emphasis on the student making a contribution to his or her own learning and to the learning of others.

GRADING POLICY AND PERSONAL GOALS:
We encourage each participant to formulate their own goals and objectives in taking this course and a personal goal statement will be collected during the third session. On--going evaluation of students by the instructor is limited. As is often the case in industry, class participants have to evaluate for themselves how they feel they are doing and whether they are achieving their objectives. The instructor will be helpful when asked to be involved. The experience of the class members in this course is usually extensive and at this stage in their education, the class participants have experienced several semesters of graduate study. The instructor will be happy to meet with anyone who has specific questions.

The weighing of student involvement is approximately as follows.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Participation in the classroom and laboratory sessions</td>
<td>25%</td>
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<tr>
<td>Preparation and presentation of Lab Reports</td>
<td>30%</td>
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<tr>
<td>Class presentations</td>
<td>20%</td>
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<tr>
<td>Examination</td>
<td>25%</td>
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PROFESSIONALISM:
It is important that all reports and activities achieve a high level of professionalism. We encourage dignified presentations, good background research into topics and well written and well delivered presentations. Investigative reporting is strongly encouraged. We believe that companies are looking for similar levels of professionalism.

The University is a community of learning. Its effectiveness requires an environment of mutual trust and integrity. Academic dishonesty undermines this environment. In general, soliciting, receiving or providing any unauthorized assistance in the completion of any work submitted toward academic credit is dishonest. Plagiarism or failure to disclose original sources is dishonest, violates the mutual trust necessary between faculty and students, undermines the assessment of the University and its students, and takes unfair advantage of fellow students. [http://www.stthomas.edu/policies/student_policy_book/Academic_rights_and_procedures.asp](http://www.stthomas.edu/policies/student_policy_book/Academic_rights_and_procedures.asp)

ATTENDANCE POLICY:
Because of the plant tours and other visual material in the course, continual attendance is strongly encouraged. Please let the instructor know in advance if you will be missing class. DO NOT MISS THE PLANT TOURS -- EVER.

SAFETY POLICIES: DO NOT GET HURT. SAFETY IS A RESPONSIBILITY OF ALL

SAFETY GLASSES ARE TO BE WORN IN THE SHOP AT ALL TIMES.

STUDENTS WILL ROTATE IN THE POSITION OF SAFETY MONITOR

THE SAFETY MONITOR WILL HAVE HIS OR HER HAND ON OR NEAR THE SAFETY SWITCH AT ALL TIMES WHEN MACHINERY IS BEING OPERATED.

THE SAFETY MONITOR WILL RECHECK MACHINE SETTINGS BEFORE OPERATION BEGIN.

ANYONE SHOULD RAISE QUESTIONS OF THE INSTRUCTOR AT ANY TIME REGARDING SAFETY.
<table>
<thead>
<tr>
<th>Lab Week #1 Tuesday - February 1 -- CLASSROOM SESSION IN LAB</th>
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<td>Attendance at this session is mandatory</td>
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<td>Dry Run and Safety Session -- Karl Mueller</td>
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<tbody>
<tr>
<td>Course outline</td>
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<tr>
<td>Description of major assignments</td>
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<td>Description of laboratory projects</td>
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<tr>
<td>General machining practices</td>
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<td>Metal Machining</td>
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<td>Cutting Tool Technology</td>
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<tr>
<th>Lab Week #1 Thursday - February 3 -- CLASSROOM SESSION IN LAB</th>
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<tr>
<th>Lab Week #2 Tuesday - February 8 LABORATORY SESSION</th>
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<tr>
<td>Team A -- Model Shop</td>
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<td>Team B -- CNC Lab</td>
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<tr>
<th>Classroom Week #2 Tuesday - February 8 -- CLASSROOM SESSION</th>
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<tr>
<td>Groover Chapter 21</td>
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<tr>
<td>Machining Operations and Machine Tools I</td>
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<td>Groover Chapter 22</td>
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<tr>
<td>Machining Operations and Machine Tools II</td>
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<td>Groover Chapter 23</td>
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<th>Lab Week #2 Thursday - February 10 LABORATORY SESSION</th>
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<td>Team B -- CNC Lab</td>
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<th>Lab Week #3 Tuesday - February 15 -- LABORATORY SESSION</th>
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<tr>
<td>Team A -- Model Shop</td>
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<td>Team B -- CNC Lab</td>
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<tr>
<th>Classroom Week #3 Tuesday - February 15 -- CLASSROOM SESSION</th>
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<tr>
<td>Groover Chapter 24</td>
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<tr>
<td>General Machining Practices</td>
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<td>Groover Chapter 24</td>
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<tr>
<td>\textit{Problem Set # 1}</td>
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<tr>
<td>\textit{Student Presentation}</td>
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<tr>
<td>Review, Test and Discussion</td>
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<td>Groover Chapter 44</td>
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<tr>
<td>Measurement and Inspection</td>
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<tr>
<th>Lab Week #3 Thursday - February 17 -- LABORATORY SESSION</th>
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<tr>
<td>Team A -- Model Shop</td>
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<td>Team B -- CNC Lab</td>
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</table>
Lab Week #4 Tuesday - February 22 -- TOUR SESSION

Engineering Tour -- Remmele Plant 30 17701 US Highway 10 Big Lake
We must leave St. Thomas by 8AM
Guest Speaker: Mr. Al Grimsheid -- Human Resources Manager
Phone 763-263-2636

Classroom Week #4 -- Tuesday - February 22 -- CLASSROOM SESSION
Non-traditional machining
Grinding and Abrasive Processes
Problem Set # 2
Problem Set # 3
Fundamentals of Metal Forming
Bulk Deformation
Review, Test and Discussion
Groover Chapter 26
Groover Chapter 25
Student Presentation
Student Presentation
Groover Chapter 18
Groover Chapter 19

Tour Week #4 Thursday - February 24 -- TOUR SESSION

Engineering Tour -- Remmele Plant 30 17701 US Highway 10 Big Lake
We must leave St. Thomas by 8AM
Guest Speaker: Mr. Al Grimsheid -- Human Resources Manager
Phone 763-263-2636

Lab Week #5 Tuesday - March 1 -- LABORATORY SESSION
Team A -- CNC Lab
Team B -- Model Shop

Classroom Week #5 -- Tuesday - March 1 -- CLASSROOM SESSION
Metal Casting
Casting Technology
Fundamental of Welding
Welding Practices
Problem Set # 4
Problem Set # 5
Review, Test and Discussion
Groover Chapter 10
Groover Chapter 11
Groover Chapter 30
Groover Chapter 31
Student Presentation
Student Presentation

Lab Week #5 Thursday - March 3 -- LABORATORY SESSION
Team A -- CNC Lab
Team B -- Model Shop

Lab Week #6 Tuesday - March 8 -- LABORATORY SESSION
Team A -- CNC Lab
Team B -- Model Shop
Classroom Week #6 -- Tuesday - March 8 -- CLASSROOM SESSION

- Shaping processes for Plastics
- Composites
- Powder Metallurgy
- Ceramics, etc.
- Problem Set # 6
- Problem Set # 7

Groover Chapter 13
Groover Chapter 15
Groover Chapter 16
Groover Chapter 17

Lab Week #6 Thursday - March 10 -- LABORATORY SESSION

- Team A -- CNC Lab
- Team B -- Model Shop

Tour Week #7 Tuesday - March 15 TOUR SESSION

- Team A -- CNC Lab
- Team B -- Model Shop

Classroom Week #7 -- Tuesday - March 15 -- CLASSROOM SESSION

- Production Lines
- Problem Set # 10
- Programmable Automation

- Groover Chapter 33
- Student Presentation
- Student Presentation

Lab Week #7 Thursday - March 17 LABORATORY SESSION

- Team A -- Welding
- Team B -- Finishing & Plastics

No Session Monday through Friday - March 21 through March 28 -- Spring Break

Extra study time made available for student enrichment through useful and productive activities.

Lab Week #8 Tuesday - March 29 LABORATORY SESSION

- Team A -- Finishing & Plastics
- Team B -- Welding

Classroom Week #8 Tuesday - March 29 -- CLASSROOM SESSION

- Surface Preparation
- Coating and Deposition
- Review, Test and Discussion
- Brazing and Adhesive Bonding
- Problem Set # 8
- Problem Set # 9

- Groover Chapter 28
- Groover Chapter 29
- Groover Chapter 32
- Student Presentation
- Student Presentation

Lab Week #8 Thursday - March 31 LABORATORY SESSION

- Team A -- Finishing & Plastics
- Team B -- Welding
Tour Week #9 Tuesday - April 5 TOUR SESSION

Graco Plant Tour 612-623-6386
60-11th Avenue NE (near Broadway and University in Minneapolis)
We must leave St. Thomas by 8:45 AM
Guest Speaker: Mr. Jim Badzinski - Cell Manager

Classroom Week #9 Tuesday - April 5 -- CLASSROOM SESSION at PRODUCTIVITY, INC.
Class will be held at Productivity, Inc. at 6:30 PM
15150 25th Avenue North
Plymouth, Minnesota
Phone: 763-476-8600

Tour Week #9 Thursday - April 7 TOUR SESSION

Graco Plant Tour 612-623-6386
60-11th Avenue NE (near Broadway and University in Minneapolis)
We must leave St. Thomas by 8:45 AM
Guest Speaker: Mr. Jim Badzinski - Cell Manager

Lab Week #10 Tuesday - April 12 LABORATORY SESSION
Team A -- Projects
Team B -- Projects

Classroom Week #10 -- Tuesday - April 12 -- CLASSROOM SESSION at PARK INDUSTRIES
Class will be held at PARK INDUSTRIES in St. Cloud, Minnesota.
6301 Saukview Drive (We must arrive promptly at 6:30 PM)
St. Cloud, MN 56303 (It takes one hour and 35 minutes from St. Thomas)
(800) 328-2309 or (320) 251-5077

Lab Week #10 Thursday - April 14 LABORATORY SESSION
Team A -- Projects
Team B -- Projects

Lab Week #11 Tuesday - April 19 LABORATORY SESSION
Team A -- Projects
Team B -- Projects

Classroom Week #11 -- Tuesday - April 19 -- CLASSROOM SESSION
Student study session - No class - instructor will be out of town

Lab Week #11 Thursday - April 21 LABORATORY SESSION
Team A -- Projects
Team B -- Projects
Lab Week #12  Tuesday - April 26  LABORATORY SESSION
   Team A -- Projects
   Team B -- Projects

Classroom Week #12 -- Tuesday - April 26 -- CLASSROOM SESSION
   Manufacturing Engineering
   Production Planning
   Problem Set # 9
   Review, Test and Discussion

Lab Week #12  Thursday - April 28  LABORATORY SESSION
   Projects

Lab Week #13 -- Tuesday - May 3  LABORATORY SESSION
   Projects

Classroom Week #13  Tuesday - May 3 -- CLASSROOM SESSION
   Student study session - No class - instructor will be out of town

Lab Week #13  Thursday - May 5  LABORATORY SESSION
   Projects

Lab Week #14  Tuesday - May 10  LABORATORY SESSION
   Projects

Classroom Week #14  Tuesday - May 10 -- CLASSROOM SESSION
   Team Lab Report Due
   Miscellaneous Contemplative Discussion
   Students bring thoughts, observations and questions
   Futuristic Thoughts (A)
   Briefing for Final Exam

Lab Week #14  Thursday - May 12  LABORATORY SESSION
   Projects

Final Exam Session -- Tuesday - May 17 at Regularly Scheduled Time
   Tuesday 5:30 p.m. - 9:15 p.m.
   Final Examination in class

Laboratory Notebooks

Each student will keep a Laboratory Notebook of experiments conducted, observations made and results obtained as well as observations made on plant tours and reference material made available in class in class. The Lab Notebooks should show foundation and connectivity with the Lab Reports.
Some Comments on Major Lab Project Reports and Examinations

Examination

The examination will consist of essay and objective questions dealing with the academic subject matter of manufacturing processes. Among the exam questions might be the following:

1. Describe in detail the practical and theoretical considerations in drilling a hole.
2. Analyze the relative importance of product design, manufacturing process and implementation as ingredients to sound manufacturing practices.
3. Describe the EDM process and when or why would you use it? When would you not use it?
4. Explain the relationship between spindle speed, metal removal rates and finish surface.
5. You have $100,000 to tool up for manufacturing a competitively priced family of towel racks measuring, 12 inches, 16 inches, 20 inches and 24 inches in width which will be sold to Walmart for $2.00, $2.50, $3.00 and $3.50 respectively. If you can hit the cost targets, it is anticipated that you can sell 120,000 of assorted lengths per year for at least five years. Packaging and shipping costs will consume eleven percent of your net proceeds and must be accounted for in the tooling. A metallic like finish is required. How would you make these towel racks and how would you spend your tooling dollars?
6. You are in charge of improving throughput through your companies machine shop, which was equipped in 1983. Revenue volume is rising slightly and is now at $17,000,000 per year. There are 100 total employees in the machine plant including overhead personnel. Most of the parts made are parts for valves and hydraulic actuators. What specific things would you look at and what specific measurements would you take? What suspicions would you have for what equipment choices would be appropriate?
7. Discuss the cost and engineering advantages and disadvantages of extruded parts, injection molded parts, sand cast parts and die cast parts.
8. What are the essential characteristics of a good welding program?

NOTE: INCLUDE ALL OF THE RELEVANT FORMULAE AND MATHEMATICAL RELATIONSHIPS.

How to earn a good grade in the course.

1. Attend class.
2. Prepare for class by reading the assignments ahead of time.
3. Participate actively, and constructively, in the discussion.
4. Do the homework completely by understanding the text material relating to the homework.
5. Prepare for the class. Your contributions are appreciated.
6. Do a professional job on your presentations.
7. Complete a high quality final paper through thorough research.
8. Use academic references in the final paper.
9. Exhibit hospitality to our guest speakers and tour guides and thank them for their participation.
10. Ask for help if you need it. It will be cheerfully given.
Manufacturing Process Lab Reports

General Assignment
The Major Lab Project Report should be written in a scholarly way with research into the literature and case histories relevant to the topics being discussed. References to academic material and the concepts covered in class are especially appreciated.

Each team of two or three students will have the responsibility of completing timely Lab Reports describing the analytical steps taken by the team to understand the process, the experiments conducted, the results initially expected, the results actually achieved, and the general summary of what knowledge was gained and what skills were developed.

Section I -- Brief description of project
Section II -- What experiments were conducted?
Section III -- What results were expected?
Section IV -- What results were observed? (Show pictures and provide technical information)
Section V -- What did you learn?
Section VI -- How did the team perform its responsibilities?
Section VII -- Your individual ratings of the team experience. (Attach)

One laboratory report is due from each team on the days specified in the syllabus. The instructor will then review the interim lab reports and return them so that the final laboratory work book can be prepared.

NOTE: IT IS VITALLY IMPORTANT THAT LABORATORY REPORTS INCLUDE SPECIFIC MEASUREMENTS RELATING TO THE THEORIES AND PRACTICES DISCUSSED IN CLASS.

Manufacturing Process Lab Reports are evaluated against four main criteria:

1. Useful knowledge
2. Engineering rigor
3. References to specific material covered in the course
4. Style and impact
## Problem Set Assignments

<table>
<thead>
<tr>
<th>Problem Set</th>
<th>Date</th>
<th>Problem # 1</th>
<th>Problem # 2</th>
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## Biography -- Frederick M. Zimmerman

Dr. Fred Zimmerman is Professor of the Manufacturing Systems Engineering and International Management at the University of St. Thomas in St. Paul, Minnesota and has taught at the University of Minnesota, Catolica in Montevideo, Uruguay and at the Czech Management Center in Celovice, Czech Republic. Prior to returning to academia in 1985, Dr. Zimmerman had spent over 25 years in industry as an engineer, manager, vice president and president primarily with IBM, National Computer Systems and an NCS affiliate company — CAMAX. He has served on the boards of directors of 14 corporations including his current board assignments; Park Industries, Energy Systems Group, Minnesota Wire and Cable and Winnebago Industries. He is the author of numerous professional and technical articles plus the McGraw--Hill book entitled THE TURNAROUND EXPERIENCE: REAL WORLD LESSONS IN REVITALIZING CORPORATIONS and MEASUREMENT OF THE INDUSTRIAL ECONOMY and THE RELLOCATION OF INDUSTRY published by the St. Thomas Technology Press. His most recent book is titled MANUFACTURING WORKS: THE VITAL LINK BETWEEN PRODUCTION AND PROSPERITY is co-authored by Dave Peal of the Pioneer Press which discusses the relationship between manufacturing and community prosperity. The book was released in 2002 by Dearborn Trade Press, an arm of the Washington Post newspaper. Dr. Zimmerman resides in Minnetonka with his wife, Joanell. The Zimmermans have five children and have housed over eighty foster children.
University of St. Thomas

Laboratory Safety Guidelines

General Policy

The Engineering and Technology Management Department encourages and demands safe laboratory practices from students, instructors, and visitors. While no document can spell out every safety rule to apply to all hazards, general guidelines follow. Additionally, there are laboratory specific safety practices, as well as machine/experiment specific safety rules.

Lab specific and machine/experiment specific safety rules are developed by the instructor, and are reviewed and updated yearly. Instructors are responsible for assuring that students receive a copy of the safety rules. Instructors are responsible for maintaining a student safety sign-off sheet. A sample form is attached.

For most pieces of equipment, complete owners manuals may be found in room LL13. Placed near some equipment are short “user guides”. These are not to be used as a substitute for proper training.

BEFORE WORKING IN THE ENGINEERING LABS:

All users of departmental laboratory spaces must view the Eye Safety videotape and receive a passing score on the quiz.
Persons using the machine tools (CNC, mills, lathes, saws, grinders, molding equipment) must additionally view the Hand Safety videotape.
Persons using any of the welding/cutting equipment must additionally view the Welding videotape.
Make arrangements with Karl Mueller (2-5767) well in advance to secure the videotapes for your viewing.

WHILE WORKING IN THE ENGINEERING LABS:

All persons are expected to wear safety glasses while working in most labs. Consult your instructor.
Loose clothing is not to be worn when using any of the machine tools.
Long hair should be tied back when in labs with rotating machinery.
In most labs, food and beverages are forbidden. Consult your instructor.
Read and follow lab specific and machine/experiment safety rules. These are posted in the labs.
EACH TEAM MEMBER SHOULD BE COGNIZANT OF WHERE THE SAFETY STOP SWITCHES ARE AT ALL TIMES.

MSDS (Material Safety Data Sheets) for hazardous materials are located in room LL17B.

Report all hazards, such as broken machine guards, frayed electrical cords, etc. to your instructor, or Karl Mueller (2-5767)
Injuries and hazardous waste spills should be reported to Campus Security. Dial 5555. Non-emergencies can be reported by calling 2-5100. All injuries are to be reported to Karl Mueller (2-5767) or Ron Bennett (2-5762).

Per the University Student Handbook:

While the University of St. Thomas can assume no responsibility for risks associated with participation in programs or activities, the university attempts to provide a safe environment for its students. Historically, few students have been injured while participating in program-related activities, yet none of us are immune to injury in the course of our daily lives, work, play, or field of study. Each student should conduct himself or herself using due and reasonable care in his or her actions. Student status creates no “special” relationship between the student and the university, and the university is not a “custodian” of the safety of students.
University of St. Thomas Laboratory Specific Safety Guidelines

CNC Machine Laboratory -- LL15

Hazards in this lab include severe cuts or amputation, injuries due to projectiles, and illness due to contact with coolant.

Students must view the Eye Protection video and receive a passing grade on the quiz.
Students must view the Hand Safety video and receive a passing grade on the quiz.
Safety glasses are to be worn at all times.
Do not operate any equipment without instruction and permission of the instructor.
Secure all work pieces with clamps or other devices.
Sandals and open-towed shoes are not to be worn in the CNC lab.
Food and beverages are not allowed in the CNC lab. Pop and machine coolant or food and metal chips are not good for your digestion.
Rings and other jewelry should be removed.
Loose clothing may be removed by rotating machinery. Avoid embarrassing yourself and others by not wearing loose clothing. Roll up long sleeves. Remove ties or scarves.
Material and tooling may become hot. Use caution.
Make sure the machines are completely stopped before attempting to remove lathe turnings or chips. Never attempt to remove them while the machine is operating.
Do not use compressed air blow chips away from the work.
Karl Mueller MUST approve all CNC programs before they are loaded. No exceptions!
Material Safety Data Sheets (MSDS) are located in LL17B.

Finishing Lab -- LL02

Hazards in this lab include severe cuts or amputation, burns, ingestion of fine particulates and severe abrasions.

All students must view the Eye Protection video and receive a passing grade on the quiz.
All students must view the Hand Safety video and receive a passing grade on the quiz.
Safety glasses must be worn at all times.
Do not operate any equipment without instruction and permission.
When using the Bead Blaster, use of a dust mask is required.
Use of a face shield in addition to safety glasses is required when doing heavy grinding, sanding, or operating the radial arm saw in the rip mode.
All machine safe guards must be properly adjusted and used.
Clamp or secure material as needed.
Gloves should not be used near rotating machine components.
Use the Torrit dust collector properly. Consult your instructor or Karl Mueller.
Material that has been ground or sanded may be hot. Use caution.

Injection Molding Laboratory -- LL15

Hazards in this laboratory include burns from molten plastic and injuries from projectiles.

Students must view the Eye Protection video and receive a passing grade on the quiz.
Students must view the Hand Safety video and receive a passing grade on the quiz.
Safety glasses are to be worn at all times.
Do not operate any equipment without instruction and permission of the instructor.
Do not touch molten plastic and any areas near the nozzle. Severe burns may result.
All guards and safety devices must be operational and used.

**Model Shop -- LL17**

Hazards in this lab include severe cuts or amputation and injuries due to projectiles.

Students must view the Eye Protection video and receive a passing grade on the quiz.

Students must view the Hand Safety video and receive a passing grade on the quiz.

Safety glasses are to be worn at all times.

Do not operate any equipment without instruction and permission of the instructor.

Secure all work pieces with clamps or other devices.

Sandals and open-toed shoes are not to be worn in the model shop.

Food and beverages are not allowed in the model shop. Pop and machine coolant or food and metal chips are not good for your digestion.

Rings and other jewelry should be removed.

Loose clothing may be removed by rotating machinery. Avoid embarrassing yourself and others by not wearing loose clothing. Roll up long sleeves. Remove ties or scarves.

Material and tooling may become hot. Use caution.

Make sure the machines are completely stopped before attempting to remove lathe turnings or chips. Never attempt to remove them while the machine is operating.

Do not use compressed air blow chips away from the work.

Use portable safety shields as needed. They have a magnetic base and can be positioned almost anywhere for your protection.

Never leave set-up tooling in a machine. (Such as a wrench in the Bridgeport draw-bar or the chuck key in lathe chuck).

BE ESPECIALLY CAREFUL OF THE ENTERPRISE LATHE. IT IS VERY EASY TO START THE UNIT IN THE WRONG DIRECTION OR GET TOO CLOSE TO THE CHUCK. IT IS ALSO EASY FOR THE OPERATOR TO START THE MACHINE IN THE WRONG DIRECTION IF THE OPERATOR IS NOT ALERT

**Welding Laboratory -- LL15**

Hazards in this lab include severe burns, electrical shock, and rental damage.

Students must view the Eye Protection video and receive a passing grade on the quiz.

Students must view the Hand Safety video and receive a passing grade on the quiz.

Students must view the Welding Safety video and receive a passing grade on the quiz.

Students must view the Compressed Gas Cylinder video and receive a passing grade on the quiz.

Safety glasses are to be worn at all times.

Gloves must be worn when welding.

Proper dress is required. Cotton pants, no cuffs, (jeans are great) cotton long sleeved shirt, high top shoes/boots. No sandals or open-toed shoes, no Nylon, Rayon, Silk, or synthetics!

Weld flash is dangerous to the eyes. Never look at the arc without protection. Warn others before striking an arc.

Do not operate equipment without instruction and permission from your instructor.

Welding produces molten metal. Consider ALL materials and work surfaces to be hot. Be careful, don’t get burned.

Keep all flammable materials away from your work area.

Know where the closest fire extinguisher is located.
ENGR 371 Manufacturing Processes Lab Report

Team Letter Designation: ____________________________ Date: ____________________________

Team Participants: ____________________________

Equipment involved in experiments: ____________________________

Brief description of Project: ____________________________

What experiments were conducted? ____________________________

What results were expected based on engineering theory and modern manufacturing practice? ____________________________

What results were observed? ____________________________

What did you learn from the project or experiment? ____________________________

How effective was the team? (Team consensus assessment) ____________________________
Personal Goal Statement

Participant's Name:______________________________________

Home Address:________________________________ City:_________________ Zip:_____
Daytime Telephone #:______________________________________

I am particularly interested in studying the following aspects of manufacturing processes:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

I wish to accumulate new KNOWLEDGE in the following areas:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

I wish to obtain new SKILLS in the following areas:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

I wish to attain new VALUES AND PERSPECTIVES in the following areas:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

I would like to contribute to the Class by sharing my own specialized knowledge in the following areas:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

I am considering the following for my Major Lab Project Report:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________