WELCOME

We are pleased you have chosen MSOE as the place to continue your education and build your future.

There's no doubt you know MSOE as a "no nonsense" university that is serious about academics and concerned about outcomes. We work hard to provide a total educational experience that is challenging, satisfying and rewarding. We will do whatever we can to help you finish what you start here, and lay the foundation for a successful future, both personally and professionally.

One of the things that sets MSOE apart from other institutions is our "four-year graduation guarantee." We guarantee the courses will be available to enable you to graduate in four years. Your responsibility is to remain on the schedule prescribed in this *Undergraduate Academic Catalog.*

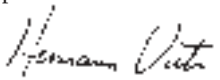
We will go even further: for the next three years after graduation, we will guarantee every one of our alumni the opportunity to re-take, free of charge, any course that may enhance performance on their job.

MSOE is committed to a basic educational philosophy that includes an "applications-oriented" approach in all classes and laboratories. Other examples of our philosophy are:

- **No graduate assistants.** All courses are taught by faculty, even laboratory courses.
- **Small classes.** This ensures that professors know students by name and have time to help them learn.
- **State-of-the-art laboratories.** Full-scale laboratories are continually upgraded to stay at a professional level.
- **Ties with business and industry.** MSOE has been affiliated with business and industry since the university's inception. We have an industrial advisory committee for each program, with membership from within the industry. Student projects are industry-oriented to give students "real-world" experience that further distinguishes them from graduates of other universities.
- **High placement rates.** Over the past five years, MSOE graduates have enjoyed a 98 percent placement rate.
- **Exciting metropolitan setting.** Located in the eastern part of downtown Milwaukee, MSOE is a short walk from the theater district, museums, sports and music venues, Lake Michigan, shopping and city festivals. Part-time employment and internship opportunities are numerous.
- **Diverse offerings.** Along with great academic programs, MSOE also offers many other personal and professional growth opportunities. From NCAA Division III athletics and intermural sports to student government, to writing for the student newspaper, there are abundant programs to give students a well-rounded education.

Over the course of 100 years, MSOE has grown to a diverse undergraduate and graduate institution with programs in fields related to engineering, business, communication and nursing.

Since 1903, we have believed learning the theory is important, but not enough; there is a responsibility to go beyond to the application of knowledge. Our students follow that path to success.



Hermann Viets, Ph.D.
President
Milwaukee School of Engineering

TABLE OF CONTENTS

President's Welcome ~~~

ACADEMIC DEPARTMENTS – PROGRAM OUTLINES B

**Architectural Engineering and Building Construction ~~~

MILWAUKEE SCHOOL OF ENGINEERING
ACADEMIC CALENDAR 2003-2005

Fall Quarter (11 Weeks)	**2003**	**2004**
Registration	May 7 - Sept. 5	May 5 - Sept. 3
Labor Day	Monday, Sept. 1	Monday, Sept. 6
Classes Begin 8 a.m.	Monday, Sept. 8	Tuesday, Sept. 7
End of Fall Quarter 5 p.m.	Saturday, Nov. 22	Saturday, Nov. 20
Commencement Exercises	Saturday, Nov. 22	Saturday, Nov. 20

Winter Quarter (11 Weeks)	**2003-04**	**2004-05**
Registration	Nov. 5 - Nov. 26	Nov. 3 - Nov. 24
Thanksgiving Day	Thursday, Nov. 27	Thursday, Nov. 25
Classes Begin 8 a.m.	Monday, Dec. 1	Monday, Nov. 29
Christmas Recess Begins 5 p.m.	Saturday, Dec. 20	Saturday, Dec. 18
Classes Resume 8 a.m.	Monday, Jan. 5	Monday, Jan. 3
End of Winter Quarter 5 p.m.	Saturday, Feb. 28	Saturday, Feb. 26
Commencement Exercises	Saturday, Feb. 28	Saturday, Feb. 26

Spring Quarter (11 Weeks)	**2004**	**2005**
Registration	Feb. 11 - March 5	Feb. 9 - March 4
Classes Begin 8 a.m.	Monday, March 8	Monday, March 7
Easter Recess Begins 10 p.m.	Thursday, April 8	Thursday, March 24
Classes Resume 8 a.m.	Monday, April 12	Monday, March 28
End of Spring Quarter 5 p.m.	Saturday, May 22	Saturday, May 21
Commencement Exercises	Saturday, May 22	Saturday, May 21

Summer Quarter

The schedule of classes may vary during the summer term. A variety of attendance options are offered from six- to 11-week sessions. Contact the Registrar's Office at (414) 277-7215 to receive a *Timetable of Classes* and further information.

All new students will be notified concerning registration dates.

GENERAL INFORMATION

A

University Overview

Vision Statement

MSOE will always be at the forefront of professional education with emphasis on both theory and technology, coupled with intensive laboratories and career practice.

Mission Statement

MSOE provides a sustained interactive educational climate for students to become well-rounded, technologically experienced graduates and highly productive professionals and leaders.

Institutional Principles

The fundamental beliefs of Milwaukee School of Engineering are the following:

- The focus is on the individual student.
- Lifelong learning is essential for success.
- Dedicated faculty with relevant, up-to-date experience are the heart of our teaching process.
- Scientific and mathematical reasoning and processes are essential.
- Applied research and evolving and interdisciplinary technologies are vital in exploiting opportunities.
- The development of communication skills is needed to function effectively.
- The student experience is strengthened by interaction with the business, industry and health care fields.
- The development of leadership and entrepreneurial characteristics is essential.
- Students, faculty, staff and volunteers all share the responsibility of learning.
- Strong personal values are necessary for success.
- The alumni strengthen the institution through their counsel, encouragement and support.
- Freedom with responsibility is the foundation of free enterprise.
- There is strength in diversity.
- Global awareness must be reflected in all activities.
- Initiation and acceptance of change is required to anticipate and capitalize on opportunities.

The MSOE Guarantee

This fall, more than 2 million students will begin their quest for a four-year college degree. Unfortunately, few of those students will graduate in four years. For many, it will take five or more years.

These delays may cause financial hardships for students. Each year a student stays in college, the more job opportunities he or she negates and is denied the ability to support themselves financially.

Therefore, MSOE students who meet the university's criteria for grade point and maintain their academic track will graduate in four years – guaranteed.

In addition, employers make significant investments when they recruit, hire and begin training recent graduates. They have a right to expect these new employees are fully qualified, work-ready and professionally competent. Therefore, MSOE guarantees that graduates may refresh their knowledge by repeating any undergraduate course, at no cost, within three years of graduation.

Guarantee Requirements

MSOE guarantees its students will graduate in four years if they meet the following criteria:

1) Students begin their freshman year during the first term of the fall quarter.

2) They successfully follow the prescribed course work full time for nine months of each year.

3) They do not drop or fail any courses and meet the university's grade point requirement for graduation.

4) They do not require any prerequisite course work.

Graduates may repeat a course under the following circumstances:

1) The employer or graduate determines that repeating the course will enhance job performance.

2) The course is repeated within three years of graduation.

3) The course was previously taken at MSOE.

Contact the Enrollment Management Department (800) 332-6763 for further information regarding the four-year guarantee and the Institutional Research Department (414) 277-7154 for information on repeating a course.

History

MSOE reached its 100th anniversary in 2003. It is quite a privilege to be part of the MSOE community during this historic and exciting time. Although most organizations and businesses are lucky to survive five years, MSOE is thriving.

This Centennial celebration is a time for reflection on the tens of thousands of men and women who obtained the education they needed at MSOE to pursue and develop meaningful careers. It also is a time to reflect on how MSOE has grown in breadth to include such things as an athletic program with 20 intercollegiate teams that compete in NCAA Division III, to the Rader School of Business and a School of Nursing, and to forward focus as we continue to anticipate business and industry needs to ensure graduate preparedness well into the 21st century.

Several special events are scheduled for the Centennial year, and MSOE welcomes you to participate. The Centennial Web site will launch in January 2003. Learn about MSOE's four presidents, view a timeline of the university's history, read about fellow alumni and their accomplishments, find out the top 50 employers of MSOE graduates or talk to members of the MSOE community via an online message board. Just log on to www.msoe.edu/centennial and celebrate MSOE's Centennial anywhere, anytime.

We invite you to share in our Centennial celebration, which not only recognizes MSOE's accomplishments, but the accomplishments of every man and woman that steps foot on our campus. This is indeed a very special time and a very special place.

Location

MSOE has a small university atmosphere within an exciting city environment. The 15-acre, user friendly campus is located in a historic downtown district, just blocks from beautiful Lake Michigan. Called The Genuine American City, Milwaukee boasts 60 miles of lakeshore, 15,000 acres of parkland and hundreds of miles of bike trails, a vibrant fine arts and cultural community, major and minor league sports, a brisk live-music scene, and is famous for its more than 50 annual festivals. The city is also a business, technological and industrial center where opportunities for internships and jobs abound.

MSOE also offers select undergraduate and graduate course work in Appleton, Wis., and other sites throughout the state.

Accreditation

MSOE is accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools (NCA, 30 N. LaSalle Street, Suite 2400, Chicago, IL 60602-2504, (312) 263-0456). Individual degree programs are accredited by appropriate professional accreditation organizations as noted in each corresponding program outline.

The Academic Year

The official academic calendar of MSOE is published in the front of this Catalog. The academic year is divided into three 11-week quarters, September through May. Courses are also offered during the summer.

Affiliations

MSOE holds institutional membership in the Wisconsin Association of Independent Colleges and Universities, the American Society for Engineering Education, the College Entrance Examination Board, the College Scholarship Service Assembly, the National Collegiate Athletic Association-Division III, the Council for the Advancement and Support of Education, Associated Schools of Construction, the College Board and the American Association of Colleges of Nursing.

MSOE is also a member of the Metropolitan Milwaukee Association of Commerce, the Greater Milwaukee Convention and Visitors Bureau and the Better Business Bureau of Greater Milwaukee.

Degree Programs

MSOE is dedicated to preparing graduates for productive and successful careers. Programs of study provide students with ample opportunities to progress in accordance with their individual abilities and professional goals. MSOE offers undergraduate and graduate degree programs, noncredit courses and seminars, on-site educational offerings, and a variety of services that meet the needs of both full-time and part-time students, business and industry.

Students in a baccalaureate level curriculum are encouraged to follow a carefully planned course progression track. These tracks, as well as program details, may be found in the "Academic Departments – Program Outlines" portion of this *Catalog*.

Undergraduate Degree Programs

The following undergraduate degree programs are available and are described fully within this *Catalog*:

Bachelor of Science Degrees

Architectural Engineering
Biomedical Engineering
Business
Computer Engineering
Construction Management
Electrical Engineering
Electrical Engineering Technology*
Industrial Engineering
International Business
Management*
Management Information Systems
Mechanical Engineering
Mechanical Engineering Technology*
Nursing
Software Engineering
Technical Communication (bachelor of arts option also available)

*Transfer programs

Graduate Degree Programs

MSOE's graduate studies programs and respective admission guidelines are detailed in a separate *Graduate Studies Catalog*. To receive a *Graduate Studies Catalog* or additional information, contact the Enrollment Management Department at (414) 277-6763 or (800) 332-6763. Graduate degree programs offered by MSOE include the following:

Master of Science Degrees

Engineering
Engineering Management (accelerated option also available)
Environmental Engineering
Medical Informatics (offered jointly with Medical College of Wisconsin)
Perfusion
Structural Engineering

Cultural and educational opportunities

MSOE's international study programs are once-in-a-lifetime opportunities to experience another culture in depth while taking college-level courses toward your degree. MSOE encourages its students to consider the opportunity these programs offer.

Business has become an endeavor without national boundaries. Changes in technology have made it easier to enter foreign markets or seek foreign suppliers. Even if your company is not international, foreign firms are entering your market, or merging with your competitors.

Business leaders today need a global perspective. For the future, we expect many employees will be required to have work experience abroad, some foreign language fluency and be expected to understand the challenges that come with doing business in multiple markets. The MSOE graduate should be prepared for this future by considering our international programs.

Germany

Electrical engineering or international business students may spend their junior year at the Lübeck University of Applied Sciences, in Lübeck, Germany. Founded in 1808, the university is similar to MSOE in that it is an applications-oriented institution. Situated near the Baltic Sea, the beautiful city of Lübeck is a center of commerce, industry and higher education, and offers a variety of recreational opportunities to young people. Much of its Middle Ages appearance is still intact in the older portion of town, which is a UNESCO World Heritage Site.

The MSOE program consists of two semesters at Lübeck, with extensive breaks to travel throughout Europe.

Key Features

- Instruction is in English.
- Participation does not delay progress toward graduation since all course work taken is integrated into the curricula of each MSOE program.
- Upon graduation, students will receive **two degrees**, one from MSOE and another from the Lübeck University of Applied Sciences.

Czech Republic

Students may study at one of the oldest and most respected technical universities in the world, Czech Technical University (CTU) in Prague, Czech Republic. Founded in 1707, CTU consists of six schools and seven institutes with some 16,000 students enrolled in engineering courses. Prague's famed diversity of architectural styles, the distinctive bridges arching the Vltava River and narrow, winding cobbled streets make it one of the world's most beautiful and charming cities. The city also is the social and cultural center of Central Europe with an entrepreneurial energy coursing through its streets.

Key Features

- Instruction is in English.
- Students have access to CTU course work beyond their selected major. In consultation with their academic adviser, students are thus able to select the number of credits taken at CTU that will transfer for academic credit toward their MSOE degree. (Taking classes that will not transfer to a student's major may delay his or her progress toward a degree.)

For further information on these programs, contact the Enrollment Management Department.

Engineering or Engineering Technology?

What is the difference between engineering and engineering technology?

"Graduates of Engineering programs apply scientific concepts to develop solutions to real world problems. Their job is more theoretical, involving the design of new products such as a robot that will be used in an auto manufacturing plant. Engineers require more theoretical, scientific and mathematical knowledge. At the same time, some colleges and universities offer two- and four-year Engineering Technology programs that prepare students for practical design and production work. Graduates of four-year Engineering Technology programs may get jobs similar to those obtained by graduates with a bachelor's degree in engineering."

Source: www.asee.org/precollege/engineering.cfm

The undergraduate **engineering programs**[1] at MSOE:

- begin with an emphasis on calculus and calculus-based sciences
- have engineering courses later in the curricula that build on the calculus/sciences base
- integrate design and applications into engineering lecture and laboratory course work
- have a stronger emphasis on theory and engineering design
- culminate in a major senior design experience

The undergraduate **engineering technology programs**[2] at MSOE:

- introduce and integrate math and sciences as needed in the curricula
- contain technical courses that occur in virtually every quarter of the programs
- have an intensive laboratory and applications focus
- have a moderate emphasis on theory and the design process
- appeal to the student who learns best in an experientially based (hands-on) environment
- culminate in a senior project experience

Additional Advice: Enroll in an **engineering program** if you:

- desire or will need to pursue registration as a Professional Engineer (PE)[3]
- plan to pursue a career in research and development (R&D)
- plan to continue your education at the graduate level in engineering (MS and/or Ph.D.)

Additional Advice: Enroll in an **engineering technology program** if you:

- desire or need the associate of applied science (AAS) degree to enter the workforce as a technician with the option to continue in a BS in engineering technology program[4]
- desire to continue your education in a program that extends and expands the educational approach of your existing AAS in engineering technology degree

Choose the type of program that is consistent with your talents and interests, learning style and career goals.

Please visit MSOE by contacting the Enrollment Management Department at (800) 332-6763. You may also contact the program directors for different academic programs (listed at www.msoe.edu).

[1] The undergraduate engineering programs at MSOE are normally offered during daytime hours.
[2] The engineering technology programs at MSOE are normally offered during evening hours.
[3] Recommendation: do not enroll in an engineering technology program if you desire or need to pursue registration as a Professional Engineer.
[4] MSOE offers only the BS degree in engineering technology. Consult with MSOE for information concerning transfer from AAS programs in engineering technology.

Enrollment Management Department

Main Office: Student Life and Campus Center, CC-302
Phone:
Local: (414) 277-6763
Toll Free: (800) 332-6763
Fax: (414) 277-7475
E-mail: explore@msoe.edu

Undergraduate Admission

The university maintains its long-standing tradition as an Equal Opportunity Educator. As such, MSOE does not discriminate in its educational opportunities on the basis of an individual's race, religion, sex, color, age, national origin, sexual orientation, physical or mental disability, veteran status or other factors prohibited by federal or state law.

Applicants who are accepted for admission are considered to have intellectual ability and personal qualifications necessary to pursue successfully a course of study at MSOE on a full- or part-time basis. Under certain circumstances, students will have to augment their secondary education in preparation for college-level study. Students wishing to enroll in full-time degree programs, or those interested in part-time study in degree programs, courses and all noncredit classes, may obtain appropriate admission material by contacting the Enrollment Management Department.

General Undergraduate Admission Guidelines

MSOE reviews all prior academic experience and seeks to determine the potential for success within the applicant's chosen field of study. In order to ensure preparation for the applicant's chosen field of study, the following standard guidelines for admission are offered:

1) A completed admission application must be on file.

2) A high school transcript must be submitted.

3) Graduation from an approved high school or the equivalent (GED test score of 265 or better).

4) Results of the American College Testing (ACT) program examination or Scholastic Aptitude Test (SAT) also is acceptable. Students who have completed 24 or more college credits, or who have been out of high school for two or more years, are not required to submit test results.

A student may be granted:

1) Full acceptance: A student is accepted directly into their desired program of study.

2) Accepted on probation: A student is accepted directly into their desired program of study but must participate in additional requirements.

3) Denied admittance: Persons denied admission to MSOE may appeal the decision, either in writing or in person, by contacting the Enrollment Management Department.

New Student Probation

Students are accepted to MSOE on probation based on factors in their background that would indicate possible difficulties in making the transition to MSOE. These factors may include low ACT/SAT scores; low grades in key subjects such as math, science and English; the lack of some of these subjects; the amount of time out of high school prior to beginning college; and/or prior college grades.

Activities required as a part of this probationary status have been developed jointly by the Learning Resource Center (LRC), the Enrollment Management Department and MSOE academic departments. The purpose of these requirements is to assist students in making a successful transition to academic life at MSOE. Students will be required to participate in LRC activities including tutoring, regularly scheduled meetings with LRC staff, the successful completion of OR-101, "Strategies for Academic Success," and time management and study skills sessions. The goal of these activities is to provide probationary students with the tools to succeed at the university level.

Students are also limited to four courses or 16 credits per term for their first three quarters at MSOE.

These requirements will be enforced through university academic policies (see page 25). The requirements have been established with the student's best academic interests in mind and are intended for no other reason than to help that student succeed at MSOE. Therefore, failure to comply with the conditions of one's probationary acceptance may have serious consequences affecting the student's continuation as a student at MSOE. Questions concerning the requirements of probation should be directed to the LRC at (414) 277-7266.

Transfer Students

Students that wish to transfer to MSOE must submit:

1) An admission application.

2) A transcript(s) of all previously completed college course work.

3) High school transcripts, (if less than one year, 24 semester credits, of college work).

4) Transfer students who apply for financial aid are required to submit financial aid transcripts from the Financial Assistance Office of any previously attended colleges.

Students may be granted:

1) Full acceptance: A student is accepted directly into their desired program of study.

2) Acceptance on probation: A student is accepted directly into their desired program of study but must participate in additional requirements.

3) Denied admission: Persons denied admission to MSOE may appeal the decision, either in writing or in person, by contacting the Enrollment Management Department.

Transfer of Grades and Courses

1) Students transferring to MSOE will establish an MSOE grade point average after their first term of attendance. A student's previous college grade point average will not be transferable.

2) A course grade of "C" or better is required to be considered for transfer.

3) All past academic work is evaluated on an individual basis with respect to courses that appear in the most recent MSOE catalog for the curriculum for which the individual is applying.

4) Transfer credit evaluations are completed by the department chair who oversees the academic program, into which the student is transferring. Transfer credit is considered provisional until the student's subsequent MSOE course work confirms that he/she is sufficiently prepared for subsequent courses. Appeal of transfer credit evaluations should be made to the Registrar's Office.

5) Credit for military service or work experience is determined by conference and/or examination by the academic department chairperson responsible for the material.

6) At least 50 percent of required courses for an undergraduate degree must be taken at MSOE.

Nonimmigrant International Undergraduate Admission

To be considered for admission, students must:

1) Complete an admission application.

2) Submit official TOEFL results showing a composite score of 550 or higher.

3) Submit English language translation of transcripts of all academic work showing a minimum of 12 years of academic study, including detailed grades.

4) A completed certification of financial responsibility.

5) Students transferring from a school in the United States must submit an International Student Transfer Form, completed by their international student adviser.

After all these documents have been received, an applicant's entire file will be reviewed for admission. A student may be granted:

1) Full acceptance: A student is accepted directly into their desired program of study.

2) Accepted on probation: A student is accepted directly into their desired program of study but must complete additional obligations.

3) Denied: Persons denied admission to MSOE may appeal the decision, either in writing or in person, by contacting the Enrollment Management Department.

Note: Accepted nonimmigrant foreign applicants who do not register for classes in the designated term must return the I-20 form to MSOE .

Lifelong Learning Institute

Students wishing to attend MSOE on a part-time basis may do so through the Lifelong Learning Institute.

The following standard guidelines for admission are offered:

1) A completed admission application must be on file.

2) A transcript(s) of all previously completed college course work.

3) High school transcripts, (if less than one year, 24 semester credits, of college work)

A student may be granted:

1) Full acceptance: A student is accepted directly into their desired program of study.

2) Accepted on probation: A student is accepted directly into their desired program of study but must complete additional requirements.

3) Denied admittance: Persons denied admission to MSOE may appeal the decision, either in writing or in person, by contacting the Enrollment Management Department.

4) Non-matriculated status: A student has not been accepted to a program of study but may take up to three courses for one quarter. At the end of the quarter the student must have earned an average of 2.50 grade point average to be considered for full acceptance or must have completed their admission file so an admission decision can be finalized.

5) Non-degree status: A student has not been admitted to a program of study but may complete up to 30 credits in their area/s of interest.

Certificate Programs

Certificate programs are three- to seven- course sequences that provide introductory level coverage of specific technical/business areas for individuals with little or no previous technical/business education. Some certificate programs are available on a credit or noncredit basis.

If you elect to take the courses on a credit basis and successfully complete all course requirements, you will receive a letter grade and the appropriate number of undergraduate quarter credits.

If you register on a noncredit basis, you must attend a minimum of 80 percent of the required class sessions; however, you will not be required to take examinations or complete any graded work assignments. Upon course completion, if you have met the attendance requirement, you will receive a certificate indicating the number of Continuing Education Units (CEU's) awarded. Grades will not be issued.

In order to receive a certificate, a student must:

1) Complete an application for admission.

2) Meet all prerequisite requirements.

3) Complete at least two-thirds of the required courses at MSOE (and have been awarded advanced credit for the other courses).

4) Obtain a "C" (2.00) average or better after completing all courses in the Certificate or, if taken on a noncredit basis, obtain a "satisfactory" in each course.

If you register for a course for credit and then change your mind and decide to take it on a noncredit basis, you must follow regular add/drop procedures described elsewhere in this *Catalog*. This procedure must also be followed if you originally register for a noncredit course and then decide to take it for credit.

Noncredit Offerings

Noncredit programs of education are offered as a service to individuals in business and industry who wish to update, upgrade or supplement their previously acquired education and experience.

Business and industry find these sessions a flexible medium for providing specialized employee updating on an individual or group basis. MSOE has developed a variety of programs through which individuals can enhance their education, and through which industry can continuously develop employees to meet the demands of today's technological progress and management challenges. A participant must:

1) Complete an application for admission.

2) Satisfy prerequisite course work.

Seminars

Seminars offered by MSOE provide the opportunity for practicing professionals to stay abreast of technological developments, current applications and techniques. Participants find that MSOE-sponsored seminars broaden the knowledge they have already acquired during their careers, and provide new information on various subjects critical to their respective fields. Continuing Education Units are awarded to seminar attendees. Seminars are offered in formats ranging from four-hour workshops to five-day symposiums. A participant must:

1) Complete a registration form.

2) Satisfy prerequisite course work.

Customized On-Site Courses

Customized education and training programs, conveniently offered at a company site, are available through our corporate educational services arm of the Lifelong Learning Institute. These programs range from a single course or series in one of our regular program tracks to custom tailored programs designed to meet specific company needs. Like our on-campus classes, programs are supported by laboratory exercises offered on site. In an effort to satisfy both long-term goals of the student and the immediate needs of the organization, these programs can often be presented on a credit/noncredit basis. Participants must:

1) Complete an admission application.

2) Satisfy prerequisite course work.

Registrar's Office: Student Life and Campus Center, CC-365
Phone: (414) 277-7215
Fax: (414) 277-6914

The regulations and policies of MSOE include only those that are necessary to the proper organization and operation of the university. MSOE reserves the right to change the rules governing admission, tuition and the granting of degrees, or any other regulation affecting its students. Such changes shall take effect whenever the administration deems it necessary. MSOE also reserves the right to exclude, at any time, students whose conduct or standing is regarded as undesirable.

Policy on Student Integrity

As an institution of higher learning, MSOE is committed above all to the educational development of its students as responsible and principled human beings, and is an institution accountable in this regard to all whom it serves and by whom it is scrutinized. MSOE has a priority interest in promoting personal integrity and in ensuring the authenticity of its graduates' credentials.

The university is similarly mindful that both the professions and business and industry have, for a long time, been concerned with the ethical, no less than the professional, practice of their members and employees. It follows, therefore, that students of MSOE – preparing for professional careers and leadership roles that are founded on responsibility and trust – must observe and be guided by the highest standards of personal integrity both in and out of the classroom.

The expectations of the university with respect to academic and classroom integrity are reflected in, but not limited to, the following guidelines:

1) The student must recognize that even a poorly developed piece of work that represents his or her best efforts is far more worthwhile than the most outstanding piece of work taken from someone else.

2) Assignments prepared outside of class must include appropriate documentation of all borrowed ideas and expressions. The absence of such documentation constitutes "plagiarism," which is the knowing or negligent use of the ideas, expressions or work of another with intent to pass such materials off as one's own.

3) The student should consistently prepare for examinations so as to reduce temptation toward dishonesty.

4) A student may not share examination answers with others for the purpose of cheating, nor should he or she, through carelessness, give them an opportunity to obtain them.

5) The student should know that a person of integrity will not support, encourage or protect others who are involved in academic dishonesty in any way, and will furthermore attempt to dissuade another student from engaging in dishonest acts.

The institutional policy that follows includes prescribed procedures for the assigning of penalties by instructors in instances of academic dishonesty as well as procedures for student appeals of such actions. A student who in any way acts dishonestly in class assignments or examinations or who submits a plagiarized or unoriginal work to an instructor shall be subject to sanctions up to and including an "F" grade for the assignment, examination and/or the course at the discretion of the instructor of the course. The numerical value of the "F" will be assigned by the instructor. If the instructor assigns an "F" for the course, the student will not be allowed to drop the course. If the instructor assigns an "F" for academic dishonesty, the student has the right to appeal following established procedures. Upon recommendation of the instructor or at his own initiation, the chief academic officer may decide that repeated or extremely serious acts of dishonesty may be grounds for more severe disciplinary action up to and including student expulsion.

Academic Dishonesty Procedure and Appeals Process

The student will be notified by the faculty member either within three academic working days of the faculty member's awareness of the problem or at the next class session attended by the student. The faculty member will notify the student using the form designed for notification. A copy of this notice will be sent to the department chairperson and the chief academic officer. The chief academic officer will retain all such reports in a permanent file.

The procedure outlined in steps 1-7 will be used if a student wishes to appeal a faculty member's judgment that academic dishonesty has occurred. If a student wishes to appeal the penalty, such an appeal must be in writing and must follow the normal grievance procedure outlined under "Grievance Process."

1) The student will have three academic working days after delivery of the written notification to initiate an appeal to the chairperson of the department in which the faculty member serves. The student will be deemed to have waived his/her right to appeal unless he/she files the appeal with the department chairperson within these three academic working days. The statement of appeal must specify each denial of the faculty member's decision and the substance of the contentions upon which the student intends to rely in his/her appeal. Filing notices of appeal in accordance with these provisions shall not suspend the operations of the sanction previously declared in the case by the faculty member. The student will remain in class during the entire appeal process.

2) The department chairperson will have three academic working days in which to review the appeal. The sole purpose of the department chairperson's review is to determine if sufficient evidence exists that the student was cheating. The chairperson must inform the student and faculty member of his/her judgment within those three academic working days.

3) The student or faculty member may further appeal to the chief academic officer within three academic working days.

4) The chief academic officer shall convene an academic review board to hear the student's appeal within a reasonable time (if possible, within three academic working days of the appeal). The academic review board shall be made up of two department chairpersons selected by the chief academic officer, and one faculty member selected by the chief academic officer and agreed upon by the person initiating the appeal. The chief academic officer will be a nonvoting chairperson. The faculty member assigning the penalty and his/her department chairperson may not be on the board.

5) The sole purpose of the academic review board is to determine if sufficient evidence exists that the student was cheating. The academic review board shall render its decision after all sufficient evidence has been presented, but in a time period not to exceed three academic working days from the commencement of its proceedings. The decision of the academic review board in appeal cases is final and cannot be further appealed under procedures established herein.

6) All appeals established by this procedure must be in writing.

7) The student may bring a representative to any meeting established under this procedure. The faculty member may also have representation at any meeting.

Grievance Process

If a student has a complaint of unfair treatment in the academic area, he/she should first consult the instructor in the course. If no mutually satisfactory solution is achieved, the chairperson of the department in which the course is being offered should be contacted next. A final appeal may be directed to the chief academic officer.

MSOE's director of human resources also may be consulted, in addition to the above officers, on matters pertaining to alleged unfair treatment because of race, gender, national origin, religion, disability or sexual orientation.

Academic Privacy

MSOE is in compliance with the Family Educational Rights and Privacy Act of 1974, the purpose of which is to let the student know what educational records are kept by the university, to give the student the right to inspect such records and to ask for correction if necessary, and to control the release of such information to those who are not involved in the educational process. Under the Privacy Act, certain directory information is made available to anyone who requests it unless the student specifically asks, in writing, that this not be done. The following is information that MSOE considers to be directory information: (1) name, addresses, telephone numbers, e-mail address, program; (2) class, dates of attendance, enrollment status (full-time, part-time, withdrawn, not enrolled), degrees and awards received; (3) date of birth, place of birth, participation in officially recognized sports and activities, weight and height of athletic team members, previously attended institutions, class schedule/roster.

Academic Advising

All new students must meet with their assigned adviser during their first term to ensure that they understand the curriculum and future scheduling procedures. All new students are provided with a program outline. The program outline specifically cites requirements for all required courses and the exact credit breakdown related to electives. In subsequent quarters, the advisers work with the students to ensure that students make satisfactory progress without violating prerequisites.

Enrollment Status Requirement

A student's quarterly enrollment status is established at the close of business on Friday of the first week of the quarter. Students registered for less than 12 credits will have their veteran's benefits and financial aid award reduced. A student's yearly enrollment status will be determined at the end of each academic year (fall, winter and spring quarters) to ensure that satisfactory progress has been made. The following matrix is used to determine enrollment status and satisfactory progress:

Enrollment Status	Quarterly Status: Credits per Quarter (attempted)	Yearly Status: Completed Credits Per Year (required)	Years to Complete: Bachelor's Degree (maximum)
Full-time	12+	36	6
Three-quarter Time	9-11	27	9
Half-time	6-8	18	12
Other	1-5	3	12

Progress will be monitored in yearly increments. When a student's enrollment status does not remain the same for all quarters during the year (i.e., when it is both part-time and full-time) an average will be used to determine if satisfactory progress has been made. A student who has not made satisfactory progress will be subject to termination from Milwaukee School of Engineering.

Financial aid recipients must meet all criteria outlined in the "Enrollment Status Requirement" and "Satisfactory Academic Progress Policy for Financial Aid Recipients" sections of this *Catalog* to remain eligible for financial aid.

Undergraduate students are classified by the number of credits earned as follows:

Freshman	0 - 45
Sophomore	46 - 96
Junior	97 - 144
Senior	more than 144

Re-admission Policy for Undergraduate Students

Students pursuing an undergraduate degree, who have been admitted to an academic program but have not completed a course for two consecutive years or longer but wish to continue their education, must apply to be re-admitted to MSOE.

The student must submit:

- A completed admission application to the admission office (the fee will be waived).
- A transcript of all course work that has been completed since the last time they applied.
- A personal statement clearly outlining their educational objectives.

Students may be granted:

- Full acceptance: If the student's cumulative and major GPA are equal to or greater than 2.00 and the student is in good academic standing as defined by the *Undergraduate Academic Catalog* (p. 25) the student will be re-admitted to full acceptance to MSOE.
- Other: If the student's cumulative and/or major GPA are less than 2.00 and/or the student is not in good academic standing as defined in the *Undergraduate Academic Catalog* (p. 25) the student will not be granted re-admission. The

student must follow the procedures outlined in the *Undergraduate Academic Catalog* "Suspension Appeal Procedures" (p. 25) to pursue re-admission to the university.

All newly re-admitted students must meet with an academic adviser prior to registering for classes and are responsible for completing the program of study that is current at the time of their re-admittance. The program director in conjunction with the department chair may reevaluate the student's transcript to determine which, if any, courses previously taken may be applied to the current program of study.

Attendance Policy

MSOE expects all students to attend regularly and promptly all lectures, laboratories and other sessions of courses for which they are registered. It is the student's responsibility to add and drop classes from his or her academic schedule.

Faculty have the option of developing a policy concerning grade reduction or dropping students for excessive absence from class. Any policy of this nature must be announced to the students during the first week of class and must be made available in writing upon request. A student dropped under such a policy must obtain written permission from the instructor to re-enter class. The instructor will inform the Registrar's Office if any student is readmitted to class.

Laboratory and examination attendance is mandatory. In the event of an excused absence, arrangements shall be made with the instructor in advance for make-up.

Excused absences for field trips or other university sponsored activities require one week advanced written notice with the approval of the chief academic officer.

Adding/Dropping Courses and Changing Sections

If a change of schedule is necessary, this may be done in the Registrar's Office before 4 p.m. on Friday of the first week of classes. **Students may neither add a course nor change sections after 4 p.m. on Friday of the first week.** This policy must also be followed by students taking courses available on a credit/noncredit basis who want to change from credit to noncredit status or from noncredit to credit status.

A student may drop a course and receive a grade of W after the first week and before 6 p.m. on Monday of the 8th week of classes. Drop forms are available in the Registrar's Office. These must be completed, properly signed, and received by the Registrar's Office before the deadline for dropping courses.

All students are responsible for their academic schedule. Students should not rely on instructors to drop them for non-attendance.

Withdrawal from All Classes

Students who wish to drop all classes must complete a withdrawal form which is available in the Registrar's Office. **This must be done before 4:30 p.m. Friday of the 10th week of classes.** Tuition refunds will be based on the date of official withdrawal, NOT on the date of last class attendance. The official withdrawal date is the date that the completed form is received by the Registrar's Office. Should a student fail to meet the withdrawal deadline, he/she will be responsible for tuition for all scheduled classes and will receive final grades in all of them.

If a student plans to complete the current quarter but not return in a future quarter, he/she should fill out a "Notification of Intent Not to Return" form which is available in the Registrar's Office

Grading System (Undergraduate)

Students receive letter grades in each course for which they register. Grades and their grade point equivalents are awarded on the following scale:

Letter Grade		Grade Points
A	(100 - 93)	4.00
AB	(92 - 89)	3.50
B	(88 - 85)	3.00
BC	(84 - 81)	2.50
C	(80 - 77)	2.00
CD	(76 - 74)	1.50
D	(73 - 70)	1.00
F	(below 70)	0.00
P	Pass	
S	Satisfactory	
U	Unsatisfactory	
W	Withdraw from class	
*	Incomplete - grade with an asterisk (*)	
NR	No grade reported	
AU	Audit	
AX	Audit dropped	

Grade point averages (GPAs) are computed by dividing the number of grade points earned by the number of credit hours attempted. **For undergraduate students, a cumulative GPA of 2.00 or higher is required for graduation.**

Major Grade Point Average

The major GPA is designed to show a student's proficiency in his/her specific degree program. Major GPA is calculated after nine (9) credits have been earned in applicable courses. **A major GPA of 2.00 or higher is required for graduation.** Nursing students only: A grade of "C" or better is required in all NU courses. See "School of Nursing" section for additional policies.

Courses used in calculating the major GPA in each program are as follows:

Architectural Engineering: all AE, CM and EE courses at the 300 and 400 level
Biomedical Engineering: all BE, EE and ME courses
Business: all MS courses at the 300 and 400 level
Computer Engineering: all CS and EE courses, and all GE courses at the 300 and 400 level
Construction Management: all CM courses and all AE courses at the 300 and 400 level
Electrical Engineering: all EE courses, and all GE courses at the 300 and 400 level
Electrical Engineering Technology: all ET courses
Industrial Engineering: all IE courses
International Business: all MS courses at the 300 and 400 level
Management: all MS courses at the 300 and 400 level
Management Information Systems: all MS courses at the 300 and 400 level
Mechanical Engineering: all ME courses
Mechanical Engineering Technology: MT and ET courses at the 300 and 400 level

Nursing: all NU courses
Software Engineering: all CS, EE and SE courses
Technical Communication (BA and BS degrees): all EN and TC courses

New Student Probation Policy (Students Accepted to MSOE on Probation)

Any student accepted to MSOE on probation whose term or cumulative GPA during their first year falls below 2.00 and who is not participating in required Learning Resource Center (LRC) activities (see page 14) will be subject to suspension. Required LRC activities during the student's first three quarters at MSOE include one hour per week of tutoring, two meetings per quarter with LRC staff and successful completion of OR-101, "Strategies for Academic Success" during the Winter Quarter.

Academic Standing

An undergraduate student is in good academic standing when any of of the following are equal to or greater than 2.00:

1) the term grade point average,

2) the cumulative grade point average and

3) the cumulative major grade point average (Cumulative major GPA for the purposes of academic standing is always calculated after completion of 15 major credits.)

When the cumulative, term or cumulative major grade point average falls below 2.00, a student is placed on probation. Normally, a student is given one term to raise the cumulative or cumulative major average to 2.00 or above. Any student on probation whose quarter grade point average for the following term is below a 2.00 will need to appeal to the SAC to continue. The committee may recommend continued probation, suspension or permanent dismissal from MSOE. Typically, suspension is for a period of two academic terms. Students who have been suspended must petition the Student Advancement Committee for lifting of the suspension during the two term suspension or for re-admittance following the two term suspension. A student who is placed on probation is limited to four courses per quarter.

A student on academic probation may not hold any class office or have officer level responsibilities in any student organization or extracurricular activity, serve as student representative on any institutional committee, or represent the university as a member of any MSOE intercollegiate or athletic team.

Suspension Appeal Procedure - Student Advancement Committee

Purpose
The purpose of the Student Advancement Committee is to allow for appeals on the part of those students who are suspended for academic reasons.

Procedure
Students submit petitions in writing to the Registrar's Office, addressed to the Student Advancement Committee. If, in the judgment of the committee members, the student is in a position to continue with a good probability of academic success, permission is granted to continue with a probationary status. The student's academic progress will then be closely monitored on a term-to-term basis. **Each student has the option of one personal appeal to the committee during his or her academic career at MSOE.**

Incomplete Grades

A letter grade followed by an asterisk is a temporary grade indicating incomplete work. It is the responsibility of the student to make arrangements with the instructor to have the work completed; these arrangements must be initiated within the first two weeks of the following quarter (not including the Summer Quarter). The student must submit the required work to complete the course within the time deadline set by the instructor, but this may not be later than the end of the same quarter. If the student has not completed all work for the course after this period of time, the asterisk will be dropped and the letter grade preceding the asterisk will become the permanent grade.

An incomplete grade is given at the discretion of the instructor. Incomplete grades are reserved for situations in which a student has done satisfactory work in a course until near the end of the term but because of extenuating circumstances, the course could not be completed.

Not Reported (NR) Grade

For specific project-oriented courses (senior design for example), student grade reports may reflect a grade designation NR each quarter until final course requirements are satisfied, at which time all previously reported NR grades will be converted to final course grades. Students receiving those grades should be aware that, unlike an incomplete grade, the NR grade is not computed in any quarter's GPA until a replacement grade is recorded.

Repeating and Grade Replacing Courses

A student may repeat any course taken at MSOE. All grades earned in the course will be calculated into the student's grade point average unless the grade is being replaced.

If a student wants to repeat a course to replace a grade, he/she must do so within one calendar year from the time the original grade was received. If a student has not been continuously enrolled during that year, an extension may be granted through the Student Advancement Committee. A written appeal for an extension should be submitted to the Registrar's Office for review by the committee. If the course is not offered within one calendar year, the student must take it the next time it is offered. Courses must be taken at MSOE to be eligible for grade replacement.

When registering for the course the second time, the student must fill out a Grade Replacement Form in the Registrar's Office. This form must be received by the Registrar's Office before the close of business on Friday of the first week of classes. Students are allowed a maximum of five (5) grade replacements in their academic career at MSOE. Grade replacements are only processed upon completion of the course the second time. If a course that is being replaced is dropped, it will not count as one of the five allowed grade replacements. After completing the course the second time, both grades will appear on the student's transcript, however, the original grade will not be used in calculating GPAs. A student who fails (F or F*) a course that is being repeated will be subject to suspension. Prerequisite courses must be successfully completed before the second course is taken; failure to adhere to this policy voids a grade replacement request for the prerequisite course.

Nursing students only: Any nursing student who earns a grade of "X," "W," "F" or "D" in any NU course, may repeat that course one time. A maximum of two NU courses may be repeated. Students who fail to achieve a grade of "C"after repeating a course will be academically dismissed from the School of Nursing.

Grade Replacement Policy for International Exchange Programs

MSOE/Lübeck University of Applied Sciences international exchange program participants only: Courses taken at MSOE cannot be used to grade replace any junior year Lübeck grades. All participating students are required to follow Lübeck policies regarding retaking/passing of exams and tests for Lübeck courses. All resulting Lübeck grades will be converted into MSOE grades. For all Lübeck courses MSOE students are always allowed to retake the equivalency MSOE course, if offered, but only without grade replacement.

Auditing Courses

An audit is intended to provide students with an opportunity to review subject matter they have previously studied or to participate in courses to obtain information of interest to them. Since an audit does not carry any credits, auditing of noncredit courses such as seminars and short courses is not permitted.

A student wanting to audit a course must have the proper prerequisites for the course. Permission to audit a course must be granted through the student's program director or adviser. **Once a student takes a course as an audit, he/she may not take the course for credit.** Students may not enroll for subsequent courses for credit based upon audited prerequisite subjects. Auditors may not use audited courses as a means for obtaining credit for any course or to satisfy any degree requirement.

Students may change from audit to credit status or credit to audit status only until Friday of the first week of classes; fees will be adjusted accordingly. Fees to audit a course are payable in full at the time of registration. The cost to audit a course is three-fourths the regular tuition of the course for students registering for 0 to 11 credits. There is no charge for students registering for 12 to 19 credits. The cost of an audit class is **nonrefundable.**

Directed Study

In the event that an undergraduate student is unable to schedule **a specific course**, the student may be granted permission to register for a directed study. Directed study provides one-on-one instruction with an MSOE faculty member. Generally, permission for such registration is granted only if the course is required in the student's program and if the student is within 16 credits of graduation. Appropriate forms are available, and permission must be obtained from the chairperson of the department under which the course is taught.

The nonrefundable fee (2003-2004 academic year) for taking an undergraduate directed study is $645 per credit.

Independent Study

An independent study gives a student the opportunity to pursue a specialized topic not covered in regularly scheduled course work. The student works closely with a faculty adviser on a project. The student must complete the appropriate Independent Study Form, available from the program director, and present it at the time of registration for the course.

Midterm Progress Reports

Students desiring a midterm progress report may receive one from each instructor during the sixth week of the quarter. Forms for requesting this service are available in the Registrar's Office. It is the responsibility of the student to submit requests to the instructor(s) during the fifth week of the term. The instructor(s) will return the completed form to the student in the sixth week of the term. No official record of the midterm grade is kept.

Dean's List and Honors List

MSOE encourages excellence in academic achievement and, as a result, publishes the Dean's List and Honors List each quarter. Undergraduate students who have earned at least 30 credits and have a cumulative GPA of 3.20 or higher are on the Dean's List. Students on that list who have maintained a 3.70 or higher receive "high honors." Students with a **term** GPA of 3.20 or higher, who are not on the Dean's List, are on the Honors List.

Graduation Requirements

Authority for the granting of degrees by MSOE and making of exceptions to standard policies lies with the chief academic officer and the Executive Educational Council.

In all cases where ABET accredited programs or other accreditations are in effect, care will be taken to ensure that all graduates meet or exceed the minimum accreditation criteria.

Bachelor's Degree Candidates

Satisfactory completion of all courses prescribed in the curriculum for the particular area of study in which the degree will be granted is required. A minimum of one half of all required credits must be completed in residence at MSOE. For undergraduate students, a cumulative GPA of 2.00 or higher and a major GPA of 2.00 or higher are required for graduation.

Undergraduate students who graduate with a cumulative GPA of between 3.20 and 3.69 will graduate with "Honors." Students who graduate with a cumulative GPA of 3.70 or above will graduate with "High Honors." "Honors" and "High Honors" will be notated on the student's diploma but not on his/her transcript.

Participation in the Commencement ceremony is **mandatory** for all bachelor's and master's degree candidates.

Minors

A student who completes a bachelor's degree at MSOE may also earn a minor in one or more areas by satisfactory completion of all the requirements stipulated for each minor. All requirements for the minor must be met by the time the student graduates with his/her bachelor's degree. A minimum grade point average of 2.00 is required for the course work that is counted toward the minor. MSOE offers five minors in the areas of management, marketing management, mathematics, physics and technical communication.

Undergraduate Two-Degree Candidates

To receive a second bachelor's degree from MSOE, a student must complete a minimum of 40 credits that are unique to the second degree. These credits must be over and above those that satisfied requirements for the first degree. Science and mathematics courses taken to fulfill basic second degree requirements will not count toward these 40 required credits.

Graduation Procedures

Students **must apply** for graduation in the Registrar's Office by the dates posted in the *Timetable of Classes*. For those who submit a graduation application on time, the Registrar's Office will do a graduation credit check before the end of the first week of the term in which the student plans to graduate and notify the student by mail if additional courses are required. Students must complete all degree requirements before they may participate in the Commencement ceremony. The **only** exception to this policy is for students intending to complete no more than two courses during the summer months; these students may participate in the Spring Commencement ceremony.

A student completing graduation requirements by the end of a term, but who has not applied for graduation by the application deadline, may be allowed to participate in Commencement, but the receipt of the diploma may be delayed.

The deadline for students to apply in the Student Life Office for the Commencement ceremony; to have their name listed in the Commencement program; and to receive a supply of invitations, printed cards, etc., is **Friday of the seventh week of classes.**

Student Financial Services

For more information about Student Financial Services, please visit www.msoe.edu/finaid.

Tuition and Fees (2003-2004 Academic Year)

MSOE reserves the right to revise tuition and fees at any time. MSOE will exercise the normal means of communication announcing revisions.

Undergraduate Tuition

Full Time (12 - 19 quarter credit hours)

If student's initial MSOE start date was:	
Fall 2000 or later	$7,678/quarter
Fall 1999-Summer 2000	$7,315/quarter
Prior to Fall 1999	$6,827/quarter

Students registering for more than 19 credits will be charged $402 per credit for each credit over 19 credits.

Part Time (1 - 11 quarter credit hours)	$ 402/credit hour
Technology Package (Laptop)	$1,140 annually To be billed at $380/quarter
Undergraduate Application Fee	$ 25

This fee is payable with the admission application and is **nonrefundable.** The application fee is required for all students requesting acceptance in credit courses.

Late Registration Fee $ 40

This fee is payable for all students who register during the first week of a term and is **nonrefundable.**

Returned Check Fee $ 30

Checks received in payment of tuition and fees or cashed at the MSOE Bookstore, which are returned by the bank as "Non Sufficient Funds," "Payment Stopped" or "Account Closed" will result in a charge of an additional $30 NSF check handling fee. If two checks are returned from the bank, the student will lose their check writing privileges in the Bookstore and their student account will be annotated to require all future payments to be in cash, cashier's check, money order or credit card.

Advanced Credit Examination Fee	$ 55
Audit Fee	3/4 of regular tuition (per quarter credit), payable at registration

Directed Study Fees

(Directed study fees must be paid in full at time of registration. This fee is non-refundable even if directed study is not completed.)

Per Credit Undergraduate Fee	$ 645

Due Dates

Charges are due and payable by Monday of the third week of classes. Students who have settled in full all obligations to MSOE will be issued earned certificates, diplomas and transcripts, and will be permitted to register for the subsequent term. A student must have a zero balance to register for the next quarter.

If payment is not received by Monday of the third week, a late payment fee may accrue at a rate of 12 percent A.P.R. (1 percent per month) until paid. Students whose financial aid has not transferred to their student account as of Monday of the third week because they have not completed their financial aid paperwork, have not yet applied for financial aid or applied for financial aid late, may be charged a late payment fee on the entire outstanding balance. Students that are sponsored by a company, Chapter 31 (Federal VA), DVR or a Foreign Embassy, who have their letter of authorization on file in the Student Accounts Office by the first day of the third week, will not be charged a late payment fee on those charges covered by a company or agency.

If a student does not make payments when due, MSOE reserves the right to require full payment of the subsequent quarter before the student may register for that quarter.

Agency or Employer Sponsorship of Students

To allow flexibility for students sponsored by a company or agency, the following is possible: If the company/agency will allow MSOE to invoice them for the student's education with no contingencies, a letter of authorization from the company or agency must be on file in the Student Accounts Office or must accompany the registration form. The letter of authorization must state exactly what expenses will be covered; i.e., which classes, costs, fees, books, etc. MSOE must have the letter at the time of the student's registration.

Credit Balance Refund Checks

All processed financial aid will transfer to your student account during the second week of the term and on a rolling basis from that time forward. Credit balance refund checks will be processed after all financial aid has been posted to your account and will be mailed to your local address (credit balance refund checks as a result of a ParentPlus loan will be mailed to the parent.)

Refund Policy

Tuition refunds will be based on the date of official withdrawal. The official withdrawal date is the date that the completed form is received by the Registrar's Office. Tuition refunds will be authorized only for withdrawals approved by the Registrar's Office.

Tuition Refund Schedule for Students NOT Receiving Financial Aid

- This refund schedule is for 11-week classes. For shorter classes, please contact the Student Accounts Office.
- Tuition refunds will be made for students not receiving financial aid who officially withdraw from one or more courses, except for those who retain full-time status according to the following schedule:

Prior to the start of the quarter	100% Tuition Refund
During the first week of the quarter	100% Tuition Refund*
During the second week of the quarter	80% Tuition Refund
During the third week of the quarter	40% Tuition Refund
During the fourth week of the quarter	20% Tuition Refund
After the fourth week of quarter	NO REFUND

**Students withdrawing completely during the first week will be assessed a $50 fee.*

Tuition Refund Schedule for Financial Aid Recipients

- A financial aid recipient is defined as any student who has been awarded financial aid (federal, state or institutional) by the Student Financial Services Office.
- **No tuition refund will be made for financial aid recipients who drop individual courses after 4 p.m. Friday of the first week of the quarter.**
- Tuition refunds will only be granted to financial aid recipients who officially withdraw from **ALL** courses according to the following schedule:

Prior to the start of the quarter	100% Tuition Refund
During the first week of the quarter	100% Tuition Refund*
During the second week of the quarter	80% Tuition Refund
During the third week of the quarter	40% Tuition Refund
During the fourth week of the quarter	20% Tuition Refund
After the fourth week of quarter	NO REFUND

**Students withdrawing completely during the first week will be assessed a $50 fee.*

Return of Title IV Funds Policy

- If a recipient of Title IV aid officially withdraws from all classes before completing 60 percent of the quarter, MSOE is required by law to calculate whether a portion of the student's federal financial aid must be returned to the federal government.
- The amount of federal aid the student keeps is in direct proportion to the length of time the student remained enrolled during the quarter. The amount of aid earned is determined by dividing the number of days completed in the quarter by the total number of days in the quarter.
- Any funds not earned will be returned in the following order:
  1) Unsubsidized Stafford Loan
  2) Subsidized Stafford Loan
  3) Federal Perkins Loan
  4) Federal PLUS Loan
  5) Federal Pell Grant
  6) Federal Supplemental Educational Opportunity Grant
  7) Other Title IV Aid
- If a student withdraws before completing 60 percent of the quarter, the student may owe a repayment to the school. A bill will be sent to the student for any balance due as a result of returning financial aid funds.
- Please contact the Student Financial Services Office before withdrawing to determine what aid will be returned and what you may owe MSOE.

Return of Institutional Funds Policy

- If a recipient of MSOE scholarships, loans or grants officially withdraws before 6 p.m. Friday of week four, MSOE will calculate the amount of institutional aid the student earned and return the unearned aid back to the university.
- The amount of aid earned is determined by dividing the number of days completed in the quarter by the total number of days in the quarter.

Residence Hall Fee Refund Policy

- Please see the Residence Hall Fees Refund Policies section of the *Timetable of Classes* or contact the Housing Office for room fee and meal account refunds.

Laptop Fee Refund Policy

Laptop fee refunds will be made for students who officially withdraw from all classes and return their laptop to CCSD according to the following schedule:

Prior to the start of the quarter	100%
During the first week of the quarter	100%
During the second week of the quarter	80%
During the third week of the quarter	40%
During the fourth week of the quarter	20%
After the fourth week of the quarter	No refund

Should a laptop not be returned, all efforts will be made by CCSD to contact the student to arrange for return of the laptop. The Use Agreement that you signed requires that you return the equipment to the school within five days prior to the expiration or termination of the Use Agreement. The Use Agreement begins the first day of the first month following the date that this Use Agreement is signed or upon delivery of the equipment, whichever is earlier. The "Use Agreement Period" shall extend from the Use Agreement Begin Date to the user's graduation date from MSOE. When you become a non-registered student of MSOE, the Use Agreement is terminated and the laptop must be returned. MSOE will take legal action to retrieve the equipment or its value from you.

Policies for Financial Aid Recipients

Satisfactory Academic Progress Policy for MSOE Financial Aid Recipients

In accordance with federal regulations, financial aid recipients are required to complete a minimum number of credits per year (defined as the Quantitative Component of Satisfactory Academic Progress) and maintain a cumulative grade point average (CGPA) that would lead to the attainment of a degree (known as the Qualitative Component of Satisfactory Academic Progress).

Quantitative Component:

In accordance with federal regulations, full-time students are required to complete a degree program within 150 percent of the standard degree completion time of four years. Therefore, the 150 percent will be calculated at six years. Students will be required to complete and receive credit for (grades A-D) 36 credits during a given academic year to meet quantitative standards. Students will be monitored yearly beginning at the end of the first year of enrollment. Students not completing a minimum of 36 credits during a given academic year will be placed on financial aid probation for their next term of attendance requiring the student to complete a minimum 12 credits that term. A student will receive financial aid for this probationary term. If a student completes 12 credits (grades A-D), financial aid probation will be lifted. If a student fails to complete 12 credits (grades A-D), a student would not qualify for financial aid for the next term of attendance. To regain financial aid eligibility, a student would need to complete 12 credits (grades A-D) in the next term of attendance and pay for the courses with funds other than financial aid. A student would then regain financial aid eligibility for the next term of attendance.

Part-time students are required to complete a minimum of six credits per term (grades A-D) to remain eligible for financial aid. Part-time students who receive financial aid will be reviewed as stated above.

Qualitative:

In accordance with federal regulations, a student's CGPA should be reviewed at the end of the second full academic year or at the time of the financial aid award for the third year and annually thereafter. Students who have not maintained a 2.00 CGPA at the time of review will be put on academic probation for the next term attended at MSOE. A student will remain eligible for financial aid during the probationary term. A full-time student will be required to complete a minimum of 12 credits and maintain a "C" or better grade in all classes in order to be removed from probation. A part-time student will be required to complete a minimum of six credits and maintain a "C" or better grade for all courses. If the student does not complete the required number of credits with a grade of "C" or better, the student will be ineligible for financial aid for the next term attended at MSOE. The full-time student will be required to complete 12 credits with a grade of "C" or better in all classes in the next term attended at MSOE and pay for the courses with resources other than financial aid. The part-time student will be required to complete six credits with a grade of "C" or better in all classes in the next term attended at MSOE and pay for the courses with resources other than financial aid. If the student successfully completes the stated requirement, the student will regain financial aid eligibility for the next term of attendance at MSOE.

Appeals:

Students may appeal the loss of their financial aid eligibility. Appeals should be submitted in writing to the Student Financial Services Office, addressed to the director. The director, in consultation with the Student Financial Services staff members, will review the appeal and notify the student in writing regarding the appeal.

MSOE Academic Scholarship Policy

- Full-time enrollment must be maintained in order to remain eligible for scholarships.
- Initial scholarship reviews and revisions will be conducted beginning at the end of a student's **second** full-time academic year of study (defined as the end of the Spring Quarter of any given year).
- Students maintaining a CGPA of 2.50-3.00 at the time of review will receive an academic scholarship at the same level as initially awarded.
- Students who have achieved a CGPA of 3.01-4.00 at the time of review will receive an increase of $500 to the scholarship for the next academic year. Scholarship increases in subsequent years will be $500 if a student maintains a CGPA of 3.01-4.00 as determined at the end of year review.
- A student who has not maintained a CGPA of 2.50 at the time of review will see the academic scholarship adjusted as follows: a cumulative CGPA of 2.00-2.499 will result in a reduction of original scholarship by 50 percent for the next academic year. A CGPA of 1.99 and below will result in a loss of scholarship for the next academic year.
- Students who lose eligibility and then regain a CGPA of 2.00 to 2.499 at the time of review will be awarded 50 percent of the original scholarship for the next academic year. Students who lose eligibility and then regain a CGPA of 2.50-3.00 at the time of review will be awarded 100 percent of the original scholarship.
- Students who have never received a scholarship in the past, but who at the time of review have completed full-time studies in the previous two consecutive academic years and have achieved a CGPA of 2.50-3.00, will receive an initial scholarship amount of $2,000 for the next academic year. Students who have achieved a CGPA of 3.01-4.00 will receive an initial scholarship of $5,000 for the next academic year. Subsequent adjustments will be addressed as stated above.

Library Resources

The Walter Schroeder Library is a service-oriented facility committed to providing scholarly, educational, and other types of information resources and services to the MSOE community – including students, faculty and staff – in response to the educational, research, administrative and social concerns of the university. It features more than 60,000 print volumes, primarily devoted to the specialized curricula of the university. The collection consists of books, periodicals, newspapers, master's theses, microforms, electronic databases and media programs. The library's catalog, Horizon, can be accessed via the Internet.

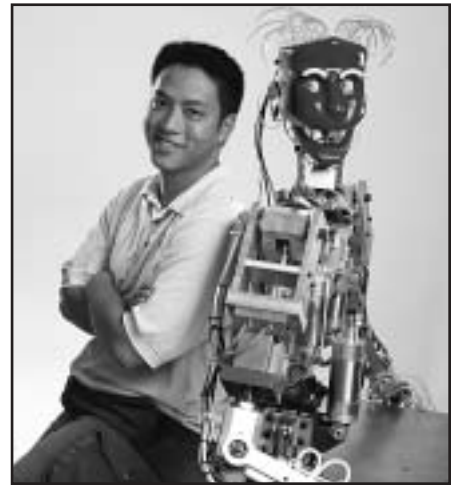
In addition to maintaining its collection of materials, the library offers a number of other services, including interlibrary loan, InfoPass (a program that permits students to borrow items directly from local libraries), database training, the ASTM standards delivery service, and extensive research and documentation help. The library provides access to several bibliographic and full-text databases. Electronic books and journals are also made available by the library via the campus network and the Web. Video and projection equipment and multimedia instructional help is available through the university's Audiovisual Center, which is housed in the library. The AV Center is also the home of the MSOE MMAC Business and Management Video Collection, which features hard-to-find productions from leading business and management theorists. A popular paperback book lounge area, group study rooms, scanners, photocopiers and Internet research desktop computers are available. Study rooms and several study carrels are networked. The Gene Carter Desktop Media MacIntosh Computer Laboratory is located on the library's first floor. The library also houses an archives that documents the history of the university.

Applied Research

Main Office: Allen-Bradley Hall of Science, S-149
Phone: (414) 277-7416
Fax: (414) 277-7470

Applied Technology Center™ (ATC)

MSOE's philosophy of an applications-oriented education – a full theoretical base plus hands-on technological experience – is exemplified by its research arm, the Applied Technology Center™. It serves as a technology and knowledge transfer catalyst among academia, business and industry, and governmental agencies and includes several centers of excellence. There are a number of opportunities for students to contribute to important cutting-edge developments while interacting with faculty, staff, industry and government. Students fulfill the roles of research assistants as part-time or summer employees.



The Applied Technology Center undertakes hundreds of projects annually supporting business, industry and governmental sectors with research, design, development and evaluation of products,

processes and manufacturing systems. Staff can construct and evaluate prototypes and assist in providing technology transfer, helping to fulfill the global objectives of applying engineering talents for the betterment of life for all people.

Some of the areas include:

- Center for BioMolecular Modeling
- Rapid Prototyping Center
- Fluid Power Institute™
- Focus on Energy
- Photonics and Applied Optics Center
- Construction Science and Engineering Center
- Electrical and Computer Programs
- High Speed Video and Motion Analysis
- High Impact Materials and Structures Center
- Professional Education

The **Center for BioMolecular Modeling** creates unique physical models of molecular structures using rapid prototyping technologies. The center works with research scientists to create custom models of the proteins whose structures they are investigating. The center also works closely with educators at both the secondary and post-secondary levels to create innovative products that make the molecular world real for students. The center is unique in the world, bringing together the disciplines of engineering, structural biology and computer visualization.

Rapid Prototyping Center offers students opportunities to work with faculty, staff and a consortium of client-members (such as Snap-On and Kohler Co.) to reduce product development cycle time and develop products using the technology of rapid prototyping. Rapid prototyping (RP) is a process that enables a 3D object to be created quickly and automatically from computer data. MSOE is the only university in the world to have machines that use each of the five leading types of RP techniques. It also utilizes the Laser Engraving Laboratory, which is co-located with the Photonics and Applied Optics Center.

The RPC also is extending the use of rapid prototyping through research projects as diverse as biomolecular and biomedical modeling, architectural modeling and manufacturing tooling. Rapid prototyping programs at MSOE currently include the Rapid Prototyping Consortium that comprises more than 40 industrial and educational members.

MSOE students participate in a National Science Foundation-sponsored program called **Research Experience for Undergraduates**. They are joined in MSOE's laboratories by students from universities around the country who vie for the opportunity to gain experience in researching applications of rapid prototyping in the fields of biomedical, architectural, aerospace, biomolecular, electrical and manufacturing industries.

In 1999, an undergraduate student and MSOE professor used RP to provide a pivotal link for law enforcement agencies in helping identify a murder victim. It was the first known use of RP for facial reconstruction by forensic experts.

In October 1999, Procter & Gamble donated to MSOE 40 patents – the company's largest donation ever – for a breakthrough technology that is complementary to current RP research. The technology reduces production time for molded parts and has garnered widespread interest from a variety of industries. MSOE students contribute to the research that will lead to realization of this technology's full potential.

The **Institutional Review Board (IRB)** was established to protect the rights and well-being of human participants recruited to participate in research activities. Milwaukee School of Engineering complies with requirements set forth in the Federal Regulations known as the "Common Rule," regardless of the source of project funding.

All students, staff and faculty at MSOE planning on conducting research involving human participants must submit an IRB protocol for review and approval by the MSOE Institutional Review Board. Review and approval must be completed ***before*** research begins. The review ensures the research plan has adequately protected the rights and well being of human participants. If the investigator is a student, the research must be performed under the supervision of an MSOE faculty or staff member who by his or her signature assumes responsibility for the conduct of that research with respect to the proper safeguards of the rights of participants.

Fluid Power Institute™(FPI), one of the first centers of its kind in the country, remains a pioneer in motion control and fluid power education. Through its state-of-the-art facilities it conducts a variety of performance, endurance and environmental evaluations of components and systems. FPI also performs component and system design, modeling and simulation, system integration and prototyping, and develops and delivers various educational programs. A $5 million endowment from the estate of Otto J. Maha provides the resources to ensure continued advancement of fluid power education.

FPI uses an interdisciplinary workforce comprised of faculty and staff from various academic departments, and undergraduate and graduate students to conduct fluid power, motion control and related industry projects. FPI's approach utilizes mechanical, electrical, computer and software engineering along with MSOE's Rapid Prototyping Center. MSOE is a member of the National Fluid Power Association and supports the activities of the Fluid Power Society and the Fluid Power Educational Foundation.

Undergraduates, in various degree programs, may be hired in their freshman or sophomore years and work 10-20 hours per week during the academic year and full time in the summer.

FPI research assistants acquire two to four years of hands-on experience combined with fluid power courses, giving them excellent problem solving and interpersonal skills. They may receive job offers upon graduation, from component manufacturers, OEM's, distributors and users.

Focus on Energy is a public-private partnership that offers energy information and services to business, industrial and residential customers throughout Wisconsin. MSOE has contracted with the State of Wisconsin to administer Business Programs within Focus on Energy. This multimillion dollar program is a joint public/private partnership directed toward increasing energy efficiency throughout the state. Business Programs encourages commercial, industrial, municipal, and agricultural organizations to increase overall energy efficiency in their programs, processes, product, facilities and overall operations. There are several primary subcontractors with more than 60 energy advisers working with our program and trade allies, as well as our program partners across the state, all interested in implementing fully integrated energy efficiency improvement solutions. The program also has environmental and economic development objectives as well as the long-term objective of making energy efficiency an integral part of organizational decision-making while developing the infrastructure to assure that energy efficient products are available as the demand for energy increases. The university administrator's office includes administration, procurement, quality, telecommunications and IT, technology and program control, with students participating in applied research, as well as procurement, telecom and IT groups.

Photonics and Applied Optics Center comprises the ***Undergraduate Applied Optics Laboratory***, the ***Phototonics and Sensors Laboratory*** and use of the Rapid Prototyping Center's ***Laser Engraving Laboratory***. All of the center's laboratories are in an extremely low-vibration site that allows performance of the most sensitive optical projects and experiments. The center includes six 4-by-8-foot optical tables and a collection of optical instruments and apparatus that includes picowatt optical power meters, computer-controlled monochromators, a broad array of optical sources including lasers and light emitting diodes and fiber optic components including an optical time-domain reflectometer. Recent projects associated with the center include an NSF-funded laboratory curriculum development project, and consulting projects for several of America's largest corporations involving lasers, LEDs, sensor applications and optical fabrication.

The **Construction Science and Engineering Center** promotes innovation in the building design and construction industries by conducting applied research in structural materials and systems as well as construction methods. The center's laboratory has approximately 2,100 square feet of floor space and a clear height of 36 feet. There is a large door for truck access and an overhead crane with two 5-ton trolleys. Specialized and adaptable structural testing systems, including a two-channel digitally controlled system, can produce loads from 50 to 500,000 pounds on specimens up to 24 feet tall. The lab has multiple computerized data acquisition capabilities and an extensive array of transducers for measuring force, displacement, and strain. Academic course activities in this laboratory ensure that MSOE graduates understand the physical realities of structural behavior and construction.

Electrical and Computer Programs include projects in which the primary technologies are software, computer hardware and electronic or electrical systems. Specialty areas include magnetic actuators and sensors as well as their use in electrohydraulic systems. Selected capabilities to create, simulate, breadboard, analyze and test electrical or software-based solutions to real world requirements are available.

The **High Speed Video and Motion Analysis** system has the ability to digitally capture – and immediately play back – events in the 1,000 to 12,000 frames per second range, enabling the user to analyze situations otherwise impossible with conventional video or the eye. Since the system is portable, it can be taken to any point of interest. Powerful motion analysis software can be used to track and graph up to nine points in the visual field. Projects for industry and aerospace engineering have been conducted.

High Impact Materials and Structures Center has developed a materials database and concepts for blast-resistant aircraft cargo containers for the Federal Aviation Administration. It is involved in other aspects of airport and aircraft security through the new Federal Transportation Security Administration. The analytical methods and experimental approaches developed at MSOE can be applied to several areas, including high speed machining of materials, large forging processes and analysis of accident effects.

Professional Education seminars at MSOE offer participants opportunities to explore technological developments and current applications and techniques. The programs are designed to keep practicing engineers abreast of new developments and applications, and also to provide a basic understanding of the technology to new entrants into the field. These seminars are based on applied research conducted by scholars using state-of-the-art laboratories with industrial-size equipment.

Computer and Communication Services Department

Help Desk: S-301
Phone: (414) 277-7288
Fax: (414) 277-7495 or (414) 277-7508

The Computer and Communication Services Department (CCSD) is responsible for the planning, development, maintenance and administration of the university's computing resources. CCSD is comprised of two main functions: the educational mission of the university, and the administrative, dealing with such things as student records, financial aid and telecommunications.

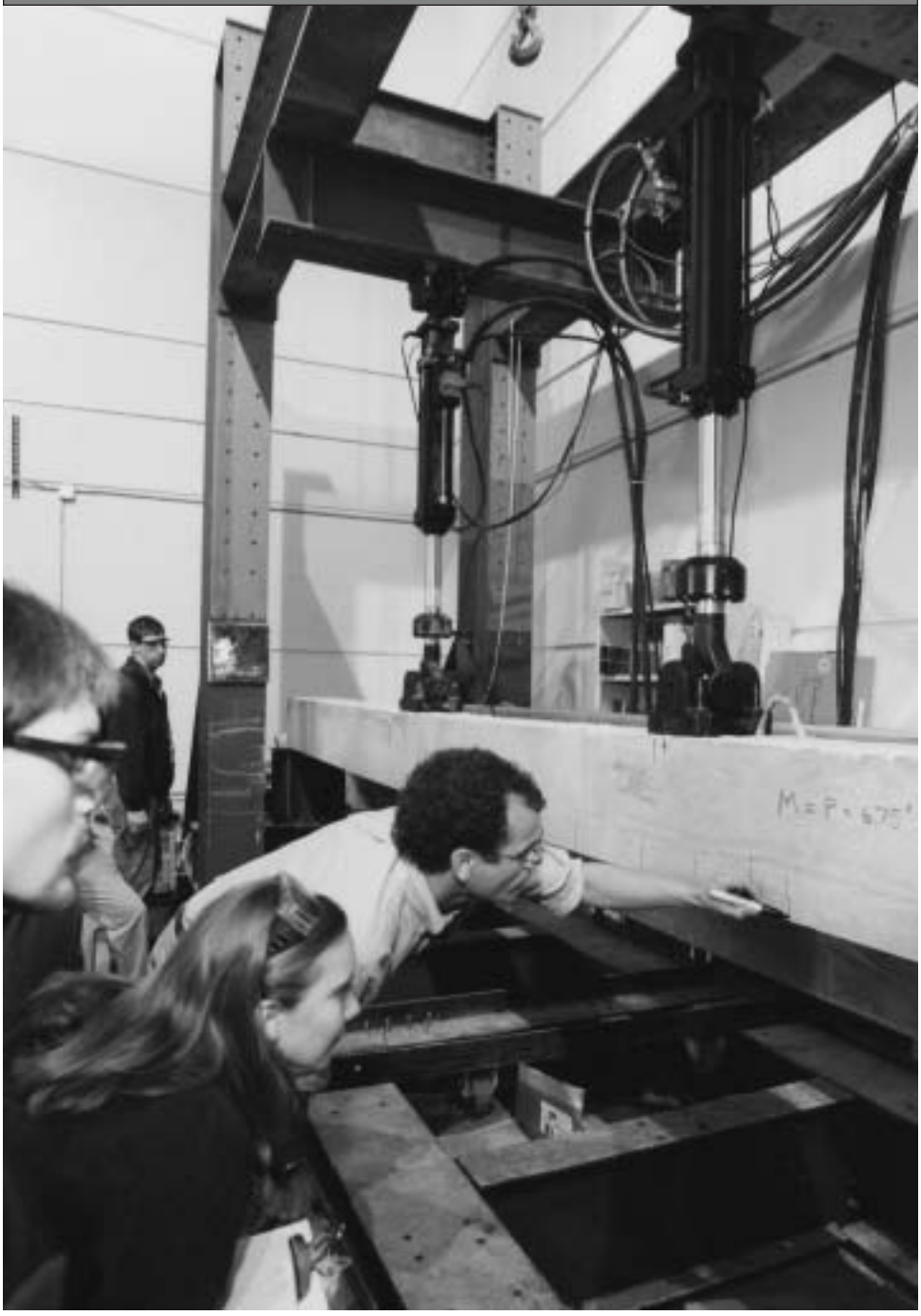
Students are assigned their own computer accounts while attending MSOE. These accounts enable students to send and receive Internet and local e-mail, access to other Internet applications, and PC network-based and systems applications. Students may also have a personal Web page which links from the MSOE home page, www.msoe.edu, if they wish.

Technology Package (Notebook Computer Program)

MSOE is leading the state in its commitment to technology, as the first university to require its students to have notebook computers. The visionary program, begun in fall 1999, gives students immediate access to the computers that they require and facilitates communication and collaboration between students, faculty and the public. The Technology Package includes standardization of software tools by degree program, upgrades as appropriate, user training and support, insurance for breakage and theft, and a guaranteed loaner for computers in need of service.

B

ACADEMIC DEPARTMENTS – PROGRAM OUTLINES



Architectural Engineering and Building Construction Department

Main Office: Student Life and Campus Center, CC-69
Phone: (414) 277-7301
Fax: (414) 277-7415

The Architectural Engineering and Building Construction Department offers a Bachelor of Science in Architectural Engineering and a Bachelor of Science in Construction Management, as well as a Master of Science in Environmental Engineering and a Master of Science in Structural Engineering.

Bachelor's degrees are concentrated in building construction, construction economics and methodology, and construction management and building design (electrical, environmental and structural). The department uses the following technical facilities to support the specializations: AE and BC Department Senior Project Studios, Johnson Controls Building Environmental Systems Laboratory, Construction Materials Laboratory and Structural/Construction Testing Laboratory, Fluids Laboratory and Building Electrical Communications Laboratory.

Faculty:

Chairperson:
Dr. Deborah Jackman

Department Secretaries:
Lynn Kallas, Kristine Morrissey

Professors:
Dr. Carol B. Diggelman, Matthew W. Fuchs, Dr. H. Peter Huttelmaier, Dr. John A. Zachar

Associate Professors:
Dr. Richard A. DeVries, Michael J. McGeen, Dr. Randy R. Rapp, Dr. Douglas C. Stahl, Robert O. Lemke

Assistant Professors:
Dr. Bass Abushakra, Michael Emmer, Dr. Francis Mahuta, Dudley Outcalt

Instructors:
J. Michael Hassler, John Jezak

Adjunct Associate Professor:
Larry Palank

Adjunct Assistant Professors:
Paul Boersma, Dr. William Gonwa, Dr. Jay Karls, Ken Kaszubowski, Dr. Mahmoud Maamouri, Jeffrey MacDonald, Lori Mayerhoff, Christopher Raebel, Ralph Schroeder, Michael Schuck, David Sheedy, Dr. Kenneth TerBeek

Lecturers:
Thomas Baade, Loei Badreddine, Jeffrey Bateman, Donald Beres, Dan Burazin, William Cummings, Larry Groser, Richard Hombsch, John Houdek, Aaron King, Ward Komorowski, Timothy O'Rorke, Gordon Pierret, Robert Prowant, Gaurie Rodman, Douglas Sauer, Martin Sell

Professors Emeriti:
Richard Cook, Paul E. Feuerstein

Bachelor of Science
Architectural Engineering

Program Director:
Dr. John Zachar
Office: CC-70
Phone: (414) 277-7307
Fax: (414) 277-7415
E-mail: zachar@msoe.edu

This four-year bachelor of science degree program prepares engineers and managers for careers in the design and construction of buildings and building systems. Lecture and laboratory courses integrate theory and the practical application of design principles, practices, methods and materials. The architectural engineering program provides graduates with a core of mathematics, science, construction materials and methods, and business, plus a design specialty.

Program Goals

Program graduates will:

- have an understanding of engineering, construction, management and architecture sufficient to enter the profession in a productive manner
- have a well-rounded knowledge of mathematics and the engineering sciences
- be proficient in oral and written communication
- be able to work effectively in a team environment
- have an understanding of the responsibilities, both professional and ethical, that are required of the architectural engineer
- have a knowledge of the need for lifelong learning and a motivation to pursue it
- have an awareness of contemporary issues necessary to understand the societal and environmental impact of their profession

Design Specialties

There are three design specialties offered in the architectural engineering program beginning in the junior year. Students must select one of the design specialities:

- Building Electrical Systems
- Building Environmental System
- Building Structural Systems

Graduates pursue diversified careers in construction or construction-related areas. Opportunities specific to each design specialty include the following:

Building Electrical Systems

Electrical Systems Engineer – Designs and specifies electrical power, lighting and communication systems for buildings. Employed in an electrical consulting design office or in electrical design-construct offices. Other responsibilities may be preparing specifications and cost estimates.

Electric Utility Engineer – Coordinates new building construction with building owners, design engineers and contractors, and updates customers on conservation and cost-saving opportunities.

Electrical Building Inspector – Employed by a public agency. Responsible for the public interest to inspect the buildings under construction for electrical code compliance.

Building Environmental Systems

Building Energy Contractor – Estimates and assembles the HVAC system from the design documents.

Building Energy Construction Manager – Supervises the mechanical trades in the installation of equipment and systems for a building.

Fire Safety/Protection Engineer – Designs various types of fire protection systems within the building. Systems include sprinkler, chemical suppression and detection devices.

Heating, Ventilating and Air Conditioning (HVAC) Engineer – Designs the HVAC systems and prepares the specifications.

Plumbing Engineer – Designs the water, processing fluid and waste systems for the building and for the site.

Building Structural Systems

Structural Engineer – Analyzes, designs and selects structural systems and components for various structures. Graduates are employed within the building industry (e.g., consulting engineering firms, pre-engineered building industry, steel fabrication and precast concrete systems, and other structural design areas such as construction equipment manufacturers).

Some Common Positions for All Design Specialities

Building-Insurance Appraiser/Engineer or Architectural/Construction Appraiser – Provides valuation of real, tangible and intangible personal property; conducts feasibility studies; and prepares maintenance of property records for industrial and commercial owners.

Investment Tax Credit Cost Analyst – Involves a detailed, in-depth analysis of construction drawings and specifications of large, multimillion dollar structures that would qualify for investment tax credit. Also segregates costs into components for depreciation purposes.

Construction Engineer – Manages the construction of a building project or within a specialized area (e.g., electrical, HVAC, plumbing, fire protection). Responsibilities include the scheduling of labor trades, material and equipment for the most economical and expeditious mode of constructing the building. Employed by general electrical or building environmental contractors.

Plant/Facilities Engineer – The owner's management liaison person interacting with architects, contractors and engineers in the design and construction of remodeling projects, additions and new facilities. Manages and develops such programs within the plant as energy conservation and preventative maintenance. Usually involved with fiscal budgeting, scheduling and prioritizing the facilities construction projects.

Sales/Applications Engineer – Provides technical advice and application of products to the building industry's architects, engineers and constructors. Suppliers and manufacturers of the product depend on the applications engineer to understand and communicate technical product information to the above diversified customer base.

Architect – Designs the building for the user, providing spatial and aesthetic requirements. Designs in concert with the structural, electrical and environmental engineers and the constructor to develop the most functional, economical and aesthetic buildings coordinated to the site for the owner. Graduates interested in becoming architects are encouraged to pursue a Master of Science in Architecture degree in addition to the Bachelor of Science in Architectural Engineering degree.

Bachelor of Science
Architectural Engineering
For All Design Specialties
Model Full-Time Track – V5.1

		QUARTER		
FRESHMAN YEAR		**1**	**2**	**3**
AE-100	Introduction to Architectural Engineering and Construction Management	2-2-3		
AE-1311	Introduction to CAD	1-1-1		
MS-183	Introduction to Computer Methods and Applications	2-0-2		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MA-136	Calculus I	4-0-4		
AE-130	Architectural Engineering Graphics		2-2-3	
MA-137	Calculus for Engineers II		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
	Elective (HU/SS)[1]		3-0-3	
AE-1231	Building Construction Materials			3-2-4
EN-241	Speech			2-2-3
MA-231	Calculus for Engineers III			4-0-4
PH-110	Physics of Mechanics			3-2-4
	TOTALS	**15-3-16**	**15-4-17**	**12-6-15**
SOPHOMORE YEAR		**4**	**5**	**6**
AE-200	Statics	4-0-4		
AE-2211	Building Construction Methods	3-2-4		
MA-235	Differential Equations for Engineers	4-0-4		
CH-201	Chemistry II	3-2-4		
GE-205	Professional Growth	1-0-0		
AE-201	Strength of Materials		4-0-4	
AE-2121	Fundamentals of Thermodynamics		4-0-4	
PH-230	Physics of Electricity and Magnetism		3-3-4	
MA-232	Calculus for Engineers IV		3-0-3	
AE-225	Specifications and Contracts		3-0-3	
EE-201	Linear Networks: Steady State Analysis			4-0-4
AE-213	Introduction to Fluid Mechanics			4-0-4
CM-224	Construction Estimating I			3-0-3
PH-220	Physics of Heat, Wave Motion and Optics			3-3-4
MA-262	Probability and Statistics			3-0-3
	TOTALS	**15-4-16**	**17-3-18**	**17-3-18**

[1] There are 12 credits of humanities and social science (HU/SS) electives, 6 of which must be in the humanities area (HU) and 6 must be in the social sciences area (SS).

JUNIOR YEAR		7	8	9
AE-3011	Principles of Structural Analysis	3-0-3		
AE-3111	Principles of Environmental Systems Design	3-0-3		
AE-3611	Principles of Electrical Systems Design	3-0-3		
CM-3011	AE/CM Project Management	3-0-3		
GE-305	Professional Growth	1-0-0		
SS-461	Organizational Psychology	3-0-3		
AE-3021	Principles of Structural Steel and Concrete Design		4-0-4	
AE-3121	Principles of Fire Protection and Plumbing Design		4-0-4	
AE-3621	Basic Principles of Illumination and Communications		4-0-4	
	Design Specialty[2]			
	BSS: AE-3023		3-2-4	
	BES: AE-3131		3-2-4	
	BEPS: AE-3631		3-2-4	
AE-3321	Architectural History			3-0-3
AE-3431	Construction Finance and Economics			3-0-3
	Elective (Science) [4]			3-0-3
	Design Specialty[2]			
	BSS: AE-303 and AE-304			7-2-8
	BES: AE-3132 and AE-3141			6-4-8
	BEPS: AE-3651 and AE-3641			7-2-8
	TOTALS			
	BEPS and BSS:	**16-0-15**	**15-2-16**	**16-2-17**
	BES:	**16-0-15**	**15-2-16**	**15-4-17**

SENIOR YEAR		10	11	12
AE-4311	Architectural Design	2-2-3		
AE-4711	Architectural Engineering Design-Build Senior Project I	1-1-1		
AE-4411	Engineering Economics and Building Investment Economics	3-0-3		
EN-441	Professional Presentation Techniques	2-2-3		
GE-405	Professional Growth	1-0-0		
	Elective (HU/SS)[1]	3-0-3		
	Design Specialty[2]			
	BSS: AE-401	3-2-4		
	BES: AE-411	3-2-4		
	BEPS: AE-463	3-2-4		
AE-4721	Architectural Engineering Design-Build Senior Project II		1-3-3	
CM-3021	Business and Construction Law		4-0-4	
AE-4121	Environmental Science in Building Construction		3-0-3	
	Elective (HU/SS)[1]		3-0-3	
	Design Specialty[2]			
	BSS: AE-407		3-0-3	
	BES: AE-412		3-0-3	
	BEPS: AE-466		3-0-3	
AE-4733	Architectural Engineering Senior Project Working Drawings			2-2-3
AE-4731	Architectural Engineering Design-Build Senior Project III			1-3-4
HU-432	Ethics for Professional Managers and Engineers			3-0-3
	Elective (HU/SS)[1]			3-0-3
	Elective (Free)[3]			3-0-3
	TOTALS	**15-7-17**	**14-3-16**	**12-5-16**

[1] There are 12 credits of humanities and social science (HU/SS) electives, 6 must be in humanities (HU) and 6 must be in social sciences (SS).
[2] All students must choose one of the three specialty sequences of classes beginning in the Winter Quarter of the junior year.
[3] These 3 credits may be taken from any field.
[4] These 3 credits must be taken from the science area.

Students in the Air Force ROTC program can make the following substitutions: AF-300 for General Elective, AF-301 for EN-441, AF-401 for SS-455 (an SS elective).

Accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700).

Architectural Engineering Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
Building Electrical Systems Design Specialty				
AE-3631	Building Electrical Power Distribution I	3	2	4
AE-3641	Building Electrical Power Distribution II	3	2	4
AE-3651	Building Illumination and Communications Design	4	0	4
AE-463	Electrical Power Quality for Buildings	3	2	4
AE-466	Project Management for Electrical Engineers	3	0	3
Building Environmental Systems Design Specialty				
AE-3131	Building Environmental Systems I	3	2	4
AE-3132	Building Environmental Systems II	3	2	4
AE-3141	Plumbing and Fire Suppression Systems Design	3	2	4
AE-411	Building Systems Controls	3	2	4
AE-412	Energy Management Techniques	3	0	3
Building Structural Systems Design Specialty				
AE-3023	Advanced Structural Analysis	3	2	4
AE-303	Soil Mechanics and Foundations	4	0	4
AE-304	Advanced Steel Design	3	2	4
AE-401	Advanced Concrete Design	3	2	4
AE-407	Wood and Masonry Design	3	0	3
Technical Electives				
AE-417	Advanced Plumbing Systems Design	3	0	3
AE-461	Advanced CAD with Architectural Engineering Applications	2	2	3
AE-490	Independent Study	3	0	3

Bachelor of Science
Construction Management

Program Director:
Dr. Randy Rapp, PE, CCE, CPC, AIC
Office: CC-61C
Phone: (414) 277-7595
Fax: (414) 277-7415
E-mail: rapp@msoe.edu

The degree is for students who wish to become nonresidential building construction project professionals. The rigorous program melds instruction about business administration, basic scientific and engineering principles, and construction science and project management techniques to graduate professionals who are savvy about current industry practices and educated for a lifetime of learning in this challenging and rewarding career.

There will always be a demand for constructors as the infrastructure changes with its ongoing need to repair, maintain, rehabilitate and build commercial, institutional and industrial buildings.

> *"Employment of construction contractors and managers is expected to increase faster than the average for all occupations through the year 2005 as the number of construction projects continues to grow. Prospects are expected to be particularly favorable for experienced managers with a Bachelor of Science degree in Construction Science with an emphasis on construction management."*
>
> – U.S. Department of Labor, Bureau of Labor Standards, Bulletin 2400.

Technical ability – comprehending and adapting to increasing scientific and engineering complexity in construction projects and in the workplace as a whole.

Managerial knowledge – making, directing and implementing good decisions by knowing the characteristics and capabilities of the people and things that must be applied and coordinated to accomplish work efficiently.

Leadership skills – understanding human motivations and organizational needs, especially at the project level. to effectively accomplish work even without formal authority.

Professional ethics – internalizing necessary values to routinely behave as a reputable construction industry professional.

Mission

The mission of the bachelor's degree in construction management program is to provide a learning environment that incorporates the needs of industry while developing a well-rounded construction management professional. This program is designed to:

- meet the needs of construction industry personnel in diverse positions
- meet the criteria set forth by the American Council for Construction Education (ACCE, 1300 Hudson Lane, Suite #3, Monroe, LA 71201-6054; telephone: (318) 323-2816), the accrediting agency for construction
- complement MSOE's B.S. in architectural engineering program
- encourage the construction and construction-related industries to increase their professional development through programs, seminars, research and other related educational resources

Program Goals

Students graduating from the MSOE construction management program will be prepared to begin a career in the building and construction industry or to continue directly on to graduate school. Program graduates will:

- be proficient in the construction estimating process, including schematic and detail estimating, quantity take-off and qualification
- have an understanding of bidding requirements and procedures, and computer estimating
- be proficient in construction scheduling and cost control, and have an understanding of various scheduling methods and applications, including computer scheduling, cost loading and analysis
- have an understanding of construction project management and administration, various contractual relationships, project delivery methods and responsibility requirements
- understand business principles
- be able to function on multi-disciplinary teams
- have the ability to apply knowledge of mathematics and science
- have a basic understanding of the engineering and design process
- be able to communicate effectively
- understand professional and ethical responsibilities
- be knowledgeable of contemporary issues
- have an understanding of construction tools, methods and materials

Some Common Positions

Construction Project Manager – The construction project manager (PM) has overall responsibility and authority to direct and coordinate actions that deliver the project to the client on time, under budget, and with required safety and quality. The PM might be associated with the project as soon as the client conceives the project and until the building is turned over to the owner for its intended use. Construction PMs can be likened to entrepreneurs with full accountability for all project activities.

Construction Cost Estimator – An estimator applies knowledge of construction materials and processes and their costs to forecast the funds required to erect a building. Estimators mentally picture the work and interact with other members of the project team to determine probable costs. Estimates are required at various stages of building design – from early conceptual estimates to help the owner determine if the project is affordable, to detailed cost estimates for competitive bids after the project is designed.

Construction Scheduler – A scheduler typically works on larger projects, applying knowledge of construction methods and processes to help plan project activity sequences and to efficiently schedule the work, in order to meet required project completion deadlines. Completing a project timely is the single most important factor for its success, and the scheduler ensures that members of the project team have the information they require to make this happen.

Construction Information Systems Manager – a construction information systems manager links advanced hardware and software technologies with construction project actions and processes to keep their companies viable. To remain competitive, modern construction firms must leverage the productivity and decision-making benefits of information automation. Information systems are indispensable for efficient knowledge management,an essential function for any construction industry company that seeks a sustainable competitive advantage. Mastering the latest technical and construction project management skills, graduates of the five-year dual-degree CMIS option deliver exceptional value to construction industry firms at the technological frontier.

Construction Superintendent – The construction superintendent is the contractor's representative at the construction site. The superintendent directs and coordinates the site activities which include the building trades. Responsibilities include ensuring that the work progresses according to the schedule and construction documents, material and equipment are delivered to the site on time and the various trade activities are not in conflict with one another.

Construction Business Administrator – The construction administrator is responsible for the coordination of a firm's project managers, general scheduling and overall general business practices. This person is involved with purchase orders, contracts, change orders, billings and proper notifications required in the construction industry.

Project Inspector – The inspector can be employed in either the private or public sector. In the private sector, the inspector could be employed by a lending institution performing on-site inspections to verify compliance with the plans and specifications for a structure. An inspector in the public sector would work for local, state or federal entities to make sure a structure is being constructed according to the appropriate building codes and ordinances.

Construction Sales – The salesperson is the representative for the company manufacturing the construction products or system equipment. The person's responsibility is to understand the product and its application to the construction industry. The person is involved with client contact, application and estimates.

Facilities Manager – One of the many responsibilities of a facilities manager is being the owner's representative in the building construction process. This responsibility may include formulating the building program's initial budget, seeking design construction services, monitoring the construction process and overseeing approval of all billings.

Plan Examiner – The state and/or municipality requires each building design to comply with local, state and federal code issues. The plan examiner must understand building design, construction methodology and code requirements to approve the design for construction. This ensures the safety of the building occupants and structural worthiness of the building environment.

The popular five-year AE/CM option practically provides knowledge and skills equivalent to those held by graduates of baccalaureate architectural engineering programs who later earn a master's degree in construction project management. These graduates fully understand the technical and managerial details of both design and construction – a noteworthy capability, since design-build is an expanding construction contracting alternative. Although CM graduates typically seek to be Certified Professional Constructors, the AE degree enables AE/CMs to also earn a Professional Engineer license. This may offer particularly great occupational flexibility for graduates, as well as exceptional value to their employers.

Bachelor of Science
Construction Management
Model Full-Time Track – V4.1

		QUARTER		
FRESHMAN YEAR		**1**	**2**	**3**
AE-100	Introduction to Architectural Engineering and Construction Management	2-2-3		
AE-1311	Introduction to CAD	1-1-1		
MS-183	Introduction to Computer Methods and Applications	2-0-2		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MA-136	Calculus for Engineers I	4-0-4		
AE-130	Architectural Engineering Graphics		2-2-3	
MA-137	Calculus for Engineers II		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
	Elective[1] (HU/SS)		3-0-3	
AE-1231	Building Construction Materials			3-2-4
MA-231	Calculus for Engineers III			4-0-4
PH-110	Physics of Mechanics			3-2-4
EN-241	Speech			2-2-3
	TOTALS	**15-3-16**	**15-4-17**	**12-6-15**
SOPHOMORE YEAR		**4**	**5**	**6**
AE-200	Statics	4-0-4		
AE-2211	Building Construction Methods	3-2-4		
CM-212	Surveying	2-3-3		
MS-221	Microeconomics	3-0-3		
GE-205	Professional Growth	1-0-0		
	Elective[1] (HU/SS)	3-0-3		
AE-201	Strength of Materials		4-0-4	
AE-2121	Fundamentals of Thermodynamics		4-0-4	
AE-225	Specifications & Contracts		3-0-3	
MS-342	Management Principles		3-0-3	
	Elective[1] (HU/SS)		3-0-3	
CM-224	Construction Estimating I			3-0-3
EE-201	Linear Networks: Steady State Analysis			4-0-4
AE-213	Fluid Mechanics			4-0-4
MA-262	Probability and Statistics			3-0-3
MS-322	Macroeconomics			3-0-3
	TOTALS	**16-5-17**	**17-0-17**	**17-0-17**

[1] There are 15 credits of humanities and social science (HU/SS) electives, of which 6 must be in the humanities area (HU) and 6 must be in the social sciences area (SS).

JUNIOR YEAR		7	8	9
AE-3611	Principles of Electrical Systems Design	3-0-3		
AE-3111	Principles of Environmental Systems Design	3-0-3		
CM-3011	AE/CM Project Management	3-0-3		
CM-3411	Construction Equipment & Safety Management for Construction Management	3-0-3		
MS-354	Principles of Accounting	3-0-3		
GE-305	Professional Growth	1-0-0		
SS-461	Organizational Psychology	3-0-3		
CM-311	Construction Issues		2-2-3	
CM-3021	Business and Construction Law		4-0-4	
AE-3021	Principles of Structural Steel & Concrete Design		4-0-4	
CM-325	Construction Estimating II		3-2-4	
MS-358	Managerial Accounting I		3-0-3	
CM-318	Building Environmental and Mechanical Systems for Construction Management			3-2-4
AE-3321	Architectural History			3-0-3
CM-321	Construction Scheduling			2-2-3
CM-316	Building Electrical and Communication Systems for Construction Management			3-2-4
CM-3013	Construction Project Finance and Cost Control			3-0-3
	TOTALS	**19-0-18**	**17-4-18**	**14-6-17**

SENIOR YEAR		10	11	12
AE-4311	Architectural Design	2-2-3		
AE-4411	Engineering Economy and Building Investment Economics	3-0-3		
EN-441	Professional Presentation Techniques	2-2-3		
CM-4311	Construction Project Management I	3-2-4		
GE-405	Professional Growth	1-0-0		
CM-4711	Construction Management Design-Build Senior Project I	1-1-1		
CM-4321	Construction Project Management II		2-2-3	
CM-4721	Construction Management Design-Build Senior Project II		1-3-3	
AE-4121	Environmental Science in Building Construction		3-0-3	
MS-327	International Business		3-0-3	
	Elective[1] (HU/SS)		3-0-3	
CM-4731	Construction Management Design-Build Senior Project III			1-3-4
HU-432	Ethics for Professional Managers & Engineers			3-0-3
	Elective[1] (HU/SS)			3-0-3
	Elective[2] (Free)			3-0-3
	TOTALS	**12-7-14**	**12-5-15**	**10-3-13**

[1] There are 15 credits of humanities and social science (HU/SS) electives, of which 6 must be in the humanities area (HU) and 6 must be in the social sciences area (SS).
[2] These 3 credits may be taken in any area.

Students are required to take the AIC/CPC Level 1 Certified Professional Constructor Exam in the senior year. This exam is administered in the fall and spring of each year.

Accredited by the American Council for Construction Education (ACCE, 1300 Hudson Lane, Suite 3, Monroe, LA 71201-6054; telephone: (318) 323-2816).

Bachelor of Science
Architectural Engineering and Construction Management
Five-Year Two-Degree
For All Design Specialties
Model Full-Time Track – V3.1

FIRST YEAR		----------QUARTER---------- 1	2	3
AE-100	Introduction to Architectural Engineering and Construction Management	2-2-3		
AE-1311	Introduction to CAD	1-1-1		
MS-183	Introduction to Computer Methods and Applications	2-0-2		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MA-136	Calculus I	4-0-4		
AE-130	Architectural Engineering Graphics		2-2-3	
MA-137	Calculus for Engineers II		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
	Elective[1] (HU/SS)		3-0-3	
AE-1231	Building Construction Materials			3-2-4
EN-241	Speech			2-2-3
MA-231	Calculus for Engineers III			4-0-4
PH-110	Physics of Mechanics			3-2-4
	TOTALS	**15-3-16**	**15-4-17**	**12-6-15**

SECOND YEAR		4	5	6
AE-200	Statics	4-0-4		
AE-2211	Building Construction Methods	3-2-4		
MA-235	Differential Equations for Engineers	4-0-4		
CH-201	Chemistry II	3-2-4		
GE-205	Professional Growth	1-0-0		
AE-201	Strength of Materials		4-0-4	
AE-2121	Fundamentals of Thermodynamics		4-0-4	
PH-230	Physics of Electricity and Magnetism		3-3-4	
MA-232	Calculus for Engineers IV		3-0-3	
AE-225	Specifications and Contracts		3-0-3	
EE-201	Linear Networks: Steady State Analysis			4-0-4
AE-213	Introduction to Fluid Mechanics			4-0-4
CM-224	Construction Estimating			3-0-3
PH-220	Physics of Heat, Wave Motion and Optics			3-3-4
MA-262	Probability & Statistics			3-0-3
	TOTALS	**15-4-16**	**17-3-18**	**17-3-18**

[1] There are 12 credits of humanities and social science (HU/SS) electives, 6 of which must be in the humanities area (HU) and 6 must be in the social sciences area (SS).

THIRD YEAR		7	8	9
MS-221	Microeconomics	3-0-3		
AE-3011	Principles of Structural Analysis	3-0-3		
AE-3111	Principles of Environmental Systems Design	3-0-3		
AE-3611	Principles of Electrical Systems Design	3-0-3		
CM-3011	AE/CM Project Management	3-0-3		
GE-305	Professional Growth	1-0-0		
	Elective[1] (HU/SS)	3-0-3		
AE-3021	Principles of Structural Steel and Concrete Design		4-0-4	
AE-3121	Principles of Fire Protection and Plumbing Design		4-0-4	
AE-3621	Basic Principles of Illumination and Communications		4-0-4	
MS-322	Macroeconomics		3-0-3	
	Design Specialty2			
	BSS: AE-3023		3-2-4	
	BES: AE-3131		3-2-4	
	BEPS: AE-3631		3-2-4	
MS-354	Principles of Accounting			3-0-3
CM-316	Building Electrical and Communication Systems for Construction Management			3-2-4
AE-3321	Architectural History			3-0-3
	Design Specialty[2]			
	BSS: AE-303 & AE-304			7-2-8
	BES: AE-3132 & AE-3141			6-4-8
	BEPS: AE-3641 & AE-3651			7-2-8
	TOTALS BEPS & BSS	**19-0-18**	**19-2-19**	**16-4-18**
	BES	**19-0-18**	**19-2-19**	**15-6-18**

FOURTH YEAR		10	11	12
AE-4311	Architectural Design	2-2-3		
AE-4711	Architectural Engineering Design-Build Senior Project I	1-1-1		
AE-4411	Engineering Economics and Building Investment Economics	3-0-3		
EN-441	Professional Presentation Techniques	3-0-3		
GE-405	Professional Growth	1-0-0		
	Elective[1] (HU/SS)	3-0-3		
	Design Specialty[2]			
	BSS: AE-401	3-2-4		
	BES: AE-411	3-2-4		
	BEPS: AE-463	3-2-4		
AE-4721	Architectural Engineering Design-Build Senior Project II		1-3-3	
CM-325	Construction Estimating II		4-0-4	
MS-342	Management Principles		3-0-3	
MS-358	Managerial Accounting I		3-0-3	
	Elective[1] (HU/SS)		3-0-3	
	Design Specialty			
	BSS: AE-407		3-0-3	
	BES: AE-412		3-0-3	
	BEPS: AE-466		3-0-3	
CM-318	Building Environmental & Mechanical Systems for Construction Management			4-0-4
CM-321	Construction Scheduling			3-0-3
CM-3013	Construction Project Finance and Cost Control			3-0-3
AE-4733	AE Senior Project, Working Drawings			2-2-3
AE-4731	Architectural Engineering Design-Build Senior Project III			1-3-4
	TOTALS	**16-5-17**	**17-3-19**	**13-5-17**

[1] There are 12 credits of humanities and social science (HU/SS) electives, 6 of which must be in the humanities area (HU) and 6 must be in the social sciences area (SS).

[2] All students choose one of the three specialties.

FIFTH YEAR		13	14	15
CM-3411	Construction Equipment and Safety Management for Construction Management	3-0-3		
CM-4311	Project Management I	3-2-4		
CM-212	Surveying	2-2-3		
CM-4711	Construction Management Design-Build Senior Project I	1-1-1		
SS-461	Organizational Psychology	3-0-3		
	Elective[1] (HU/SS)	3-0-3		
CM-3021	Business and Construction Law		4-0-4	
CM-311	Construction Issues		3-0-3	
CM-4321	Project Management II		2-2-3	
CM-4721	Construction Management Design-Build Senior Project II		1-3-3	
AE-4121	Environmental Science in Building Construction		3-0-3	
CM-4731	Construction Management Design-Build Senior Project III			1-3-4
HU-432	Ethics for Professional Managers & Engineers			3-0-3
MS-327	International Business			3-0-3
	Elective[4] (Science)			3-0-3
	Elective[3] (Free)			3-0-3
	TOTALS	**15-5-17**	**13-5-16**	**13-3-16**

[1] There are 15 credits of humanities and social science (HU/SS) electives, 6 of which must be in the humanities area (HU) and 6 must be in the social sciences area (SS).
[2] All students must choose one of the three specialty sequences of classes beginning in the Winter Quarter of the junior year.
[3] These 3 credits may be taken from any field.
[4] These 3 credits must be taken from the science area.

Students in the Air Force ROTC program can make the following substitutions: AF-300 for General Elective, AF-301 for EN-441, AF-302 for AE-440, AF-401 for SS-455 (an SS elective), AF-402 for MS-331.

Students are required to take the AIC/CPC Level 1 Certified Professional Constructor Exam in the senior year. This exam is administered in the fall and spring of each year.

Accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700)

Accredited by the American Council for Construction Education (ACCE, 1300 Hudson Lane, Suite 3, Monroe, LA 71201-6054; telephone: (318) 323-2816)

Rader School of Business

Main Office: 1235 North Milwaukee Street
Phone: (414) 277-7279
Fax: (414) 277-7479

Successful organizations search for business graduates that are prepared for the "information technology" era. MSOE business graduates fill this need though the unique blend of technical and business courses that are the heart of our exciting programs. Recently, programs were reorganized to best address the needs of students and industry:

Rader School of Business programs

Undergraduate programs include:
- Bachelor of Science in Business
- Bachelor of Science in International Business
- Bachelor of Science in Management
- Bachelor of Science in Management Information Systems

Undergraduate degree concentrations are offered in:
- Business Administration
- Information Systems
- Financial Management
- Operations Management
- Marketing Management
- Computer Systems Infrastructure
- Software Application Support and Development

Graduate programs include:
- Master of Science in Engineering Management
- Master of Science in Medical Informatics (offered jointly with the Medical College of Wisconsin)

Certification and Professional Programs include:
- Microsoft Certified Systems Engineer (MCSE) certification
- Novell - Novell Education Academic Partner (NEAP)
- A+ Computer Certificate
- C++ Certificate
- Project Management Certificate
- Lean Manufacturing Certificate
- Java Server Pages Certificate
- Web Site Design Certificate

The faculty of the Rader School of Business is committed to the basic educational philosophy that includes an applications-oriented approach in all classes and laboratories, development of a strong foundation of business skills and knowledge for all students, and the integration of and exposure to the latest technologies and business practices in all of its programs. MSOE business programs are distinguishable from traditional business administration degrees in that MSOE students become well-versed in the technology that drives businesses. The Rader School of Business views technology as machines, systems and approaches that extend human capacity and performance.

Vision

Establish the Rader School of Business as the preferred path for building and enhancing business careers that are based on both technical expertise and practical business knowledge. Superior job placement, alumni satisfaction and accomplished faculty and staff evidence success.

Mission

The Rader School of Business will continually strive to provide a business education in areas that emphasize the understanding and application of current technology and the business practices essential for success in the 21st century.

MSOE's Rader School of Business has offered courses in business and management since the mid-1950s. Today, the Rader School of Business serves nearly 300 undergraduate, more than 200 graduate, and more than 200 certificate students each year.

Faculty:

Chairman:

Joseph R. Papp

Department Secretary:

Kimberly Popp Benson

Professors:

Kenneth K. Dawson, Dr. George P. Lephardt, Joseph R. Papp, Dr. Douglas L. Reed, Larry J. Schmedeman, Dr. Bruce R. Thompson

Associate Professors:

Dr. Steven C. Bialek, Dr. Jeffrey Blessing, Dr. Paul A. Hudec, Carol S. Mannino, David Tietyen

Assistant Professor:

Dr. John Traxler

Instructor:

Mary Jo Suminski

Adjunct Professor:

Dr. Dennis L. Wanless

Adjunct Associate Professors:

Robert Hankes, Thomas J. Jerger, Jerry Lieberthal, Michael J. Talbot Sr.

Adjunct Assistant Professors:

Charles Birringer, Brian Bogan, Bruce Buerger Jr., James Eggers, John D. Geder, Sue Hoerchner, Clint Houchens, Clement F. Hying, Julie A. Kriewaldt, Kenneth F. Mannino, Thomas R. Repko Jr., Dr. Jeffrey Santaga, Dr. Timothy Schoewe, Mark Treager

Lecturers:

Michael Ariens, Dr. Richard W. Chiapete, Wendy Jensen, Scott Jonk, Danny Lane, Dr. Joseph Militello, Tyler Moore, Thomas Sipla, Walter Swiger

Professor Emeritus:

Thomas D. Pease

Bachelor of Science
Business

Program Director:
Dr. Steven C. Bialek
Office: B-307
Phone: (414) 277-7364
Fax: (414) 277-7479
E-mail: bialek@msoe.edu

The Bachelor of Science in Business (BSB) program provides students with the general business preparation to lead and manage organizations, processes and people. The program was introduced in fall 2000 as a spin off of the long established Bachelor of Science in Business and Computer Systems (B&CS). Prior to the BSB introduction, students in the B&CS program were able to choose a concentration area of study in marketing, financial or manufacturing management, computer systems or networking. The three former concentrations were used as a foundation to build the BSB.

The BSB provides the opportunity for students to concentrate their studies by selecting course work in one of the following areas:

Business Administration – broad-based business focus with study in accounting and finance, operations management, human resources and marketing

Financial Management – traditional practice and computer applications in the areas of accounting, finance, budgeting and costing

Operations Management – supply chain, quantitative, advanced operations, project management, and quality and operation simulations

Marketing Management – technical selling, promotional strategies, e-business marketing and business-to-business marketing

Program Goals

The goal of the program is to produce graduates who are prepared to excel in:

positions of responsibility and leadership in business organizations;

application of interpersonal skills with particular appreciation for cultural diversity; and

lifelong learning that enables them to continually improve business processes and practices.

Through an integrated array of courses and application of skills, graduates of the program:

have and maintain skills to effectively apply technological tools to business practices including accounting, finance, marketing and operations management;

understand and can apply the methodology and tools of quantitative analysis, and the systems approach to the application of knowledge and decision making;

possess the business management skills to improve productivity, enhance the quality of work life, and advance an organization's products, services and information;

are adept at business planning, plan implementation and change management;

have a solid grounding in humanistic studies, and are competent and effective communicators; and

understand the importance of integrity, professional responsibility, and the societal and global impact of their profession.

Bachelor of Science
Business
Model Full-Time Track – V2.0

FRESHMAN YEAR		QUARTER 1	QUARTER 2	QUARTER 3
MS-184	Introduction to Computer Methods and Applications	3-0-3		
MS-280	Introduction to Management Information Systems	3-0-3		
EN-131	Composition	3-0-3		
MA-126	Trigonometry	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
	Science Elective[2]	3-2-4		
MS-221	Microeconomics		3-0-3	
HU-100	Contemporary Issues		3-0-3	
EN-132	Technical Composition		3-0-3	
MA-127	College Algebra II		4-0-4	
	Science Elective[2]		3-2-4	
MS-322	Macroeconomics			3-0-3
EN-241	Speech			2-2-3
MS-273	Web Site Design Basics			3-0-3
MA-129	Introduction to Differential and Integral Calculus			4-0-4
SS-460	Foundations of Psychology			3-0-3
	TOTALS	**17-2-17**	**16-2-17**	**15-2-16**

SOPHOMORE YEAR		4	5	6
MS-382	Introduction to JAVA	3-0-3		
TC-453	Intercultural Communications	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-361	Marketing	3-0-3		
	Social Science Elective (SS)[3]	3-0-3		
TC-351	Organizational Communication		3-0-3	
MS-356	Business Finance		3-0-3	
	Elective (Concentration)[5]		3-0-3	
MA-340	Business Statistics		4-0-4	
	Social Science Elective (SS)[3]		3-0-3	
MS-331	Business Law			3-0-3
MS-342	Management Principles			3-0-3
MS-358	Managerial Accounting			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
	Humanities Elective (HU)[4]			3-0-3
	TOTALS	**15-0-15**	**16-0-16**	**14-2-15**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation. Students following the Model Full-time Track may be required to take classes during the evening or occasionally on weekends.

[2] Students must complete a minimum of 8 natural science credits. The specific course selection MUST be approved by the curriculum adviser. At least one course chosen must have a lab.

[3] BSB students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

[4] BSB students must complete at least 12 credits of humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in the HU-420, HU-430, HU-440, or HU-480 series. Electives are chosen in consultation with an adviser.

[5] BSB students must complete at least 10 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

JUNIOR YEAR		----------QUARTER---------- 7	8	9
	Humanities Elective (HU)[4]	3-0-3		
MS-4599	Managerial Finance	3-0-3		
EN-432	Business Communication	3-0-3		
SS-453	American Government	3-0-3		
	Elective (Concentration)[5]	3-0-3		
EN-342	Group Discussion		3-0-3	
MS-340	Operations Management		3-0-3	
MS-444	Business and Government Relations		3-0-3	
SS-461	Organizational Psychology		3-0-3	
MS-363	E-business Marketing Strategies		3-0-3	
	Elective (Concentration)[5]		3-0-3	
MS-441	Supervision			3-0-3
MS-393	Quantitative Management			3-0-3
MS-498	Business Internship6			1-3-3
TC-452	Interpersonal Communications			3-0-3
	Elective (Concentration)[5]			3-0-3
	Humanities Elective (HU)[4]			3-0-3
	TOTALS	**15-0-15**	**18-0-18**	**16-3-18**

SENIOR YEAR		10	11	12
MS-344	Organizational Behavior and Leadership	3-0-3		
MS-483	Database Development and Management	2-2-3		
OR-402	Professional Guidance	1-0-1		
HU-432	Ethics for Professional Managers	3-0-3		
	Elective (Concentration)[5]	3-0-3		
	Elective (Concentration)[5]	3-0-3		
MS-448	Employment Law		3-0-3	
MS-4801	Project Management		3-0-3	
	Elective (Concentration)[5]		3-0-3	
	Elective (Concentration)[5]		3-0-3	
	Humanities Elective (HU)[4]		3-0-3	
MS-446	General Management Policies			3-0-3
MS-449	Human Resource Management			3-0-3
	Elective (Concentration)[5]			3-0-3
	Elective (Concentration)[5]			3-0-3
	Social Science Elective (SS)[3]			3-0-3
	TOTALS	**15-2-16**	**15-0-15**	**15-0-15**

[3] BSB students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

[4] BSB students must complete at least 12 credits of humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in the HU-420, HU-430, HU-440, or HU-480 series. Electives are chosen in consultation with an adviser.

[5] BSB students must complete at least 10 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

[6] Business Internship is not required for students who can show evidence of an internship experience appropriate to their professional development related to the BSB program. One MS elective will be substituted with consent of adviser.

Bachelor of Science
Business
Model Part-Time Track – V2.0

FRESHMAN AND SOPHOMORE YEARS		QUARTER Fall	QUARTER Winter	QUARTER Spring
MS-184	Introduction to Computer Methods and Applications	3-0-3		
MA-126	Trigonometry	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
MS-280	Introduction to Management Information Systems		3-0-3	
MA-127	College Algebra II		4-0-4	
MS-221	Microeconomics			3-0-3
MA-129	Introduction to Differential and Integral Calculus			4-0-4
MS-322	Macroeconomics	3-0-3		
	Science Elective[2]	3-2-4		
EN-131	Composition		3-0-3	
	Science Elective[2]		3-2-4	
EN-132	Technical Composition			3-0-3
MS-273	Web Site Design Basics			3-0-3
EN-241	Speech	2-2-3		
MS-354	Principles of Accounting	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MS-382	Introduction to JAVA		3-0-3	
MS-356	Business Finance		3-0-3	
SS-460	Foundations of Psychology			3-0-3
MS-358	Managerial Accounting			3-0-3
TC-453	Intercultural Communications	3-0-3		
MS-4599	Managerial Finance	3-0-3		
	Social Science Elective (SS)[3]	3-0-3		
TC-351	Organizational Communication		3-0-3	
	Social Science Elective (SS)[3]		3-0-3	
MA-340	Business Statistics			4-0-4
MS-361	Marketing			3-0-3
MS-342	Management Principles	3-0-3		
	Humanities Elective (HU)[4]	3-0-3		
	Elective (Concentration)[5]		3-0-3	
MS-331	Business Law		3-0-3	
TC-342	Professional Presentation Techniques			2-2-3
	Elective (Concentration)[5]			3-0-3
	TOTALS	**37-4-38**	**31-2-32**	**31-2-32**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation. Students following the Model Part-time Track can expect that classes will be offered during the evening, or occasionally on weekends. Full-time study may not be possible every quarter if students intend to register exclusively for evening or weekend classes.

[2] Students must complete a minimum of 8 natural science credits. The specific course selection MUST be approved by the curriculum adviser. At least one course chosen must have a lab.

[3] BSB students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

[4] BSB students must complete at least 12 credits of humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in the HU-420, HU-430, HU-440, or HU-480 series. Electives are chosen in consultation with an adviser.

[5] BSB students must complete at least 10 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

JUNIOR AND SENIOR YEARS		----------QUARTER---------- Fall	Winter	Spring
	Humanities Elective (HU)[4]	3-0-3		
SS-461	Organizational Psychology	3-0-3		
MS-363	E-business Marketing Strategies		3-0-3	
MS-340	Operations Management		3-0-3	
MS-441	Supervision			3-0-3
MS-393	Quantitative Management			3-0-3
MS-344	Organizational Behavior and Leadership	3-0-3		
SS-453	American Government	3-0-3		
EN-342	Group Discussion		3-0-3	
MS-4801	Project Management		3-0-3	
TC-452	Interpersonal Communications			3-0-3
	Elective (Concentration)[5]			3-0-3
MS-483	Database Development and Management	2-2-3		
OR-402	Professional Guidance	1-0-1		
HU-432	Ethics for Professional Managers	3-0-3		
MS-448	Employment Law		3-0-3	
	Elective (Concentration)[5]		3-0-3	
MS-449	Human Resource Management			3-0-3
	Humanities Elective (HU)[4]			3-0-3
MS-498	Business Internship[6]	1-3-3		
	Humanities Elective (HU)[4]	3-0-3		
EN-432	Business Communication		3-0-3	
MS-444	Business and Government Relations		3-0-3	
MS-446	General Management Policies			3-0-3
	Social Science Elective (SS)[3]			3-0-3
	Elective (Concentration)[5]	3-0-3		
	Humanities Elective (HU)[4]	3-0-3		
	Elective (Concentration)[5]		3-0-3	
	Elective (Concentration)[5]		3-0-3	
	Elective (Concentration)[5]			3-0-3
	Elective (Concentration)[5]			3-0-3
	TOTALS	**28-5-31**	**30-0-30**	**30-0-30**

[3] BSB students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

[4] BSB students must complete at least 12 credits of humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in the HU-420, HU-430, HU-440, or HU-480 series. Electives are chosen in consultation with an adviser.

[5] BSB students must complete at least 10 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

[6] Business Internship is not required for students who can show evidence of an internship experience appropriate to their professional development related to the BSB program. One MS elective will be substituted with consent of adviser.

Bachelor of Science in Business Concentration Electives

Students in the BSB program are required to choose a concentration from one of the four areas of study listed below. Courses designated within the concentration must be completed as part of the BSB requirements. Alternatives to the designated courses below are considered on a case-by-case basis under extraordinary circumstances. Students should consult with their faculty adviser.

A. Business Administration

MS Electives (choose two courses from Marketing Management Concentration)
MS Electives (choose two courses from Operations Management Concentration)
MS Electives (choose two courses from Financial Management Concentration)
Elective (choose four 300-400 level courses from any field in consultation with adviser)

B. Financial Management

MS-450 Management Control Systems
MS-451 Personal Tax
MS-452 Investment and Portfolio Analysis
MS-4544 Financial Management Policies
MS-457 Financial Intermediaries
MS-459 Intermediate Accounting
Elective (choose four 300-400 level courses from any field in consultation with adviser)

D. Marketing Management

MS-363 eBusiness Marketing Strategies
MS-365 Business-to-Business Marketing
MS-462 Technical Selling
MS-467 Marketing Research
MS-468 Advertising and Promotion
MS-469 Advanced Marketing Strategies (Simulation)
Elective (choose four 300-400 level courses from any field in consultation with adviser)

E. Operations Management

MS-3405 Advanced Operations Management
MS-3991 Supply Chain Management
MS-3992 Operations Management Simulation
MS-441 Supervision
MS-443 Labor Relations
MS-450 Management Control Systems
MS-3991 Supply Chain Management
Elective (choose four 300-400 level courses from any field in consultation with adviser)

Bachelor of Science
International Business

Program Director:
Professor Larry J. Schmedeman
Office: B-311
Phone: (414) 277-7359
Fax: (414) 277-7479
E-mail: schmedem@msoe.edu

Why Study International Business?

Instead of viewing the world in terms of separate national markets, business has become an endeavor without national boundaries. Changes in technology coupled with the desire by firms to enter foreign markets or seek foreign suppliers creates an inevitable link to the development of new business skills, and the need for business leaders with international experience.

The Bachelor of Science in International Business program is a four-year program of study built on the rich tradition of MSOE's application-oriented philosophy and use of technology in its programs. It's necessitated by the need to respond to the future competitive challenges of business and the expectation that business leaders today should have a global perspective, work experience abroad, some foreign language fluency, and an understanding of challenges that go beyond doing business in only one market.

The program provides a strong foundation for students in business and management, and the availability of a large number of elective courses that allow for professional development in one of the following concentrations:

- Computer Systems and Networking
- Enterprise Systems Development
- Marketing and E-business
- Operations and Logistics

A cornerstone of the international business program is the required one-year study abroad during the junior year. MSOE has an exchange agreement with the Lübeck University of Applied Sciences, Lübeck, Germany, where students from Lübeck and MSOE take classes together for one year. The classes are taught in English with a year of German included in the curriculum. In addition to the formal study, students are able to travel and experience the cultural diversity and historic heritage of Europe. Courses in marketing, finance, systems analysis, logistics, Integrated Systems (SAP) and German language and history are part of the study program at Lübeck.

Upon successful completion of the junior year and completion of the senior year at MSOE, graduates are awarded two bachelor degrees: Diplom-Wirtschaftsingenieur (B.S. Engineering and Business Management) from Lübeck, and Bachelor of Science in International Business from MSOE.

Program Goals and Objectives

Body of Knowledge – Graduates should acquire business and management knowledge with an international perspective to optimize business decisions. They will:

- Have a solid foundation in economics, marketing, accounting, management sciences and finance.
- Be able to demonstrate theoretical use and practical application of business and management tools to analyze, synthesize and execute appropriate solutions to organizational problems.
- Have developed a global awareness.

Specialty Knowledge – Graduates should attain expertise in one or more specialized areas of study ranging from computer systems and networking, enterprise systems development, and marketing and e-business, to operations and logistics. They will:

- Be able to demonstrate substantial knowledge in at least one concentration offered in the international business program.
- Be able to unite theory with practice in analyzing, synthesizing and executing the appropriate technical solutions to a diverse set of problems appropriate for an entry-level professional.

Professional skills and personal development – Graduates should develop excellent communication skills, ethical values and integrity, be able to work alone and in teams, have a sensitivity to diversity, be committed to professional growth and lifelong learning, and develop a personal style of management and leadership. They will:

- Be able to critically analyze and interpret information presented in written, verbal and nonverbal forms and respond appropriately.
- Be able to demonstrate the ability to communicate skillfully in written, verbal and other forms across a diverse set of situations and cultures, professionally and personally.
- Understand the dynamic nature of our society and work environment and apply ethical and socially responsible reasoning in professional and managerial roles.
- Understand and be committed to lifelong learning, positive personal development and professional growth.
- Be able to analyze and appraise ideas from a global perspective.

Bachelor of Science
International Business
Model Full-Time Track – V2.1

FRESHMAN YEAR		QUARTER 1	QUARTER 2	QUARTER 3
MS-184	Introduction to Computer Applications	3-0-3		
MS-280	Introduction to Management Information Systems	3-0-3		
EN-131	Composition	3-0-3		
MA-126	Trigonometry	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
	Science Elective[2]	3-2-4		
MS-221	Microeconomics		3-0-3	
HU-100	Contemporary Issues		3-0-3	
EN-132	Technical Composition		3-0-3	
MA-127	College Algebra II		4-0-4	
	Science Elective[2]		3-2-4	
MS-322	Macroeconomics			3-0-3
EN-241	Speech			2-2-3
HU-494	Creative Thinking			3-0-3
MA-129	Introduction To Differential & Integral Calculus			4-0-4
	SS Elective			3-0-3
	TOTALS	**17-2-17**	**16-2-17**	**15-2-16**

SOPHOMORE YEAR		QUARTER 4	QUARTER 5	QUARTER 6
MS-354	Principles of Accounting	3-0-3		
MS-361	Marketing	3-0-3		
MS-382	Introduction to JAVA[3]	3-2-4		
TC-453	Intercultural Communications	3-0-3		
	Elective (Concentration)	3-0-3		
MS-358	Managerial Accounting I		3-0-3	
SS-455	International Relations		3-0-3	
MA-340	Business Statistics		4-0-4	
	Electives (Concentration)		6-0-6	
MS-342	Management Principles			3-0-3
MS-327	International Business			3-0-3
MS-331	Business Law			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
	Elective (Concentration)			6-0-6
	TOTALS	**15-2-16**	**16-0-16**	**17-2-18**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation.

[2] All students must take a minimum of 8 natural science credits. The curriculum adviser MUST approve the specific course selection. At least one course chosen must have a lab.

[3] MS 3811 C++ or MS-282 Cobol Programming may be substituted in quarter 4.

JUNIOR YEAR

		QUARTER 7	QUARTER 8	QUARTER 9

COURSES AT THE LÜBECK UNIVERSITY OF APPLIED SCIENCES[4]

Semester 1
Finance I
Production Management
International Business and Marketing
Systems Analysis & Design I
German History
German Language I
Professional Behavior
Concentration Elective[5]

Semester 2
Finance II
Quantitative Management
Business Project
Integrated Systems (SAP)
Contrastive German-American Culture
German Language II
Concentration/Elective[5]

SENIOR YEAR

		10	11	12
SS-461	Organizational Psychology	3-0-3		
MS-483	Database Development and Management	2-2-3		
OR-402	Professional Guidance	1-0-1		
HU-432	Ethics for Professional Managers & Engineers	3-0-3		
	Electives (Concentration)	6-0-6		
MS-393	Quantitative Techniques		3-0-3	
MS-448	Employment Law		3-0-3	
MS-4801	Project Management		3-0-3	
	Electives (Concentration)		6-0-6	
MS-446	General Management Policies			3-0-3
MS-449	Human Resource Management			3-0-3
MS-344	Organizational Behavior & Leadership			3-0-3
	Electives (Concentration)			6-0-6
	TOTALS	**15-2-16**	**15-0-15**	**15-0-15**

[4] Upon successful completion of the curriculum at the Lübeck University of Applied Sciences and graduation from MSOE, the degree Diplom-Wirtschaftsingenieur will be awarded.
[5] Electives are Material Handling Systems, Telematics, or Electronics in Transportation Systems.

Bachelor of Science
International Business
Concentrations – V2.1

There are 10 concentration electives in the IB program designed for professional development in a specialty. SEVEN must be chosen from an approved list of courses within one of the specialty areas below. The remainder must be selected from within the Rader School of Business or by consent of the program director.

Computer Systems and Networking

Select THREE foundation courses from the following:

MS-300 Principles of Operating Systems
MS-419 A+ Certification
MS-420 Microsoft Windows 2000 Professional
MS-478 Fundamentals of Wide Area Networking
MS-479 Network+ Certification
MS-485 Telecommunications

Select FOUR core courses from the following:

MS-388 Computer Systems Analysis and Design II
MS-389 Data Center Management
MS-421 Microsoft Windows 2000 Server
MS-422 Microsoft Windows 2000 Active Directory Services
MS-423 Microsoft Windows 2000 Network Infrastructure Administration
MS-424 Designing a Microsoft Windows 2000 Directory Services Infrastructure
MS-4715 Foundations of Novell Networking
MS-4733 Novell eDirectory Design & Implementation
MS-4745 Novell Network Management
MS-476 Novell Service & Support
MS-4765 Integrating NetWare and Microsoft Windows
MS-4831 Advanced Database Management

Enterprise Systems Development

Select THREE foundation courses from the following:

MS-273 Web Design
MS-275 Advanced Web Site Development
MS-478 Fundamentals of Wide Area Networking
MS-300 Principles of Operating Systems
MS-3811 C++ Programming for Business
MS-3803 Intermediate Java Programming
MS-485 Telecommunications

Select FOUR core courses from the following:

MS-277 Multimedia for Web Sites
MS-2775 Servlets for the Web
MS-2777 Web Java Server Pages
MS-371 Introduction to Unix Operating Systems
MS-373 Advanced Unix and System Administration
MS-3804 Advanced Java Programming
MS-3805 Introduction to Enterprise Java Programming
MS-3806 Intermediate Enterprise Java Programming
MS-3831 Advanced C++ Programming for Business
MS-388 Computer Systems Analysis and Design II
MS-389 Data Center Management
MS-480 XML/XSL Programming
MS-482 Introduction to ASP.NET
MS-4831 Advanced Database Management

Marketing and E-business

Select THREE foundation courses from the following:

MS-273 Web Design
MS-363 E-business Marketing Strategies
MS-365 Business-to-Business Marketing
MS-468 Advertising and Promotion Strategies
TC-242 Persuasive Speech

Select FOUR core courses from the following:

MS-275 Advanced Web Site Development
MS-277 Multimedia for Web Sites
MS-395 E-business Technologies
MS-462 Technical Selling
MS-467 Marketing Research
MS-469 Advanced Marketing Strategies
MS-4831 Advanced Database Management
TC-332 Advanced Technical Writing
TC-381 Marketing Communications

Operations and Logistics

Select THREE foundation courses from the following:

MS-3405 Advanced Operations Management
MS-3411 Leading Project Teams
MS-346 Project Management
MS-443 Labor Relations
MS-3991 Supply Chain Management

Select FOUR core courses from the following:

MS-441 Supervision
MS-4545 Finance and Accounting (within the project series)
MS-475 Activity-Based Management
IE-336 Contemporary Integrated Manufacturing
IE-348 Quality Assurance
IE-362 Ergonomics & Methods Development
IE-381 Deterministic Modeling and Optimization
IE-382 Stochastic Processes
IE-383 Simulation
IE-411 Compensation System Design
IE-449 Quality Management

Bachelor of Science Management

Program Director:
Dr. Steven C. Bialek
Office: B-307
Phone: (414) 277-7364
Fax: (414) 277-7479
E-mail: bialek@msoe.edu

For those with an associate degree or two years of college, the Bachelor of Science in Management (BSM) program is an opportunity to complete a four-year degree in management. It is designed for anyone considering a career change, or for those who may have found their career path limited by the lack of a formal degree. In the BSM program, students develop superior management skills and capabilities. Students can extend their competencies in a specialized field by choosing a concentration in:

Business Administration
Financial Management
Information Systems (Computer Systems and Computer Networking)
Marketing Management
Operations Management

Drawing upon MSOE's nearly 50-year tradition of offering degrees in business and management, the Rader School of Business is committed to the basic educational philosophy that includes an applications-oriented approach in all classes and laboratories, development of a strong foundation of business skills and knowledge for all students, and the integration of and exposure to the latest technologies and business practices in all of its programs. The Rader School of Business views technology as machines, systems and approaches that extend human capacity and performance.

Program Goals

Upon completion of the Bachelor of Science in Management degree, students will have comprehensive knowledge, demonstrable skills, and an appreciation of the disciplines associated with decision-making and management within a business enterprise. These will include professional, technical, business and management skills. Furthermore, they will extend their competencies in one or more desired fields of study: accounting, marketing/sales, operations (service and manufacturing) and/or information systems.

Knowledge

- awareness of the academic and professional principles associated with the field of management studies
- understanding of the distinctions between manufacturing and service organizations, and between profit and nonprofit organizations
- understanding of how decisions in marketing, finance, manufacturing, information systems and other disciplines have an effect on other functional areas of the organization

- awareness of the organizational structures used to manage and operate organizations
- understanding of the humanities and social sciences, and their relevance to one's professional and personal life
- awareness of the structure, application and implementation of computer and management information systems within business
- an improved consciousness of one's personal management style and how to best adapt it to achieve effective outcomes under varying business systems

Recognize and Appreciate

- the importance and necessity for diversity in the workplace
- the need for a global perspective in decision-making and management
- the importance of conducting oneself in an ethical and moral manner in one's personal and professional lives.
- the value of lifelong learning

Skills

- ability to communicate facts, information and ideas using the full range of communication media including written, electronic, face-to-face, interpersonal and group
- ability to understand the information in an organization's financial documents and reports, and effectively use that information in decision-making and analysis.
- ability to effectively participate and lead group/team activities
- ability to use computer tools in a variety of activities including report preparation and Web page development
- ability to effectively analyze business problems and derive solutions based on logical reasoning
- ability to successfully meet the needs of organizations that are undergoing continuous transformation
- conduct oneself in an ethical and moral manner in all academic and extracurricular activities

Bachelor of Science Management[1] Model Full-Time Track – V2.0

JUNIOR YEAR		QUARTER 7	QUARTER 8	QUARTER 9
MA-340	Business Statistics	4-0-4		
MS-280	Introduction to MIS	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-361	Marketing	3-0-3		
SS-461	Organizational Psychology	3-0-3		
OR-301	Transfer Student Orientation	1-0-0		
MS-340	Operations Management		3-0-3	
MS-342	Management Principles		3-0-3	
MS-356	Business Finance		3-0-3	
MS-382	Introduction to JAVA		3-0-3	
MS-4801	Project Management		3-0-3	
EN-432	Business Communication		3-0-3	
MS-344	Organizational Behavior and Leadership Development			3-0-3
MS-358	Managerial Accounting			3-0-3
MS-393	Quantitative Management Techniques			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
HU-100	Contemporary Issues in Humanities			3-0-3
	Humanities/Social Science (HU/SS) Elective[2]			3-0-3
	TOTALS	**17-0-16**	**18-0-18**	**17-2-18**

SENIOR YEAR		QUARTER 10	QUARTER 11	QUARTER 12
MS-448	Employment Law	3-0-3		
MS-4599	Managerial Finance	3-0-3		
MS-498	Business Internship[4]	1-3-3		
	Elective (Concentration)[3]	3-0-3		
	Elective (Concentration)[3]	3-0-3		
	Humanities/Social Science (HU/SS) Elective	3-0-3		
MS-444	Business and Government Relations		3-0-3	
MS-483	Database Management		3-0-3	
HU-432	Ethics for Professional Managers		3-0-3	
OR-402	Professional Guidance		1-0-1	
	Elective (Concentration)[3]		3-0-3	
	Elective (Concentration)[3]		3-0-3	
MS-446	General Management Policies			3-0-3
	Humanities/Social Science (HU/SS) Elective			3-0-3
	Elective (Concentration)[3]			3-0-3
	Elective (Concentration)[3]			3-0-3
	Elective (Concentration)[3]			3-0-3
	TOTALS	**16-3-18**	**16-0-16**	**15-0-15**

[1] The BSM is a degree completion program and requires an associate degree or 60 semester / 90 quarter credits for admission. Previous study must include specific courses in: computer methods, microeconomics, macroeconomics, business law, college mathematics, two courses in natural sciences (one with lab), English composition, technical composition, and two courses in humanistic studies. Additional time to completion will be added to the BSM if any of these requirements are missing. Students following the Model Full-time Track may be required to take classes during the evening or occasionally on weekends.

[2] BSM students must complete at least 9 credits of humanities or social science (HU/SS) electives. Combined with previous study, students must demonstrate a balance in the number of HU and SS designated courses completed. The specific number of HU or SS credits will be determined upon admission.

[3] BSM students must complete at least 7 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

[4] Business Internship is not required for students who can show evidence of an internship experience appropriate to their professional development related to the BSM program. One MS elective will be substituted with consent of adviser.

Bachelor of Science
Management[1]
Model Part-Time Track – V2.0

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-354	Principles of Accounting	3-0-3		
SS-461	Organizational Psychology	3-0-3		
MS-280	Introduction to MIS		3-0-3	
MS-356	Business Finance		3-0-3	
OR-301	Transfer Student Orientation			1-0-0
MS-361	Marketing			3-0-3
MA-340	Business Statistics			4-0-4
MS-340	Operations Management	3-0-3		
MS-342	Management Principles	3-0-3		
HU-100	Contemporary Issues in Humanities	3-0-3		
MS-382	Introduction to JAVA		3-0-3	
EN-432	Business Communication		3-0-3	
MS-358	Managerial Accounting			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
MS-393	Quantitative Management			3-0-3
MS-4599	Managerial Finance	3-0-3		
MS-448	Employment Law	3-0-3		
MS-4801	Project Management		3-0-3	
	Humanities/Social Science (HU/SS) Elective[2]		3-0-3	
MS-483	Database Management		3-0-3	
MS-344	Organizational Behavior and Leadership Development			3-0-3
	Elective (Concentration)[3]			3-0-3
	Elective (Concentration)[3]	3-0-3		
	Humanities/Social Science (HU/SS) Elective	3-0-3		
MS-444	Business and Government Relations		3-0-3	
HU-432	Ethics for Professional Managers		3-0-3	
OR-402	Professional Guidance		1-0-1	
	Humanities/Social Science (HU/SS) Elective			3-0-3
	Elective (Concentration)[3]			3-0-3
MS-498	Business Internship[4]	1-3-3		
	Elective (Concentration)[3]	3-0-3		
	Elective (Concentration)[3]		3-0-3	
	Elective (Concentration)[3]		3-0-3	
MS-446	General Management Policies			3-0-3
	Elective (Concentration)[3]			3-0-3
	TOTALS	**31-3-33**	**34-0-34**	**34-2-34**

[1] The BSM is a degree completion program and requires an associate degree or 60 semester / 90 quarter credits for admission. Previous study must include specific courses in: computer methods, microeconomics, macroeconomics, business law, college mathematics, two courses in natural sciences (one with lab), English composition, technical composition, and two courses in humanistic studies. Additional time to completion will be added to the BSM if any of these requirements are missing. Students following the Model Part-time Track can expect that classes will be offered during the evening, or occasionally on weekends. Full-time study may not be possible every quarter if students intend to register exclusively for evening or weekend classes.

[2] BSM students must complete at least 9 credits of humanities or social science (HU/SS) electives. Combined with previous study, students must demonstrate a balance in the number of HU and SS designated courses completed. The specific number of HU or SS credits will be determined upon admission.

[3] BSM students must complete at least 7 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

[4] Business Internship is not required for students who can show evidence of an internship experience appropriate to their professional development related to the BSM program. One MS elective will be substituted with consent of adviser.

Bachelor of Science in Management Concentration Electives

Students in the BSM program are required to choose a concentration from one of the five areas of study listed below. Courses designated within the concentration must be completed as part of the BSM requirements. Alternatives to the designated courses below are considered on a case-by-case basis under extraordinary circumstances. Students should consult with their faculty adviser.

A. Business Administration

MS Electives (choose two courses from Marketing Management Concentration)
MS Electives (choose two courses from Operations Management Concentration)
MS Electives (choose two courses from Financial Management Concentration)
Elective (choose one 300-400 level course from any field in consultation with adviser)

B. Financial Management

MS-450 Management Control Systems
MS-451 Personal Tax
MS-452 Investment and Portfolio Analysis
MS-4544 Financial Management Policies
MS-457 Financial Intermediaries
MS-459 Intermediate Accounting
Elective (choose one 300-400 level course from any field in consultation with adviser)

C. Information Systems

MS-300 Principles of Operating Systems
MS-371 Introduction to UNIX Operating Systems
MS-3811 C++ Programming for Business (or) MS-282 COBOL Programming I
Choose three classes from the following:
- ET-351 Survey of Communication Circuits
- MS-3831 Advanced C++ (or) MS-284 COBOL Programming II
- MS-387 Computer Systems and Analysis and Design I
- MS-388 Computer Systems and Analysis and Design II
- MS-389 Data Center Management
- MS-395 E-business Technologies
- MS-419 A+ Certification Course
- MS-420 Microsoft Windows 2000 Professional
- MS-421 Microsoft Windows 2000 Server
- MS-422 Microsoft Windows 2000 Active Directory Services
- MS-471 Novell NetWare System Management
- MS-479 Network+ Certification
- MS-484 Business Use and Management of Networks
- MS-485 Telecommunications

Elective (choose one 300-400 level course from any field in consultation with adviser)

Bachelor of Science in Management
Concentration Electives continued

D. Marketing Management

MS-273 Web Design
MS-363 E-business Marketing Strategies
MS-462 Technical Selling
MS-467 Marketing Research
MS-468 Advertising and Promotion Strategies
MS-469 Advanced Marketing Strategies

E. Operations Management

MS-3405 Advanced Operations Management
MS-3991 Supply Chain Management
MS-3992 Operations Management Simulation
MS-441 Supervision
MS-443 Labor Relations
MS-450 Management Control Systems
Elective (choose one 300-400 level course from any field in consultation with adviser)

Bachelor of Science
Management Information Systems

Program Director:
Dr. Jeffrey Blessing
Office: B-305
Phone: (414) 277-7194
Fax: (414) 277-7479
E-mail: blessing@msoe.edu

The Bachelor of Science in Management Information Systems (MIS) program provides students with a combination of business, management and information technology preparation needed to succeed in today's dynamic business environments. The program was introduced in fall 2000 as a spin off of the long established Bachelor of Science in Business and Computer Systems (B&CS). Prior to the MIS introduction, students in the B&CS program were able to choose a concentration area of study in marketing, financial or manufacturing management, computer systems or networking. The two latter concentrations were used as a foundation to build the MIS.

The program provides the opportunity for students to concentrate their studies by selecting course work in one of the following areas:

Computer Systems Infrastructure – networking, systems analysis, systems design, operating systems and security; and

Application Support and Development – advanced computer programming, Internet and World Wide Web applications, business process analysis, software integration and implementation, database development and information technology product management.

Program Goals

The goal of the program is to produce graduates who:

- are prepared to excel in positions of responsibility and leadership in the computer-oriented, information and technology-based organizations of the future
- have a solid grounding in humanistic studies, an appreciation for cultural diversity and skills to work effectively with people
- possess the skills to achieve competitive advantage for business and service organizations through making effective and efficient use of information technology
- have a propensity to be lifelong learners, to track new information technology and assist in incorporating it into an organization's strategy, planning and practices

Through an integrated array of courses and application of technologies, graduates of the program:

- understand and can apply the methodology and tools of quantitative analysis, and the systems approach to the application of knowledge and decision-making
- are prepared to lead business and industry in a global information and communication-dominated economy
- possess technical and managerial skills and capabilities in the gathering, analysis and communication of critical business information
- are able to integrate technology to maintain and improve productivity, enhance the quality of work life, and advance technically oriented products, services and information

Bachelor of Science
Management Information Systems
Model Full-Time Track – V2.1

FRESHMAN YEAR		QUARTER 1	QUARTER 2	QUARTER 3
MS-184	Introduction to Computer Methods and Applications	3-0-3		
MS-280	Introduction to Management Information Systems	3-0-3		
EN-131	Composition	3-0-3		
MA-126	Trigonometry	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
	Science Elective[2]	3-2-4		
MS-221	Microeconomics		3-0-3	
HU-100	Contemporary Issues		3-0-3	
EN-132	Technical Composition		3-0-3	
MA-127	College Algebra II		4-0-4	
	Science Elective[2]		3-2-4	
MS-322	Macroeconomics			3-0-3
EN-241	Speech			2-2-3
MS-273	Web Site Design Basics			3-0-3
MA-129	Introduction to Differential and Integral Calculus			4-0-4
SS-460	Foundations of Psychology			3-0-3
	TOTALS	**17-2-17**	**16-2-17**	**15-2-16**

SOPHOMORE YEAR		QUARTER 4	QUARTER 5	QUARTER 6
MS-382	Introduction to Java	3-0-3		
SS-453	American Government	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-361	Marketing	3-0-3		
	Social Science Elective (SS)[3]	3-0-3		
MS-356	Business Finance		3-0-3	
MS-3803	Intermediate Java Programming		3-0-3	
MS-420	Windows 2000 Professional		3-2-4	
MA-340	Business Statistics		4-0-4	
	Social Science Elective (SS)[3]		3-0-3	
MS-331	Business Law			3-0-3
MS-342	Management Principles			3-0-3
MS-358	Managerial Accounting			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
	Elective (Concentration)[5]			3-0-3
	TOTALS	**15-0-15**	**16-2-17**	**14-2-15**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation. Students following the Model Full-Time Track may be required to take classes during the evening or occasionally on weekends.

[2] Students must complete a minimum of 8 natural science credits. The specific course selection MUST be approved by the curriculum adviser. At least one course chosen must have a lab.

[3] MIS students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

[4] MIS students must complete at least 12 credits of humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in the HU-420, HU-430, HU-440, or HU-480 series. Electives are chosen in consultation with an adviser.

[5] MIS students must complete at least 8 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

JUNIOR YEAR		----------QUARTER---------- 7	8	9
MS-371	Introduction to the Unix Operating System	2-2-3		
MS-4599	Managerial Finance	3-0-3		
MS-483	Database Development and Management	2-2-3		
	Social Science Elective (SS)[3]	3-0-3		
	Elective (Concentration)[5]	3-0-3		
MS-373	Advanced Unix and System Administration		2-2-3	
MS-387	Computer Systems Analysis and Design I		3-0-3	
MS-444	Business and Government Relations		3-0-3	
SS-461	Organizational Psychology		3-0-3	
MS-363	E-business Marketing Strategies		3-0-3	
	Elective (Concentration)[5]		3-0-3	
MS-3811	C++ Programming for Business			3-2-4
MS-395	E-business Technologies			3-0-3
MS-485	Telecommunications			3-0-3
MS-498	Business Internship[6]			3-0-3
	Elective (Concentration)[5]			3-0-3
	Humanities Elective (HU)[4]			3-0-3
	TOTALS	**13-4-15**	**17-0-18**	**18-2-19**

SENIOR YEAR		10	11	12
MS-300	Principles of Operating Systems	3-0-3		
MS-3831	Advanced C++ Programming for Business	3-2-4		
OR-402	Professional Guidance	1-0-1		
HU-432	Ethics for Professional Managers & Engineers	3-0-3		
	Elective (Concentration)[5]	3-0-3		
	Humanities Elective (HU)[4]	3-0-3		
MS-448	Employment Law		3-0-3	
MS-4801	Project Management		3-0-3	
EN-432	Business Communication		3-0-3	
	Elective (Concentration)[5]		3-0-3	
	Humanities Elective (HU)[4]		3-0-3	
MS-446	General Management Policies			3-0-3
MS-344	Organizational Behavior and Leadership			3-0-3
	Elective (Concentration)[5]			3-0-3
	Elective (Concentration)[5]			3-0-3
	Humanities Elective (HU)[3]			3-0-3
	TOTALS	**16-2-17**	**15-0-15**	**15-0-15**

[3] MIS students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

[4] MIS students must complete at least 12 credits of humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in the HU-420, HU-430, HU-440, or HU-480 series. Electives are chosen in consultation with an adviser.

[5] MIS students must complete at least 8 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

[6] Business Internship is not required for students who can show evidence of an internship experience appropriate to their professional development related to the MIS program. One MS elective will be substituted with consent of adviser.

Bachelor of Science
Management Information Systems
Model Part-Time Track – V2.1

FRESHMAN AND SOPHOMORE YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-184	Introduction to Computer Methods and Applications	3-0-3		
MA-126	Trigonometry	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
MS-280	Introduction to Management Information Systems		3-0-3	
MA-127	College Algebra II		4-0-4	
MS-221	Microeconomics			3-0-3
MA-129	Introductory Differential and Integral Calculus			4-0-4
MS-322	Macroeconomics	3-0-3		
	Science Elective[2]	3-2-4		
EN-131	Composition		3-0-3	
	Science Elective[2]		3-2-4	
EN-132	Technical Composition			3-0-3
MS-273	Web Site Design Basics			3-0-3
EN-241	Speech	2-2-3		
MS-354	Principles of Accounting	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MS-382	Introduction to Java		3-0-3	
MS-356	Business Finance		3-0-3	
SS-460	Foundations of Psychology			3-0-3
MS-358	Managerial Accounting			3-0-3
MS-371	Introduction to the Unix Operating System	2-2-3		
MS-4599	Managerial Finance	3-0-3		
	Social Science Elective (SS)[3]	3-0-3		
MS-3803	Intermediate Java Programming		3-0-3	
	Social Science Elective (SS)[3]		3-0-3	
MA-340	Business Statistics			4-0-4
MS-361	Marketing			3-0-3
MS-342	Management Principles	3-0-3		
SS-453	American Government	3-0-3		
MS-420	Windows 2000 Professional		3-2-4	
MS-331	Business Law		3-0-3	
TC-342	Professional Presentation Techniques			2-2-3
MS-373	Advanced Unix and System Administration			2-2-3
	TOTALS	**36-6-38**	**31-4-33**	**30-4-32**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation. Students following the Model Part-time Track can expect that classes will be offered during the evening, or occasionally on weekends. Full-time study may not be possible every quarter if students intend to register exclusively for evening or weekend classes.

[2] Students must complete a minimum of 8 natural science credits. The specific course selection MUST be approved by the curriculum adviser. At least one course chosen must have a lab.

[3] MIS students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-483	Database Development and Management	2-2-3		
SS-461	Organizational Psychology	3-0-3		
MS-387	Computer Systems Analysis and Design I		3-0-3	
MS-363	E-business Marketing Strategies		3-0-3	
MS-395	E-business Technologies			3-0-3
MS-485	Telecommunications			3-0-3
MS-344	Organizational Behavior and Leadership	3-0-3		
	Humanities Elective (HU)[4]	3-0-3		
MS-3811	C++ Programming for Business		3-2-4	
MS-4801	Project Management		3-0-3	
MS-3831	Advanced C++ Programming for Business			3-2-4
	Elective (Concentration)[5]			3-0-3
MS-300	Principles of Operating Systems	3-0-3		
OR-402	Professional Guidance	1-0-1		
HU-432	Ethics for Professional Managers & Engineers	3-0-3		
MS-448	Employment Law		3-0-3	
	Elective (Concentration)[5]		3-0-3	
	Humanities Elective (HU)[4]			3-0-3
	Elective (Concentration)[5]			3-0-3
MS-498	Business Internship[6]	3-0-3		
	Humanities Elective (HU)[4]	3-0-3		
EN-432	Business Communication		3-0-3	
MS-444	Business and Government Relations		3-0-3	
MS-446	General Management Policies			3-0-3
	Social Science Elective (SS)[3]			3-0-3
	Elective (Concentration)[5]	3-0-3		
	Humanities Elective (HU)[4]	3-0-3		
	Elective (Concentration)[5]		3-0-3	
	Elective (Concentration)[5]		3-0-3	
	Elective (Concentration)[5]			3-0-3
	Elective (Concentration)[5]			3-0-3
	TOTALS	**30-2-31**	**30-2-31**	**30-2-31**

[3] MIS students must complete at least 9 credits of social science (SS) electives. Electives are chosen in consultation with an adviser.

[4] MIS students must complete at least 12 credits of humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in the HU-420, HU-430, HU-440, or HU-480 series. Electives are chosen in consultation with an adviser.

[5] MIS students must complete at least 8 concentration COURSES. Concentration courses are chosen in consultation with an adviser. See the prescribed concentration course list for options.

[6] Business Internship is not required for students who can show evidence of an internship experience appropriate to their professional development related to the MIS program. One MS elective will be substituted with consent of adviser.

Management Minors

Contact:

Dr. Steven C. Bialek
Phone: (414) 277-7364
Fax: (414) 277-7479
E-mail: bialek@msoe.edu

The Minor in Management and the Minor in Marketing Management are offered to those students who wish to expand their background and understanding of the managerial and marketing functions. These options will augment a student's specialty, make his/her degree more attractive to potential employers and provide the background necessary for entrance into a master's in business administration or engineering management degree program. The management minor consists of 27 credits as follows:

MINOR IN MANAGEMENT

Required Courses:

IE-423 Engineering Economy
MS-221 Microeconomics
MS-331 Business Law
MS-342 Management Principles
MS-354 Principles of Accounting
MS-356 Business Finance I
MS-358 Managerial Cost Accounting I

Plus TWO electives from the following:

MS-322 Macroeconomics
MS-327 International Business
MS-340 Production Management
MS-3405 Advanced Operations Management
MS-344 Organizational Behavior and Leadership Development
MS-361 Marketing
MS-363 E-business Marketing Strategies
MS-393 Quantitative Techniques
MS-3992 Operations Management Simulation
MS-433 Small Business Management
MS-441 Supervision
MS-443 Labor Relations
MS-444 Business and Government Relations
MS-445 Business Forecasting
MS-448 Employment Law
MS-449 Human Resource Management
MS-450 Management Control Systems
MS-451 Personal Tax
MS-452 Investment and Portfolio Analysis
MS-453 Personal Investment
MS-457 Financial Intermediaries
MS-459 Intermediate Accounting
MS-4599 Managerial Finance
MS-462 Technical Selling
MS-467 Marketing Research
MS-468 Promotion and Advertising Strategies
MS-475 Activity-Based Management

MINOR IN MARKETING MANAGEMENT

Required Courses:

MS-221 Microeconomics
MS-331 Business Law
MS-361 Marketing
MS-363 E-business Marketing Strategies
MS-468 Advertising and Promotion Strategies OR
TC-381 Marketing Communication

Plus FOUR electives from the following:

HU-494 Creative Thinking
MA-340 Business Statistics
MS-273 Web Design
MS-327 International Business
MS-342 Management Principles
MS-344 Organizational Behavior and Leadership Development
MS-393 Quantitative Techniques
MS-433 Small Business Management
MS-441 Supervision
MS-462 Technical Selling
MS-467 Marketing Research
MS-483 Database Management Systems
TC-151 Theory of Communication
TC-242 Persuasive Speech
TC-342 Professional Presentation Techniques
TC-351 Organizational Communications

In most cases, the courses required for the minors will entail taking courses above the minimum needed within a student's degree program requirements. Please see your adviser or the program director for more details.

Certifications

The following groups of certification courses are available for credit as technical electives in many degree programs. They are an integral part of the Bachelor of Science in Management Information Systems degree program. Students not pursuing a degree at MSOE may participate in the courses as nondegree students. MSOE is committed to updating the course curriculum on a continual basis to meet changing requirements.

MSOE has partnered with Virtual University Enterprises (VUE) to offer certification testing on campus. Certification exams for any of the programs identified below can be arranged and paid for by the student through MSOE's VUE Testing Center.

Novell Certifications

MSOE's Rader School of Business is a Novell Academic Training Partner (NATP) and offers Novell authorized education courses. In various combinations, these courses will help prepare students for certification as a Novell Certified NetWare Administrator (CNA) and a Novell Certified NetWare Engineer (CNE).

NetWare CNA/CNE Certification Track

MS-4715 Foundations of Novell Networking
MS-4733 Novell eDirectory Design and Implementation
MS-4745 Novell Network Management
MS-479 Network+ Certification

By offering courses in the CNA/CNE certification tracks, MSOE is preparing individuals to enter the work force with the skills necessary to begin a network support and management career.

Microsoft Certifications

MSOE's Rader School of Business is proud to be part of the Microsoft IT Academy and offers Microsoft authorized training courses. As a Microsoft IT Academy provider, MSOE is offering courses necessary to obtain the Microsoft Certified Systems Engineer (MCSE) and Microsoft Certified Systems Administrator (MCSA) certifications.

Microsoft Certified Systems Engineer /Systems Administrator Track

MS-420 Microsoft Windows 2000 Professional
MS-421 Microsoft Windows 2000 Server
MS-422 Microsoft Windows 2000 Active Directory Services
MS-423 Microsoft Windows 2000 Network Infrastructure Administration
MS-424 Designing a Microsoft Windows 2000 Directory Services Infrastructure
MS-425 Designing a Microsoft Windows 2000 Network Infrastructure
MS-426 Designing Microsoft Windows 2000 Network Security

CompTIA Certifications

MSOE's Rader School of Business is proud to offer courses designed to prepare students for the Computing Technology Industry Association (CompTIA)-sponsored A+, Network+ and Security+ certifications. The A+ and Network+ courses are entry-level courses that satisfy the prerequisites for advanced study in the Novell and Microsoft certification programs. Network+ is accepted by Novell in place of its Networking Technologies certification requirement for all Certified Novell Engineers (CNE). A+ and Network+ are accepted by Microsoft as electives for the Microsoft Certified Systems Administrator (MCSA) certification.

MS-419 A+ Certification
MS-479 Network+ Certification
MS-4795 Security+ Certification

Electrical Engineering and Computer Science Department

Main Office: Walter Schroeder Library, L-350
Phone:
Local: (414) 277-7323
Toll Free: (888) 333-6763 (EEE-MSOE)
Fax: (414) 277-7465

The Electrical Engineering and Computer Science (EECS) Department is the oldest and largest academic department at MSOE. The department supports 16 engineering laboratories, plus the EECS Technical Support Center. Undergraduate degree granting responsibility includes the areas of biomedical, computer, electrical and software engineering, and electrical engineering technology. The department offers graduate degree programs in engineering and perfusion. Related certificate and special company programs are also offered.

Faculty:

Chairman:
Ray W. Palmer

Vice Chairman:
Dr. John D. Gassert

Department Secretaries:
Susan Lennartson, Marilyn Searing

Professors:
William Barnekow, Dr. Steven Barnicki, Dr. Vincent R. Canino, Dr. Edward W. Chandler, Dr. Michael T. Chier, Dr. John Gassert, Dr. Andrew Kwon, Michael O'Donnell, Ray W. Palmer, Dr. Owe G. Petersen, Dr. Steven E. Reyer, Dr. Teodoro Robles, Dr. Hadi Saadat, Dr. Mark Sebern, Dr. Robert A. Strangeway, Dr. Thomas J. Swiontek, Dr. Henry L. Welch, Dr. Gerald Woelfl

Associate Professors:
Dr. Larry Fennigkoh, Dr. Ron Gerrits, Dr. Lisa M. Milkowski, John Starr, Hue V. Tran, Dr. Chris Taylor, Dr. Charles Tritt, Dr. Stephen Williams, Dr. Glenn Wrate

Assistant Professors:
Dr. Eric Durant, Dr. Russ Meier, Dr. Joerg Mossbrucker, Dr. Darrin Rothe, Dr. Deepti Suri

Adjunct Professors:
Dr. Kishore Acharya, Waldemar Gerassimoff

Adjunct Associate Professors:
Dr. John Brauer, Dr. Dennis Hafemann, Charles Kocourek, John Lunz

Lecturers:
Dean Thomas Bray, Maheshwar Gundelly, Jeffry Orthober, John Wheeldon, Lillian Witzke

Professors Emeriti:
Dr. Robert Bartfeld, Bernard Budny, James Eckl, Frank Evans, Dr. Donald Petzold, Hans Schroeder, Thomas Tillman, Dr. Richard J. Ungrodt, Ralph Wey

Bachelor of Science
Biomedical Engineering

Program Director:
Dr. Vincent R. Canino
Office: S-364
Phone: (414) 277-7331
Fax: (414) 277-7465
E-mail: canino@msoe.edu

The biomedical engineering faculty of the Milwaukee School of Engineering is dedicated to providing each biomedical engineering student with the knowledge and educational skills needed to function as an entry-level engineer or graduate student. Our curriculum was designed to educate each student in the areas of mathematics, physical sciences, life sciences, communications, social sciences, humanities and engineering. Through an 11-quarter biomedical engineering design team experience and engineering course work, the student will learn the engineering skills – both classical and biomedical – to satisfy the requirements of their career.

Program Goals

Biomedical engineering is a demanding engineering discipline where students are responsible for learning and developing the skills necessary to perform and advance within the career of their choosing. The biomedical engineering program at MSOE is responsible for providing the academic environment and curriculum in which its students can develop and learn these skills. Therefore, in accordance with the mission of the university, MSOE will provide the students with the education that will allow the students to:

Develop general education skills that society commonly expects of persons holding a baccalaureate degree, and to recognize the need to include service to society in their career plans. Service to society includes service to the engineering profession and to the many social, charitable and civic organizations.

Possess the skills required to function as an entry-level engineer as defined by the Fundamentals of Engineering examination. Possess the skills required to meet the minimum requirements to function as an entry-level biomedical engineer in the areas of medical instrumentation, biomaterials, biomechanics, biomedical signal processing and medical imaging.

Recognize the ethical, legal and social issues involved in the practice of engineering and/or biomedical engineering.

Develop personal and professional skills that allow them to function as productive members of an engineering design team. Professional skills include an understanding of common industrial practices that will allow them to excel in industrial and laboratory environments.

Receive current information relative to the many career options open to engineering graduates. These options include continuing education in professional schools, graduate schools (both full-time and part-time) and employment options in industry, health care, engineering consulting and government. Further, each student will recognize the need for lifelong learning and the many ways in which such learning can take place.

Student Objectives:

Prior to graduation, each biomedical engineering student must demonstrate:

1. An ability to apply knowledge of mathematics. This includes calculus, differential equations, statistics, vector analysis and matrix analysis.

2. An ability to apply knowledge of physics, chemistry, biology and physiology.

3. An ability to apply knowledge of engineering science across the range of engineering topics.

4. An ability to solve problems at the interface of engineering, medicine and biology.

5. An ability to design and conduct experiments, as well as to analyze and interpret data involving both living and non-living systems.

6. An ability to design a system, component or process to meet desired needs including the need to address the problems associated with the interaction between living and non-living materials and systems.

7. An ability to function on multi-disciplinary teams as demonstrated by participation in an 11-quarter Biomedical Engineering Design experience.

8. An ability to identify, analyze and solve engineering problems involving living systems.

9. An understanding of professional and ethical responsibility including the special requirements imposed on engineering solutions applied to living systems.

10. An ability to communicate effectively with co-workers or as part of a team.

11. The broad education necessary to understand the impact of engineering solutions in a global and societal context with special consideration given to health care issues.

12. An ability to engage in lifelong learning.

13. Knowledge of contemporary social issues.

14. The ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Biomedical Engineers

Biomedical engineers are engineers who add knowledge from the life sciences to the practice of their profession. Biomedical engineers need to have a solid education in engineering and a working knowledge of biology, physiology and medicine.

Biomedical engineering is defined as the application of engineering principles to understand, modify or control living systems such as the human body. Biomedical engineers use scientific theories to design products to improve health care. They use engineering principles to gain a greater understanding of human health needs. They also use current scientific knowledge to analyze disease processes and develop products and/or techniques to treat medical conditions.

Six Major Areas Within Biomedical Engineering

Medical Instrumentation

Medical instrumentation is the application of electronics and measurement techniques to develop devices used in diagnosis and treatment of disease. Computers are an important and increasingly essential part of medical instrumentation, from the microprocessor in a single-purpose instrument to the microcomputer needed to process the large amount of information in a medical imaging system.

Examples of medical instrumentation include: heart monitors, microelectrodes, defibrillators and glucose monitoring machines.

Biomaterials

Elastomer-based devices, like tracheal tubes, are assembled using various combinations of adhesives and special materials.Biomaterials is the use of materials, both living tissue and artificial materials, for implantation. Understanding the properties of the living materials is vital in the design of implant materials. The selection of an appropriate material to place in the human body may be one of the most difficult tasks faced by the biomedical engineer. Certain metal alloys, ceramics, polymers and composites have been used as implant materials. Biomaterials must be nontoxic, non-carcinogenic, chemically inert (not reacting violently with the body's chemical composition), stable and mechanically strong enough to withstand the repeated forces of a lifetime of use. Newer biomaterials even incorporate living cells in order to provide a true biological and mechanical match for the living tissue.

Examples of biomaterials include dental adhesives, bone cement, replacement bones/joints, heart prosthetics, heart replacement valves and artificial lungs and kidneys.

System Physiology and Modeling

In the context of biomedical engineering, modeling refers to the use of scientific and engineering principles to predict the behavior of a system of interests. Systems of interest may include the human body, particular organs or organ systems and medical devices.

This aspect of biomedical engineering is used to gain a comprehensive and integrated understanding of the function of living organisms. These organisms range from bacteria to humans. Modeling is used in the analysis of experimental data and in formulating mathematical descriptions of physiological events. In research, modeling is used as a predictive tool in designing new experiments to refine our knowledge.

Biosignal Processing

Signal processing involves the collection and analysis of data from patients or experiments in an effort to understand and identify individual components of the data set or signal. The manipulation and dissection of the data or signal provides the physician and experimenter with vital information on the condition of the patient or the status of the experiment. Biomedical Engineers apply signal-processing methods to the design of medical devices that monitor and diagnose certain conditions in the human body.

Medical Imaging

Medical Imaging combines knowledge of a unique physical phenomenon (sound, radiation, magnetism etc.) with high-speed electronic data processing, analysis and display to generate an image. Often, these images can be obtained with minimal or completely non-invasive procedures, making them less painful and more readily repeatable than invasive techniques.

Biomechanics and Rehabilitation Engineering

This area is comprised of two related parts: biomechanics and rehabilitation engineering.

Biomechanics applies both fluid mechanics and transport phenomena to biological and medical issues. It includes the study of motion, material deformation, flow within the body, as well as devices, and transport phenomena in the body, such as transport of chemical constituents across biological and synthetic media and membranes.

Efforts in biomechanics have developed the artificial heart, replacement heart valves and the hip replacement.

Rehabilitation engineering uses concepts in biomechanics and other areas to develop devices to enhance the capabilities and improve the quality of life for individuals with physical and cogitative impairments. They are involved in prosthetics, the development of the home and/or workplace, and transportation modifications.

Bachelor of Science
Biomedical Engineering
Model Full-Time Track – V3.4

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
MA-136	Calculus for Engineers I	4-0-4		
CH-200	Chemistry I	3-2-4		
BI-102	Biology	3-3-4		
EN-131	Composition	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
HU-100	Contemporary Issues	3-0-3		
MA-137	Calculus for Engineers II		4-0-4	
CH-201	Chemistry II		3-2-4	
PH-110	Physics of Mechanics		3-2-4	
BE-103	Freshman Biomedical Engineering Design		1-3-2	
EN-132	Technical Composition		3-0-3	
MA-231	Calculus for Engineers III			4-0-4
CH-222	Organic Chemistry I			2-2-3
PH-230	Physics of Electricity and Magnetism			3-3-4
BE-104	Computing in Biomedical Engineering I			2-3-3
EN-241	Speech			2-2-3
	TOTALS	**17-5-18**	**14-7-17**	**13-10-17**

SOPHOMORE YEAR		4	5	6
MA-235	Differential Equations for Engineers	4-0-4		
CH-223	Biochemistry	3-2-4		
PH-220	Physics of Heat, Wave Motion and Optics	3-3-4		
ME-205	Engineering Statics	4-0-4		
BE-200	Sophomore BE Design I	1-0-1		
MA-232	Calculus for Engineers IV		3-0-3	
BE-201	Sophomore BE Design II		1-0-1	
EE-201	Linear Networks: Steady State Analysis		4-0-4	
ME-206	Engineering Dynamics		4-0-4	
BE-205	Computing in Biomedical Engineering II		1-3-2	
SS-461	Organizational Psychology		3-0-3	
BE-261	Biostatistics I			3-0-3
BE-206	Signals and Systems 1			3-3-4
BE-202	Sophomore Biomedical Engineering Design III			1-0-1
EE-290	Combinational and Sequential Logic			3-3-4
ME-207	Mechanics of Materials			3-2-4
	TOTALS	**15-5-17**	**16-3-17**	**13-8-16**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation.

JUNIOR YEAR		----------QUARTER---------- 7	8	9
BE-361	Biostatistics II	3-0-3		
EE-291	Microprocessor Systems	3-3-4		
BE-307	Signal and Systems II	4-0-4		
BE-381	Biophysical Phenomena: Thermo and Heat Transfer	4-0-4		
BE-300	Junior Biomedical Engineering Design I	1-0-1		
EE-310	Electronic Devices and Circuits		3-3-4	
BE-330	Bioelectric Fields		4-0-4	
BI-373	Physiology I		3-3-4	
BE-382	Biophysical Phenomena: Fluid and Mass		4-0-4	
BE-301	Junior Biomedical Engineering Design II		1-0-1	
BE-306	Biomedical Instrumentation			3-3-4
BI-374	Physiology II			3-3-4
BE-302	Junior Biomedical Engineering Design III			1-0-1
HU-332	Bioethics			3-0-3
MS-331	Business Law			3-0-3
	Elective (HU/SS)[2]			3-0-3
	TOTALS	**15-3-16**	**15-6-17**	**16-6-18**

SENIOR YEAR		10	11	12
BE-404	Biomedical Engineering Design I	1-3-2		
BE-433	Biomedical Digital Signal Processing	3-3-4		
BE-417	Biomedical Electronics	3-3-4		
BE-410	Biomaterials	3-0-3		
	Elective (HU/SS)[2]	3-0-3		
BE-405	Biomedical Engineering Design II		1-3-2	
BE-460	Medical Imaging Systems		3-3-4	
BE-471	Biomedical Control Systems: Analog		4-0-4	
BE-411	Biomechanics		3-0-3	
	Elective (HU/SS)[2]		3-0-3	
BE-472	Biomedical Control Systems: Digital			3-3-4
BE-406	Biomedical Engineering Design III			1-3-2
	Technical Elective[3]			3-0-3
	Electives (HU/SS)[2]			6-0-6
	TOTALS	**13-9-16**	**14-6-16**	**13-6-15**

[2] There are 15 credits of humanities and social sciences (HU/SS) electives of which 6 must be taken in the humanities area, 6 in the social science area and 3 in either.
[3] Technical electives, any 200 level or above course from mathematics, science or engineering.

Students in the Air Force ROTC may make the following substitutions in the Biomedical Engineering program: AF-401 for Technical Elective, AF-402 for MS-331. All other AF courses must be scheduled in addition to the courses listed above.

Accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET,111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700).

Bachelor of Science
Computer Engineering

Program Director:
Dr. Steven L. Barnicki
Office: CC-27F
Phone: (414) 277-7342
Fax: (414) 277-7497
E-mail: barnicks@msoe.edu
Web site: www.msoe.edu/eecs/ce/

Computer engineering is the engineering discipline that deals with the design and application of computer systems. MSOE's computer engineering program balances hardware and software by integrating "electrical engineering" hardware topics with "computer science" software subjects.

This broad background enables the computer engineer to contribute to the design, implementation, testing, maintenance and application of computer-based systems, from tiny embedded processors to massive database and network servers.

The computer engineering program at MSOE implements the university's mission by facilitating the personal and professional growth of its students so that they can become effective contributors to the engineering profession and to society as a whole. Graduates of the computer engineering program will:

- be able to unite theory with practice, be prepared and motivated to engage in lifelong learning, and have a solid foundation in mathematics and science
- be productive practitioners skilled in applying engineering process and practice to computer hardware, software and systems
- be proficient in oral and written communication, and effective in team work
- actively demonstrate professional and ethical responsibility
- have the broad education and awareness of contemporary issues necessary to understand the societal and global impact of their profession

MSOE's computer engineering program unites theory with industry practice. Classroom and laboratory activities complement each other throughout the curriculum. Laboratories and computer systems are accessible outside of class time, and students often use these facilities to explore new areas on their own.

Hardware and software design is emphasized, beginning in freshman courses. All computer engineering students complete a major team project during their two-quarter senior design sequence. A solid foundation in mathematics, science and engineering principles supports current and future learning, while humanities and business courses help to develop a well-rounded engineer.

Communication skills and teamwork are stressed. Written and oral reports are an integral part of the design experiences, particularly in upper-level courses. In the senior design sequence, teams learn to manage their own projects and to meet schedule and performance objectives.

Computer Engineering Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
CS-421	Advanced Computer Graphics	2	2	3
CS-4802	Digital Image Processing	2	2	3
CS-4811	Java Programming	2	2	3
CS-484	Graphical User Interface Design	2	2	3
CS-486	Database System Design	3	0	3
CS-4881	Artificial Intelligence (AI)	3	0	3
CS-493	Computer Architecture II	2	2	3
CS-499	Independent Study	1	0	3

Bachelor of Science
Computer Engineering
Model Full-Time Track – V2.11

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
EN-131	Composition	3-0-3		
GE-110	Intro to Engineering Concepts	2-2-3		
MA-136	Calculus for Engineers I	4-0-4		
HU-100	Contemporary Issues	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
MS-221	Microeconomics	3-0-3		
CH-200	Chemistry I		3-2-4	
CS-182	Computer Programming		3-3-4	
EN-132	Technical Composition		3-0-3	
MA-137	Calculus for Engineers II		4-0-4	
CS-183	Software Design			3-3-4
EN-241	Speech			2-2-3
MA-231	Calculus for Engineers III			4-0-4
PH-110	Physics of Mechanics			3-2-4
	TOTALS	**16-2-16**	**13-5-15**	**12-7-15**

SOPHOMORE YEAR		4	5	6
EE-201	Linear Networks: Steady State Analysis	4-0-4		
MA-235	Differential Equations for Engineers	4-0-4		
ME-255	Engineering Statics	3-0-3		
PH-230	Physics of Electricity & Magnetism	3-3-4		
CS-285	Data Structures		2-2-3	
EE-290	Combinational and Sequential Logic		3-3-4	
MA-230	Discrete Mathematics		4-0-4	
ME-256	Engineering Dynamics		3-0-3	
PH-220	Physics of Heat, Wave Motion & Optics		3-3-4	
CS-280	Embedded Systems Software			3-2-4
EE-202	Linear Networks: Transient Analysis			3-3-4
EE-210	Electronic Devices and Computer Interfacing			3-3-4
MA-232	Calculus for Engineers IV			3-0-3
MA-262	Probability and Statistics			3-0-3
	TOTALS	**14-3-15**	**15-8-18**	**15-8-18**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
CS-321	Computer Graphics	3-3-4		
CS-381	Engineering Systems Analysis with Numerical Methods	3-2-4		
MA-343	Matrix Methods & Linear Programming	3-0-3		
ME-354	Thermodynamics & Heat Transfer	3-0-3		
PH-250	Modern Physics	3-3-4		
CS-384	Design of Operating Systems		3-2-4	
CS-393	Computer Architecture		3-2-4	
OR-402	Professional Guidance		1-0-1	
IE-423	Engineering Economy		3-0-3	
PH-360	Physics of Electronics		3-3-4	
CS-391	Embedded Computer System Design			3-3-4
EE-371	Control Systems			3-2-4
EE-393	VLSI Design			3-3-4
SS-461	Organizational Psychology			3-0-3
	TOTALS	**15-8-18**	**13-7-16**	**12-8-15**

SENIOR YEAR		10	11	12
CS-489	Software Engineering Design	3-3-4		
CS-495	Data Communications and Networking	3-3-4		
	Program Elective	3-0-3		
	Elective (HU/SS)[2]	3-0-3		
	Elective (HU/SS)[2]	3-0-3		
CS-400	Senior Design Project I		3-0-3	
	Elective (HU/SS)[2]		3-0-3	
	Program Elective		3-0-3	
	Free Elective		3-0-3	
	Elective (HU/SS)[2]		3-0-3	
CS-401	Senior Design Project II		3-0-3	
CS-470	Computer Modeling and Simulation			3-2-4
HU-432	Ethics for Professional Managers and Engineers			3-0-3
MS-331	Business Law			3-0-3
	Elective (HU/SS)[2]			3-0-3
	TOTALS	**15-6-17**	**15-0-15**	**15-2-16**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation.

[2] There are 24 credits of elective subjects in the computer engineering program which must be taken as follows:

- 15 credits of humanities and social sciences: 6 credits of humanities (HU), 6 credits of social science (SS), and 3 credits of humanities or social science.
- 6 credits of approved program electives.
- 3 credits of an upper-division course from any area.

Engineering technology courses may not be used to satisfy requirements of the computer engineering curriculum.

Students enrolled in Air Force ROTC must complete AF-100, AF-200, AF-202, AF-300, AF-301, AF-302, AF-400, AF-401, and AF-402. Upon completion of these courses credit will be given for MS-331, SS-455 (a social science elective), the free elective, and one program elective.

Accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700).

Bachelor of Science
Electrical Engineering

Program Director:
Dr. Owe G. Petersen
Office: S-300
Phone: (414) 277-7114
Fax: (414) 277-7465
E-mail: petersen@msoe.edu
Web site: www.msoe.edu/eecs/ee/

Think about all the things around you that you use all the time and that make life very delightful so often. Things like the cellular phone to call a friend, television to watch a favorite show, CT scanners to save lives, vehicle ignition systems to allow travel, computers to surf the Internet, satellite communication and a vast variety of other things we use routinely. Who designed all of this stuff? It is primarily the electrical engineer.

Students learn about general topics such as digital and analog circuits, programming, microprocessors, microcontrollers, wireless communications and electrical motors as well as special topics such as fuzzy logic, robotics and optical communications. Electrical engineering topics range from very small things like integrated circuits (IC), which control virtually every electronic item in the home and industry, to large things like the electric power grid that stretches across the nation.

Program Goals

The electrical engineering program at MSOE implements the mission of the university by fostering the professional and personal development of its students, resulting in graduates who are competent and effective contributors to the engineering profession and society as a whole.

The goals of the electrical engineering program are to produce graduates who will have:

- demonstrated knowledge of mathematics, the basic sciences and the engineering sciences
- demonstrated their theoretical and practical understanding of open-ended design problems as applied to complex electrical engineering systems and circuits using analytical and simulation skills
- demonstrated the laboratory implementation of their engineering designs and the ability to relate experimental results to a theoretical understanding
- demonstrated proficiency in oral and written communication skills and effective teamwork skills
- an understanding of their personal, professional and ethical responsibilities as applied to both the engineering profession and society as a whole
- an understanding of the necessity of lifelong learning to maintain professional viability and be prepared to continue their formal education for advanced degrees

The Electrical Engineering Curriculum

The electrical engineering program (BSEE) at MSOE places a very strong emphasis on design, applications and hands-on laboratory experimentation. Think for a moment of how you can demonstrate that you learned something very well. What if in addition to the normal exams, you designed, built and debugged an electronic circuit that functions just like it is suppose to? The laboratory is a great place to work out the details of your understanding of the theory. The BSEE program at MSOE prepares its graduates for successful entry into the engineering profession, as well as for graduate school.

Design and laboratory projects grow in complexity throughout the four-year BSEE program. Sophomores might be asked to design the logic circuit for a vending machine or an intelligent traffic intersection. Senior students work in teams of three to five on a major project for the entire academic year. Some recent projects were:

- portable, low-cost oscilloscope that connects to a PC
- airplane navigational "black box" finder
- universal test platform for NASA zero-gravity flights
- solar-powered boat for competitive racing
- microprocessor controlled practice putting surface

Many of the projects use wireless communication and microprocessors. The projects are usually defined by the students, sometimes with the help of faculty and/or local industry. Because of its urban location MSOE has a very strong relationship with local industry. This is very advantageous for students, not just for design projects, but also for industry internships or summer jobs.

The BSEE program at MSOE has a very unique junior year international exchange program with the Lübeck University of Applied Sciences in Lübeck, Germany. There are three key features to the program.

- All instruction is in English, although students are encouraged to learn some German while studying at Lübeck.
- Students receive both their MSOE degree and a degree from Lübeck.
- If a student stays on track in the curriculum, he or she will graduate in four years.

This is a tremendous opportunity for anyone who is thinking about a career path that involves the global economy and viewpoint. For details, please see the *German Exchange Program* section in this *Catalog.*

Careers in Electrical Engineering

Graduating with a degree in electrical engineering prepares the student for an extremely wide variety of careers in almost any industry.

Examples of the **type of industries** graduates could work in include:

- Aerospace
- Automation
- Automotive
- Communications
- Computers
- Electronics
- Instrumentation
- Integrated circuits
- Medical
- Power generation/distribution

Examples of typical electrical engineering **technologies** implemented in these industries are:

- Expert systems
- High-definition television
- Micro-electro/mechanical systems
- Microprocessor controls
- Optical communications
- Programmable controllers
- Robotics
- Wireless communications

Examples of the **type of jobs** that are available:

- Computer automation
- Computer modeling/simulations
- Development of new products
- Design of products or equipment
- Manufacturing/production
- Project leader
- Researcher of new ideas
- Technical marketing

Examples of specific **career opportunities**:

- Design engineer – Uses computer simulations and modeling to design new high-frequency circuits for digital cellular phones.
- Research engineer – Invents new optoelectronic devices to build optical computer.
- Project engineer – Leads a team of engineers from different disciplines to design, test and manufacture an undersea optical amplifier.
- Test engineer – Writes and implements the computer program to do automated testing of an electronic ignition system.
- Application engineer – Defines and integrates existing equipment to solve customer problems.
- System engineer – Defines and develops a communications network.

Bachelor of Science
Electrical Engineering
Model Full-Time Track – V14.10

FRESHMAN YEAR		QUARTER 1	QUARTER 2	QUARTER 3
EE-100	Intro to Electrical Engineering	1-2-2		
MA-136	Calculus for Engineers I	4-0-4		
CS-150	Intro to Computer Programming	2-2-3		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
EG-122	Engineering Graphics and Visualization		1-3-2	
MA-137	Calculus for Engineers II		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
MS-221	Microeconomics		3-0-3	
MA-231	Calculus for Engineers III			4-0-4
PH-110	Physics of Mechanics			3-2-4
CH-201	Chemistry II			3-2-4
EN-241	Speech			2-2-3
Elective	HU/SS Elective[2]			3-0-3
	TOTALS	**14-4-15**	**14-5-16**	**15-6-18**

SOPHOMORE YEAR		4	5	6
EE-201	Linear Networks: Steady State Analysis	4-0-4		
ME-255	Engineering Statics	3-0-3		
MA-235	Differential Equations for Engineers	4-0-4		
CS-250	Intro to Object Oriented Programming	2-2-3		
PH-230	Physics of Electricity & Magnetism	3-3-4		
EE-230	Special Network Applications		3-0-3	
EE-290	Combinational & Sequential Logic		3-3-4	
ME-256	Engineering Dynamics		3-0-3	
MA-232	Calculus for Engineers IV		3-0-3	
PH-220	Physics of Heat, Wave Motion & Optics		3-3-4	
EE-202	Linear Networks: Transient Analysis			3-3-4
EE-291	Microprocessor Systems			3-3-4
MA-262	Probability and Statistics			3-0-3
PH-250	Modern Physics			3-3-4
	TOTALS	**16-5-18**	**15-6-17**	**12-9-15**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100 but will be required to complete OR-301 Transfer Student Orientation.

[2] See next page.

JUNIOR YEAR		----------QUARTER---------- 7	8	9
EE-310	Electronic Devices & Circuits	3-3-4		
EE-392	Digital System Design	3-3-4		
MA-330	Vector Analysis	3-0-3		
ME-354	Thermodynamics & Heat Transfer	3-0-3		
PH-360	Physics of Electronics	3-3-4		
EE-303	Signal Analysis		4-0-4	
EE-311	Electronic Networks		3-3-4	
EE-320	Electric & Magnetic Fields		4-0-4	
EE-340	Electromechanical Energy Conversion		3-3-4	
GE-300	Career & Professional Guidance		0-2-1	
EE-371	Control Systems			3-2-4
EE-383	Computer-Aided Design			3-3-4
EE-393	VLSI Design			3-3-4
MS-331	Business Law			3-0-3
Elective	HU/SS Elective[2]			3-0-3
	TOTALS	**15-9-18**	**14-8-17**	**15-8-18**

SENIOR YEAR		10	11	12
EE-401	Principles of Communications	3-0-3		
EE-407	Senior Design Project I	3-0-3		
EE-412	Electronic Systems Design	3-3-4		
Electives	Electives (one EE, one HU/SS)[2]	6-0-6		
EE-408	Senior Design Project II		2-3-3	
IE-423	Engineering Economy		3-0-3	
SS-461	Organizational Psychology		3-0-3	
Electives	Electives (one EE, one HU/SS, one Free)[2]		9-0-9	
EE-409	Senior Design Project III			2-3-3
HU-432	Ethics for Professional Managers & Engineers			3-0-3
Electives	Electives (one EE, one HU/SS, one Free)[2]			9-0-9
	TOTALS	**15-3-16**	**17-3-18**	**14-3-15**

[2] The 30 credits of elective subjects in the Electrical Engineering program must be taken as follows:
- 15 required credits of Humanities and Social Science (HU/SS) electives. Of these 15 credits, 6 must be taken in the Humanities area (HU), 6 must be taken in the Social Sciences area (SS), and the remaining 3 must be taken in either the Humanities or the Social Sciences.
- 9 credits of Electrical Engineering from the approved program elective list.
- 6 credits from any area (Free Electives).

All Electrical Engineering electives must be at the 300 or 400 level.

Engineering Technology courses may not used to satisfy any Electrical Engineering program requirements.

Students in Air Force ROTC may make the following substitutions: AF-400/401 for SS-455 (an HU/SS elective), AF-402 for MS-331. In addition, a student may use the course sequence AF-300, AF-301, and AF-302 for up to 6 credits of Free Electives. Additional AF courses cannot be used to satisfy any Electrical Engineering requirements.

Accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 – telephone: (410) 347-7700.)

Electrical Engineering Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
EE-404	Active Filters	3	0	3
EE-420	Transmission Line Circuits	3	0	3
EE-421	Digital Communication Systems	3	0	3
EE-422	Digital Signal Processing (DSP)	3	0	3
EE-423	Applications of DSP	2	2	3
EE-424	Data Communications	3	0	3
EE-425	Radio Frequency Circuit Design	2	2	3
EE-429	Microwave Engineering	2	3	3
EE-444	Power Electronics	3	0	3
EE-447	Power System Analysis I	3	0	3
EE-449	Power System Analysis II	3	0	3
EE-460	Quality in Electronic Systems	3	0	3
EE-462	Communication Systems	3	0	3
EE-464	Fiber Optic Communication	3	0	3
EE-474	Programmable Controllers	2	2	3
EE-479	Digital Control Systems	3	0	3
EE-481	Fuzzy Sets and Applications	3	0	3
EE-484	Neural Networks	3	0	3
EE-486	C Language	3	0	3
EE-487	Machine Vision	2	2	3
EE-488	Introduction to Artificial Intelligence and Expert Systems	3	0	3
EE-493	Architecture and Programming of a 16-bit Microprocessor	2	2	3
EE-499	Independent Study	1-4	0	1-4

International Study

Students in the electrical engineering program at MSOE have the opportunity to participate in foreign study through an agreement between MSOE and the Lübeck University of Applied Sciences in Lübeck, Germany.

The timing could not be better. American business is competing on an international level like at no other time in U.S. history. Foreign companies are buying or forming alliances with American companies at a record pace. There is a great likelihood of a graduate doing business with or even working for a foreign owned company. The graduate who has traveled internationally, speaks a foreign language or has an understanding of the cultures and traditions of other nations will have a marked advantage.

The MSOE German Exchange Program enables students to study for one year at a German university where the focus is in the area of applied engineering with superbly outfitted laboratories, while at the same time gaining firsthand experience by being immersed in German culture.

The key features of MSOE's program are:

- All instruction is in English. Students do NOT need to know any German.
- Students will receive two degrees, one from MSOE and one from the Lübeck University of Applied Sciences.
- Students will graduate on schedule, if they stay on track in the EE curriculum.

The Program

Electrical engineering students who enroll in the German Exchange Program will study for two semesters at the Lübeck University of Applied Sciences during their junior year. The school year runs September through June with an extensive break between semesters providing an excellent opportunity for European travel. Students live in off-campus housing arranged by the university. They are in class with their German counterparts for studying a curriculum that includes the following topics:

First Semester

Analog electronics
Control systems
Signal analysis
Principles of communication
Microwaves
Humanities/social sciences
German language and culture

Second Semester

Computer-aided design
Control systems laboratory
Programmable controllers
Microwaves
Principles of communication
Humanities/social sciences
German language and culture

The Lübeck University of Applied Sciences has a long tradition that goes back as far as 1808 when the first Navigation School was founded. This highly regarded applied engineering university in the Federal Republic of Germany has approximately 115 professors, 90 staff engineers and 70 laboratories to provide its 3,000 students with an excellent educational experience. The university combines the availability of the latest equipment with a nationally recognized level of expertise, providing students with a quality education and excellent professional opportunities following graduation.

Lübeck, Germany

Founded in A.D. 1134, Hansestadt Lübeck is among the few European cities whose Middle Ages appearance is still intact. In 1987, a portion of the old part of town was declared a UNESCO World Heritage Site and was included in the list of the cultural and natural heritage of the world.

Located in the German state of Schleswig-Holstein on the Baltic Sea, this city of approximately 210,000 offers a variety of attractive cultural and recreational opportunities, especially for young people. Considered the "Cultural Capital of the North," Lübeck offers a lively art scene with the Engelswisch Art Centre, Overbeck-Gesellschaft and Kunsthaus, and gallery of Metta Linde. Lübeck is the main venue for the world-famous Schleswig-Holstein Music Festival, and its Northern Film Days turn Lübeck into the film capital of northern Europe. The adjacent Baltic resort of Travemünde offers beaches and night life.

Electrical Engineering
MSOE Students at Lübeck
Junior Year

FIRST SEMESTER

		Lecture Hours	*Lab Hours*
EE-370	Control Systems	6	
EE-311	Analog Electronics II	2	2
EE-401/421	Principles of Communication I	4	1
	Microwaves I (EE Elective)	3	1
EE-303	Tutorials on Signal Analysis	2	
	Humanities/Social Sciences	4	
	German Language and Culture	4	2
	Total Hours	**31**	

SECOND SEMESTER

	Controls Laboratory		2
EE-474	Stored Program Control Systems	3	1
EE-424	Principles of Communication II	4	1
	Microwaves II (EE Elective)	3	1
EE-383	Computer-Aided Design	4	2
	Humanities/Social Sciences	4	
	German Language and Culture	4	2
	Total Hours	**31**	

All MSOE EE students who wish to study in Lübeck during their junior academic year must take EE-310 during their sophomore year before going to Germany. This can be accommodated by delaying taking PH-250 until returning to MSOE for the senior year.

The indicated hours are in the context of the normal time allocation for courses of study at Lübeck, and are not an indication of MSOE credit hours.

MSOE Students Back at MSOE
Senior Year

FALL QUARTER

		Credits
EE-407	Senior Design I	3
EE-392	Digital Systems Design	4
EE-412	Electronic System Design	4
MA-330	Vector Analysis	3
PH-250	Modern Physics	4
	Total Credits	**18**

WINTER QUARTER

EE-408	Senior Design II	3
EE-340	Electromechanical Energy Conversion	4
EE-320	Electric and Magnetic Fields	4
PH-360	Physics of Electronics	4
GE-300	Career and Professional Guidance	1
	Total Credits	**16**

SPRING QUARTER

EE-409	Senior Design III	3
EE-393	VLSI Design	4
HU-432	Ethics	3
IE-423	Engineering Economy	3
MS-331	Business Law	3
	Total Credits	**16**

- Students who have taken one or more of the above courses before going to Germany should consult with the EE program director.
- ME-354 will be waived for MSOE students studying in Lübeck in order to accommodate the PH-250/360 sequence.
- SS-461 will be waived for MSOE students to make room for MS-331.

WINTER QUARTER

		Credits
EE-422	Digital Signal Processing I	3
EE-481	Fuzzy Logic Control	3
GE-460	Quality in Electronic Systems	3
CS-250	Introduction to Object-Oriented Programming	3
	HU/SS Elective	3
EE-408	Supplemental	0
	Total Credits	**15**

SPRING QUARTER

EE-423	Digital Signal Processing II	3
EE-393	VLSI Design	4
PH-324	Optical Fibers and Sensors	3
	HU/SS Elective	3
	HU/SS Elective	3
EE-409	Supplemental	0
	Industry Seminar	0
	Total Credits	**16**

SUMMER QUARTER

During the combined Summer/Fall Quarters, Lübeck students will do their Diploma Design Project, which is reasonably equivalent to MSOE's Senior Design Project.

Note: For every MSOE credit a Lübeck student should normally allocate a minimum of three hours per week to allow for the fulfillment of all class requirements.

Bachelor of Science
Electrical Engineering Technology

Program Director:
Dr. Edward W. Chandler
Office: S-306
Phone: (414) 277-7337
Fax: (414) 277-7465
E-mail: chandler@msoe.edu
Web site: www.msoe.edu/eecs/et/

The prominence of electrical and electronic products in today's society is increasing dramatically. Wireless communications, personal computers, efficient electrical vehicles and high-definition television are just a few examples of exciting high-technology areas. Electrical engineering technology graduates are prepared to join industry in these and many other areas.

Important Notice Concerning the Electrical Engineering Technology Program

The electrical engineering technology (EET) program at MSOE is a "+2 EET" (junior/senior years) program. No new-to-college freshman students are being admitted into the EET program. Transfer students and returning former MSOE EET students are eligible for admission.

Students who have graduated with an associate in/of applied science degree in electrical/electronics engineering technology from an institution with which MSOE has a transfer agreement in EET, and who meet the EET program admission requirements at MSOE, will be accepted into the EET program with junior standing.

Those with other AAS degrees are also encouraged to apply. Applicants who are accepted may be required to complete prerequisite course work at other college campuses. A transition plan into the BS-EET program will be developed with an EET program adviser. The transition plan will identify the prerequisites to be fulfilled in order to establish junior standing in the EET program. Students who are enrolled/plan to be enrolled in a two-year college in the Wisconsin Technical College System should consult the EET program information on the MSOE EET Web site.

Program Goals

The electrical engineering technology program at MSOE implements the mission of the university by fostering the personal and professional growth of its students, resulting in competent and effective contributors to engineering technology and society as a whole. The philosophy of the educational approach in this program is implemented using an inductive, experienced-based learning methodology that unites theory with practice. The technical and educational content of the program is kept current through input from appropriate constituencies. This program is accessible on both a full- and part-time basis to transfer students.

To that end, electrical engineering technology program graduates will:

- have demonstrated knowledge of mathematics, the basic sciences, and the elements of engineering sciences as they apply to electrical engineering technology
- have demonstrated problem solving, analytical, simulation, design, laboratory and teamwork skills with application to electrical, electronic, and computer components, circuits and systems
- have the preparation and an understanding of the importance to continue their education, both formally and informally, throughout their careers
- have demonstrated oral and written communication skills, especially in conveying technical information
- have an understanding of professional and ethical responsibilities as applied to both engineering technology and society as a whole

The Electrical Engineering Technology (EET) Curriculum

The EET curriculum is focused on an experience-based learning style and, hence, most of the engineering technology and science courses have an associated laboratory. The electrical engineering technology program generally appeals to students who learn best by experiencing what they are learning (hands-on), who prefer the use of specific examples to help them learn the overall general concepts, and who favor the use of physical concepts to clarify mathematics.

Students in this EET program typically begin at the junior level. As students progress through the curriculum, the mathematics and science (physics and chemistry) courses, as well as previous engineering technology courses, lead into the more advanced engineering technology courses. This curricular approach fits well with the experience-based learning style and allows the student to reach and cover many advanced electrical and electronic topics such as:

- electrical and electronic circuit design
- electronic signal representation and application to electronic circuits using Fourier Series, Laplace Transforms and Fourier Transforms
- electronic communications including transmission lines, signal integrity, and data communications

- electromagnetic fields including an introduction to EMI (electromagnetic interference)
- control of systems using feedback
- use of computer software tools and advanced computer programming digital- and microprocessor-based design

In addition to the breadth of these electrical topics, which are an integral part of the curriculum, the student takes a two-course senior project sequence in the senior year. The senior project areas are offered based on student voting in the previous year (in the course GE-300). In the senior project, the student obtains a deeper understanding of the theory and applications in that topical area. Popular topical areas include analog and digital electronics, computer hardware and software, electronic communications, and industrial electronics and controls.

Careers in Electrical Engineering Technology

Graduates of the electrical engineering technology program enter a variety of industries, such as:

aerospace	electronics and controls
automation	industrial equipment
automotive	instrumentation
communications	medical
computers	power generation and distribution

Graduates of the program are inclined to enter industry in positions that involve:

- developing, designing or improving components and products
- applications of engineering and technology to new and existing products, such as in applications engineering, field service or technical sales
- manufacturing, testing or quality assurance of products

A few examples of industrial projects that program graduates have been involved with:

- design and control of AC motor drive systems
- establishment of wireless communications services in communities
- design of RF (radio frequency) and microwave electronic circuits
- testing products for electromagnetic interference
- developing software for instrumentation and controls
- design or modification of digital- and/or microprocessor-based systems

2 + 2 Transfer Option

A new opportunity has been developed in cooperation with the Wisconsin Technical College System. Graduates from an Associate of Applied Science degree program in Electrical Engineering Technology (who meet specific conditions listed later in this section) at several Wisconsin Technical Colleges may transfer into the junior year of MSOE's Bachelor of Science in Electrical Engineering Technology (BS-EET) program.

This opportunity not only provides associate degree graduates with the education and skills they need for employment in today's fast-paced electronics industry, but also enables them to extend their education with study toward a BS-EET degree without losing credit for work already completed at the technical college.

This 2 + 2 program enables an EET associate degree graduate from a college in the Wisconsin Technical College System to be admitted with junior status into MSOE's Bachelor of Science in Electrical Engineering Technology (BS-EET) program if the graduate meets the following conditions:

- Has successfully completed all courses in the Associate of Applied Science in Electrical Engineering Technology program with a grade of C or better (not C-) in each course;
- Has successfully completed any other specified courses, per the transfer agreement at the technical college, with a grade of C or better (not C-) in each course; and
- Meets the MSOE admission requirements for transfer students into the BS-EET program, with a cumulative GPA of 2.75 or greater for full acceptance (GPA of 2.50 to 2.74 for acceptance on probationary status).

Consult the EET program Web page on the MSOE Web site (www.msoe.edu) for a current list of transfer agreements with colleges in the Wisconsin Technical College System.

Advice for Other Transfer Students

Students whose previous formal education has been gained through a technical, community or junior college are required to consult with the Admission Office at MSOE about credit transfer. Consultation with an electrical engineering technology program adviser is required to plan a transition schedule around their previously completed and qualifying academic experience.

A student who plans to transfer from another college into the program at some future date is encouraged to correspond with the Admission Office at MSOE. The student will be assisted in coordinating, as closely as possible, courses to be taken at another institution of higher education with those courses that are part of the graduation requirements at MSOE. The MSOE philosophy of individual attention to each student is a major factor in making a successful academic transition possible.

Bachelor of Science
Electrical Engineering Technology
Model Full-Time +2 EET Curriculum Track – V7.0

		QUARTER		
		FA	WI	SP
MA-227	Differential Equations	3-0-3		
ET-3051	Signals, Circuits, and Systems I	3-2-4		
OR-307S	Transfer Orientation Seminar	0		
CH-310	Applied Chemistry	3-2-4		
EG-122	Engineering Graphics and Visualization	1-3-2		
SS-461	Organizational Psychology[2]	3-0-3		
	TOTAL	**13-7-16**		
EN-333	Applied Technical Communication[1]		3-2-4	
ET-3000	Linear Circuit Design[1]		3-2-4	
ET-3801	C++ Programming		3-2-4	
HU-100	Contemporary Issues		3-0-3	
GE-300	Career and Professional Guidance		0-2-1	
	TOTAL		**12-8-16**	
ET-3060	Signals, Circuits, and Systems II			4-0-4
ET-3100	Electronic Circuit Design			3-2-4
ET-3201	Electromagnetic Fields Concepts			4-0-4
ET-3900	Design of Logic Systems			3-2-4
	TOTAL			**14-4-16**
ET-4620	Data Communications	4-0-4		
PH-361	Physics of Materials	3-2-4		
ET-4710	Feedback Control Systems and Circuits	3-2-4		
ET-4601	Quality in Electronic Systems	3-0-3		
IE-423	Engineering Economy[2]	3-0-3		
	TOTAL	**16-4-18**		
ET-4261	Transmission Lines		3-2-4	
MT-4501	Mechanics		3-0-3	
ET-4001	Senior Project I		3-2-4	
MS-4801	Project Management		3-0-3	
HU-4XX	Humanities Elective[2]		3-0-3	
	TOTAL		**15-4-17**	
ET-4250	Electromagnetic Field Applications			3-2-4
MT-4511	Thermodynamics and Heat Transfer			3-0-3
ET-4002	Senior Project II			3-2-4
HU-432	Ethics for Professional Managers and Engineers			3-0-3
HU-4XX	Humanities Elective[2]			3-0-3
	TOTAL			**15-4-17**

[1] Coordinated presentations.
[2] Scheduled after consultation with an EET adviser.

Accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700).

Bachelor of Science
Electrical Engineering Technology
Model Part-Time +2 EET Curriculum Track – V7.0

		QUARTER			
		FA	WI	SP	SU
MA-227	Differential Equations	3-0-3			
ET-3051	Signals, Circuits, and Systems I	3-2-4			
OR-307S	Transfer Orientation Seminar	0			
EN-333	Applied Technical Communication[1]		3-2-4		
ET-3000	Linear Circuit Design[1]		3-2-4		
ET-3060	Signals, Circuits, and Systems II			4-0-4	
ET-3100	Electronic Circuit Design			3-2-4	
CH-310	Applied Chemistry	3-2-4			
EG-122	Engineering Graphics and Visualization	1-3-2			
ET-3801	C++ Programming		3-2-4		
HU-100	Contemporary Issues		3-0-3		
ET-3201	Electromagnetic Fields Concepts			4-0-4	
ET-3900	Design of Logic Systems			3-2-4	
ET-4620	Data Communications	4-0-4			
PH-361	Physics of Materials	3-2-4			
ET-4261	Transmission Lines		3-2-4		
MT-4501	Mechanics		3-0-3		
GE-300	Career and Professional Guidance		0-2-1		
ET-4250	Electromagnetic Field Applications			3-2-4	
MT-4511	Thermodynamics and Heat Transfer			3-0-3	
ET-4710	Feedback Control Systems and Circuits	3-2-4			
ET-4601	Quality in Electronic Systems	3-0-3			
ET-4001	Senior Project I		3-2-4		
MS-4801	Project Management		3-0-3		
ET-4002	Senior Project II			3-2-4	
HU-432	Ethics for Professional Managers and Engineers			3-0-3	
HU-4XX	Humanities Elective[2]				3-0-3
HU-4XX	Humanities Elective[2]				3-0-3
IE-423	Engineering Economy[2]				3-0-3
SS-461	Organizational Psychology[2]				3-0-3

[1] Coordinated presentations.
[2] Scheduled after consultation with an EET adviser.

Accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700).

Bachelor of Science
Software Engineering

Program Director:
Dr. Mark J. Sebern
Office: CC-27
Phone: (414) 277-7213
Fax: (414) 277-7465
E-mail: sebern@msoe.edu
Web site: www.msoe.edu/eecs/se/

Software engineering is the application of engineering concepts, techniques and methods to the development of software systems. A software engineering program develops engineering professionals with a mastery of software development theory, practice and process.

Software engineering is based on computer science in the same way other engineering disciplines are based on natural or life sciences. However, it adds an emphasis on issues of process, design, measurement, analysis and verification, providing a strong foundation in engineering principles and practice as applied to software development.

Software engineering students gain knowledge and skill in all aspects of the software development life cycle, including requirements elicitation and analysis, software architecture, design, construction and verification/validation. They learn to work within and to continuously improve a defined software development process, with the aim of producing high-quality software predictably and efficiently. To provide a basis for this software engineering practice and process, students are grounded in the fundamentals of computer science, including data structures, algorithms, formal methods and operating systems.

Program Goals

The software engineering program at MSOE implements the university's mission by facilitating the personal and professional growth of its students so they can become effective contributors to the engineering profession and to society as a whole.

Graduates of the software engineering program will:

- be able to unite theory with practice, be prepared and motivated to engage in lifelong learning, and have a solid foundation in mathematics and science
- be productive practitioners skilled in applying engineering process and practice to software components and systems
- be proficient in oral and written communication, and effective in team work
- actively demonstrate professional and ethical responsibility
- have the broad education and awareness of contemporary issues necessary to understand the societal and global impact of their profession

Curriculum

MSOE prides itself on uniting theory with industry practice, in both classroom and laboratory activities. Software practice and process are emphasized throughout the curriculum. The software development laboratory provides experience in various roles, working on large-scale projects using software engineering tools and techniques. In the senior design sequence, software engineering students work in teams to complete a major project. Often project ideas originate in industry, where many students work as interns.

Software is a critical component of many different types of products and systems, in fields such as consumer electronics, transportation, health care, communications, finance, manufacturing, entertainment, government and education. To work effectively and collaboratively in one of these application areas, a software engineer must become familiar with its body of knowledge, practices and vocabulary. Each software engineering student demonstrates an ability to do this by completing a sequence of elective courses in a chosen "application domain" field. Since many software engineers develop computer systems that are embedded into other products, from cellular telephones to medical devices to vehicle controls, the software engineering program incorporates a sequence of computer engineering courses in hardware and software design of microprocessor-based systems.

Because of the inherently social nature of contemporary software development, communication skills and teamwork are stressed. Course work and projects provide many opportunities to develop proficiency in writing, oral presentation and project management.

Bachelor of Science
Software Engineering
Model Full-Time Track – V2.0

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
CS-182	Computer Programming	3-3-4		
EN-131	Composition	3-0-3		
GE-110	Introduction to Engineering Concepts	2-2-3		
MA-136	Calculus for Engineers I	4-0-4		
MS-221	Microeconomics	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
CS-183	Software Design		3-3-4	
EN-132	Technical Composition		3-0-3	
MA-137	Calculus for Engineers II		4-0-4	
PH-110	Physics of Mechanics		3-2-4	
CH-200	Chemistry I			3-2-4
EN-241	Speech			2-2-3
HU-100	Contemporary Issues in the Humanities			3-0-3
MA-231	Calculus for Engineers III			4-0-4
MA-262	Probability and Statistics			3-0-3
	TOTALS	**16-5-17**	**13-5-15**	**15-4-17**

SOPHOMORE YEAR		4	5	6
CS-285	Data Structures	2-2-3		
MA-232	Calculus for Engineers IV	3-0-3		
MA-235	Differential Equations for Engineers	4-0-4		
PH-230	Physics of Electricity and Magnetism	3-3-4		
SE-283	Introduction to Software Verification	2-2-3		
EE-201	Linear Networks: Steady State Analysis		4-0-4	
EE-290	Combinational and Sequential Logic		3-3-4	
MA-343	Matrix Methods and Linear Programming		3-0-3	
SE-280	Software Engineering Process		2-2-3	
	Elective (HU/SS)[2]		3-0-3	
CS-280	Embedded Systems Software			3-2-4
MA-230	Discrete Mathematics			4-0-4
PH-220	Physics of Heat, Wave Motion, and Optics			3-3-4
SE-281	Software Component Design			3-2-4
	TOTALS	**14-7-17**	**15-5-17**	**13-7-16**

JUNIOR YEAR		QUARTER 7	QUARTER 8	QUARTER 9
CS-385	Algorithms	3-2-4		
CS-386	Introduction to Database Systems	2-2-3		
IE-423	Engineering Economy	3-0-3		
SE-3821	Software Requirements and Specification	3-2-4		
	Elective (HU/SS)[2]	3-0-3		
CS-384	Design of Operating Systems		3-2-4	
OR-402	Professional Guidance		1-0-1	
SE-3091	Software Development Laboratory I		1-3-3	
SE-380	Principles of Software Architecture		3-2-4	
	Elective (HU/SS)[2]		3-0-3	
CS-391	Embedded Computer System Design			3-3-4
HU-432	Ethics for Professional Managers and Engineers			3-0-3
SE-3092	Software Development Laboratory II			1-3-3
SE-3811	Formal Methods			2-2-3
	Application Domain Elective[2]			3-0-3
	TOTALS	**14-6-17**	**11-7-15**	**12-8-16**

SENIOR YEAR		10	11	12
CS-409	Ethical and Professional Issues in Computing	1-0-1		
SE-4093	Software Development Laboratory III	1-3-3		
	Math/Science Elective[2]	3-0-3		
	Elective (HU/SS)[2]	3-0-3		
	Application Domain Elective[2]	3-0-3		
	Free Elective[2]	3-0-3		
CS-381	Engineering Systems Analysis with Numerical Methods		3-2-4	
SE-400	Senior Design Project I		3-0-3	
SE-4831	Software Quality Assurance		2-2-3	
	Program Elective[2]		3-0-3	
	Application Domain Elective[2]		3-0-3	
MS-442	Management in the Era of Rapid Technological Change			3-0-3
SE-401	Senior Design Project II			3-0-3
SS-461	Organizational Psychology			3-0-3
	Program Elective[2]			3-0-3
	Elective (HU/SS)[2]			3-0-3
	TOTALS	**14-3-16**	**14-4-16**	**15-0-15**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to complete OR-301 Transfer Student Orientation.

[2] There are 36 credits of elective subjects in the software engineering program which must be taken as follows:
- 15 credits of humanities and social sciences: 6 credits of humanities (HU), 6 credits of social sciences (SS), and 3 credits of humanities or social sciences.
- 6 credits of approved program electives.
- 3 credits of an approved math/science elective.
- 9 credits of approved application domain electives.
- 3 credits of an upper-division course from any area.

Engineering technology courses may not be used to satisfy requirements of the software engineering curriculum. Students in Air Force ROTC may make the following substitutions in the software engineering program: AF-300 for MS-442 and AF-401 for SS-455 (a social science elective).

General Studies Department

Main Office: Walter Schroeder Library, L-326
Phone: (414) 277-7351
Fax: (414) 277-7462

The General Studies Department is responsible for administering and providing core courses for the Bachelor of Arts/Science in Technical Communication degree. In addition, the department is primarily responsible for offering courses in the humanities, social sciences, English and engineering graphics. These offerings include both fundamental and advanced courses to develop and enrich students so they might become more sensitive to and fully aware of themselves and others.

Faculty:

Chairman:
Dr. R. David Kent

Department Administrative Assistant:
Sharisse M. Lussier

Professors:
Marvin L. Bollman, Joanne M. Dyskow, Dr. Roger J. Frankowski, Robert L. Kleppin

Associate Professors:
Gary C. Boelkins, Dr. Jon K. Borowicz, James W. Friauf, Dr. R. David Kent, Dr. Katherine Wikoff

Assistant Professors:
Brian E. Bennett, Dr. Harry Rollings III, Dr. Carma Stahnke

Adjunct Professors:
Patrick J. Coffey, Veronica S. Haggerty, Kenneth McAteer, Joseph P. Meloy, Leonard A. Vanden Boom

Adjunct Associate Professors:
Dr. Donald Ashby, Virginia K. Reinmuller

Adjunct Assistant Professors:
Elizabeth A. Albrecht, Dianne L. Weber

Lecturers:
Martha J. Ammermann, Michael Bell, Pauli Taylor-Boyd, James Brierly, Mary S. Briggs, Sara L. Cissna, Cathleen R. Cochrane, J. Kate Dawson, Gary L. Dobson, Sandra L. Gruhle, Susan K. Hoerchner, Cynthia Kotlarek, Se Eun Krainz, Robert Krueger, Sally S. Kubly, Mary Nielsen, Dr. John Penglase, Brooke Brokaw Ruddy, Jeffery Sachse, Robert Scholz, Rebekah Sneed, Mary Spencer, Lucinda M. Staudacher, Jerry C. Stemkoski

Professors Emeriti:
Susannah P. Locke, Mary Ann Perdue, Dr. Constantin Popescu, Judith L. Steininger

General Studies Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
Engineering Graphics Elective				
EG-460	Modern Engineering Tolerancing	3	0	3
Humanities and Social Sciences Electives (HU/SS)				
Language Series				
HU-410	Foreign Language I	2	2	3
HU-411	Foreign Language II	2	2	3
HU-412	Foreign Language III	2	2	3
HU-413	Foreign Language IV	3	0	3
HU-414	Foreign Language V	3	0	3
Literature Series				
HU-420	Classical Derivatives	3	0	3
HU-421	Literary Genres	3	0	3
HU-422	British Literature	3	0	3
HU-423	American Literature	3	0	3
HU-425	Contemporary Literature	3	0	3
HU-426	Survey of Third World Literature	3	0	3
HU-427	Oriental Literature	3	0	3
HU-428	Classics in Literature	3	0	3
HU-429	Literature of American Minorities	3	0	3
Philosophy Series				
HU-430	Epistemology	3	0	3
HU-431A	Formal Logic	3	0	3
HU-431B	Informal Logic	3	0	3
HU-433	Philosophy	3	0	3
HU-434	Existentialism	3	0	3
HU-435	Philosophy of Religion	3	0	3
HU-436	Metaphysics	3	0	3
HU-437	Praxiology	3	0	3
HU-438	Aesthetics	3	0	3
HU-439	Philosophy of Technology	3	0	3
History Series				
HU-440	Global History I-World to 1500	3	0	3
HU-441	Global History II-World Since 1500	3	0	3
HU-442	Modern European History	3	0	3
HU-443	Russian History	3	0	3
HU-444	United States History	3	0	3

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
Political Science Series				
SS-453	American Government	3	0	3
SS-454	Political Science	3	0	3
SS-455	International Relations	3	0	3
SS-456	Public Policy in Urban America	3	0	3
SS-457	Current Affairs	3	0	3
Psychology Series				
SS-461	Organizational Psychology	3	0	3
SS-462	Intro to Human Development	3	0	3
SS-464	Human Factors in Engineering and Design	2	2	3
SS-466	Abnormal Psychology	3	0	3
Sociology Series				
SS-415	Cultural Dimensions	3	0	3
SS-471	Sociology	3	0	3
SS-472	Social Problems	3	0	3
SS-473	World Societies	3	0	3
SS-474	The Family	3	0	3
SS-475	Addictions and Compulsions	3	0	3
SS-476	Death and Dying	3	0	3
Fine Arts Series				
HU-485	Fine Arts	3	0	3
HU-486	Theater Arts	3	0	3
HU-487	Visual Arts	3	0	3
Optional Electives				
SS-492	Educational Methods	3	0	3
HU-494	Creative Thinking	3	0	3
HU-495	Selected Studies	3	0	3
SS-495	Selected Studies	3	0	3

Foreign Language Courses at MSOE

Enrollment in Foreign Language Courses

1) A student may not enroll in a foreign language course if that foreign language is spoken in the student's home.

2) A student who has had one year of a specific language in high school may enroll in the introductory language course. Students having two years of a specific language in high school must begin at the second language course. For each additional year of language in high school, a student must begin at a correspondingly higher level.

Fulfillment of HU Elective Credit

1) Students enrolling in a beginning language course (designated by the Roman numeral "I") must enroll in and successfully complete two quarters of language courses in order to receive HU credit for the beginning course. If a student were to take German I, for example, but not German II, the three credits would be tabulated in the student's grade point average, but the credit would not apply toward the fulfillment of HU electives.

2) A student who is placed in "Foreign Language II" or "Foreign Language III" will receive three credits of HU elective credit for that course without completing another sequential course.

3) A student placed in "Foreign Language II" or "Foreign Language III" will not receive credit for more fundamental language courses.

4) Taking two quarters of the same foreign language does satisfy HU series obligations.

Bachelor of Science or Bachelor of Arts
Technical Communication

Program Director:
Dr. Katherine Wikoff
Office: L-323
Phone: (414) 277-4542
Fax: (414) 277-7462
E-mail: wikoff@msoe.edu

The field of technical communication is a logical extension of the rapid growth in technology and the resulting need to communicate development not only to persons within the scientific and technical community, but also to the general public. Individuals in this field creatively express ideas and accomplishments of industry, business and other institutions through a variety of manuals, pamphlets, brochures, visually assisted oral presentations and the mass media. Consequently, individuals in this field have aptitude and education in both the humanities and the sciences, and are able to relate readily to people on many levels.

The degree in technical communication at MSOE is designed to provide students with the following:

- a core liberal arts program in humanities and social sciences
- courses in the major area which will allow students to design and produce both written documents and oral presentations for business, industry and institutions
- literacy in basic engineering, mathematics, physical science, computers and business

Program Goals

The primary goals of the program are to produce students who are capable of the following:

- developing, designing and distributing written documents and oral presentations conveying technical material for business, industry and other institutions
- understanding communication theory in order to assist business, industry and other institutions with developing management tools related to the flow of information within an organization
- acting as a link between the expertise of technical personnel and the needs of the various audiences of industry, business and other institutions
- pursuing graduate study in areas related to communication

Potential employment in a wide variety of fields is available to graduates of the program because of the scope of the degree. Typical employment opportunities for graduates include engineering firms, government, health field services, banking and other financial institutions, insurance companies, public relations firms, and the mass media such as television or radio.

The bachelor of arts degree requires five (5) quarters of a foreign language.

A bachelor of science degree option is available in this program. Upon consultation with the program director, a student may choose to select 15 credits of technical electives in place of 15 credits of a foreign language, which would result in the bachelor of science degree.

Bachelor of Science
Technical Communication
Model Full-Time Track – V4.2

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MA-126	Trigonometry	4-0-4		
MT-1201	Materials and Processes	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
TC-151	Theory of Communication	3-0-3		
CH-103	Principles of Chemistry		3-2-4	
EN-241	Speech		2-2-3	
MA-127	College Algebra II		4-0-4	
MS-184	Intro to Computer Methods and Applications		3-0-3	
TC-111	Intro to Technical Communication		2-0-2	
EG-103	Technical Drawing and Visualization			3-2-4
HU-431B	Informal Logic			3-0-3
HU-494	Creative Thinking			3-0-3
MS-221	Microeconomics			3-0-3
TC-172	Information Processing			2-2-3
	TOTALS	**17-0-16**	**14-4-16**	**14-4-16**

SOPHOMORE YEAR		4	5	6
HU-440	Global History I	3-0-3		
MS-273	Web Site Design Basics	3-0-3		
MS-322	Macroeconomics	3-0-3		
PH-113	College Physics I	3-3-4		
SS-453	American Government	3-0-3		
EN-342	Group Discussion		3-0-3	
HU-441	Global History II		3-0-3	
TC-233	Introduction to Report Writing/Proposal Writing		4-0-4	
TC-261	Research Methods		3-0-3	
	Elective (HU/SS)[2]		3-0-3	
MT-151	Applications of M.E. Technology			3-0-3
PH-123	College Physics II			3-2-4
TC-242	Persuasive Speech			3-0-3
	Elective (HU/SS)[2]			3-0-3
	Elective (HU/SS)[2]			3-0-3
	TOTALS	**15-3-16**	**16-0-16**	**15-2-16**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to satisfactorily complete OR-301 Transfer Student Orientation.

[2] There are 36 credits of electives in the BS technical communication program, which must be taken as follows:
- 12 credits from the field of humanities and social sciences (HU/SS): 6 credits from the humanities, 6 credits from the social sciences.
- 3 credits from management systems
- 6 credits from mathematics, science, engineering, computer science or engineering technology.
- 15 credits from any of the computer science, engineering, engineering technology, science, mathematics, or management systems.

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
CS-150	Intro. to Engineering Computing	2-2-3		
ET-351	Survey of Communication Circuits	2-2-3		
MS-331	Business Law	3-0-3		
TC-321	Visual Design Techniques	3-2-4		
TC-453	Intercultural Communication	3-0-3		
ET-1520	Electric Circuits		3-2-4	
SS-461	Organizational Psychology		3-0-3	
TC-332	Advanced Technical Writing		3-0-3	
TC-351	Organizational Communication		3-0-3	
	Technical Elective[2]		3-0-3	
MA-340	Business Statistics			4-0-4
TC-342	Professional Presentation Techniques			2-2-3
TC-381	Marketing Communications			3-0-3
TC-452	Interpersonal Communication			3-0-3
	Technical Elective[2]			3-0-3
	TOTALS	**13-6-16**	**15-2-16**	**15-2-16**

SENIOR YEAR		**10**	**11**	**12**
BE-352	Survey of Biomedical Engineering	3-0-3		
HU-432	Ethics for Professional Managers & Engineers	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-371	Introduction to Unix Operating Systems	2-2-3		
TC-432	Writing & Editing for Publication	3-0-3		
TC-451	Mass Communication	3-0-3		
TC-499	Internship		6-0-6	
	Elective (HU/SS)		3-0-3	
	Technical Elective[2]		3-0-3	
	Technical Elective[2]		3-0-3	
	Technical Elective[2]		3-0-3	
IE-340	Project Management			3-0-3
SS-415	Cultural Dimensions			3-0-3
OR-402	Professional Guidance			1-0-1
	Business & Management Systems Elective[2]			3-0-3
	Technical Elective[2]			3-0-3
	Technical Elective[2]			3-0-3
	TOTALS	**17-2-18**	**18-0-18**	**16-0-16**

* The difference between the BS and BA degrees in technical communication is that students in the BA program take 15 credits of a foreign language in place of 15 credits of technical electives.

* Students in the Air Force ROTC may take the following substitutions in the above program: AF-300 and AF-302 for technical electives; AF-301 for SS 461; AF-400 for SS-471; AF-401 for SS-455; and AF-402 for MS-331. Other AF courses must be taken in addition to the above program and do not count as electives.

Bachelor of Arts
Technical Communication
Model Full-Time Track – V4.2

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MA-126	Trigonometry	4-0-4		
MT-1201	Materials and Processes	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
TC-151	Theory of Communication	3-0-3		
CH-103	Principles of Chemistry		3-2-4	
CS-150	Intro to Engineering Computing		2-2-3	
EN-241	Speech		2-2-3	
MA-127	College Algebra II		4-0-4	
TC-111	Intro to Technical Communication		2-0-2	
EG-103	Technical Drawing and Visualization			3-2-4
HU-494	Creative Thinking			3-0-3
MS-184	Intro to Computer Methods and Applications			3-0-3
MS-221	Microeconomics			3-0-3
TC-172	Information Processing			2-2-3
	TOTALS	**17-0-16**	**13-6-16**	**14-4-16**
SOPHOMORE YEAR		**4**	**5**	**6**
HU-440	Global History I	3-0-3		
MS-273	Web Site Design Basics	3-0-3		
MS-322	Macroeconomics	3-0-3		
PH-113	College Physics I	3-3-4		
HU-410	Foreign Language I[2]	2-2-3		
EN-342	Group Discussion		3-0-3	
HU-441	Global History II		3-0-3	
TC-233	Intro to Report Writing/Proposal Writing		4-0-4	
TC-261	Research Methods		3-0-3	
HU-411	Foreign Language II[2]		2-2-3	
HU-431B	Informal Logic			3-0-3
MT-151	Applications of M.E. Technology			3-0-3
PH-123	College Physics II			3-2-4
HU-412	Foreign Language III[2]			2-2-3
	Elective (HU/SS)[3]			3-0-3
	TOTALS	**14-5-16**	**15-2-16**	**14-4-16**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to satisfactorily complete OR-301 Transfer Student Orientation.

[2] Students may receive a BS degree by substituting 15 technical elective credits for the required foreign language. The difference between the BS and BA degrees in technical communication is that students in the BA program take 15 credits of a foreign language in place of 15 credits of technical electives.

[3] See next page.

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MS-331	Business Law	3-0-3		
MS-371	Introduction to Unix Systems	2-2-3		
TC-321	Visual Design Techniques	3-2-4		
TC-453	Intercultural Communication	3-0-3		
HU-413	Foreign Language IV[2]	3-0-3		
ET-1520	Electric Circuits		3-2-4	
MA-340	Business Statistics		4-0-4	
TC-332	Advanced Technical Writing		3-0-3	
TC-351	Organizational Communication		3-0-3	
HU-414	Foreign Language V[2]		3-0-3	
TC-242	Persuasive Speech			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
TC-381	Marketing Communication			3-0-3
TC-452	Interpersonal Communication			3-0-3
	Elective (HU/SS)[3]			3-0-3
	Technical Elective[3]			3-0-3
	TOTALS	**14-4-16**	**16-2-17**	**17-2-18**

SENIOR YEAR		**10**	**11**	**12**
BE-352	Survey of Biomedical Engineering	3-0-3		
ET-351	Survey of Communication Circuits	2-2-3		
HU-432	Ethics for Professional Managers & Engineers	3-0-3		
MS-354	Principles of Accounting	3-0-3		
TC-432	Writing & Editing for Publication	3-0-3		
TC-451	Mass Communication	3-0-3		
SS-453	Survey of American Government		3-0-3	
TC-499	Internship		6-0-6	
	Elective (HU/SS)[3]		3-0-3	
	Elective (HU/SS)[3]		3-0-3	
IE-340	Project Management			3-0-3
OR-402	Professional Guidance			1-0-1
SS-461	Organizational Psychology			3-0-3
SS-415	Cultural Dimensions			3-0-3
	Business and Management Systems Elective[3]			3-0-3
	Technical Elective[3]			3-0-3
	TOTALS	**17-2-18**	**15-0-15**	**16-0-16**

[3] There are 21 credits of electives in the BA in technical communication program, which must be taken as follows:
- 12 credits from the field of humanities and social sciences: 6 credits from the humanities and 6 credits from the social sciences.
- 3 credits from management systems.
- 6 credits from mathematics, science, engineering, engineering technology, computer science or management systems.

* Students in the Air Force ROTC may take the following substitutions in the above program: AF-300 and AF-302 for Technical Electives; AF-301 for SS 461; AF-400 for SS-471; AF-401 for SS-455; and AF-402 for MS-331. Other AF courses must be taken in addition to the above program and do not count as electives.

Bachelor of Science
Technical Communication – 2 + 2 Degree

The 2 + 2 degree program in technical communication offered by MSOE is designed for individuals with an associate degree in applied science. This program is an excellent opportunity for those individuals with technical aptitude whose career goals are in technical communication, technical training or technical writing. The 2 + 2 program also will be attractive to individuals performing technical writing duties but lacking an academic background in writing and communication.

Graduates with a two-year associate degree in applied science, business or science may transfer with junior standing and expect a full two years of advanced credit. In some cases, advanced undergraduate standing in technical course work can be considered in lieu of an associate degree. Prerequisite subjects, if needed, may be scheduled.

Bachelor of Science
Technical Communication - 2 + 2 Degree[1]
Model Full-Time Track – V3.1

THIRD YEAR		7	8	9
		----------QUARTER----------		
EN-241	Speech	2-2-3		
HU-100	Contemporary Issues	3-0-3		
HU-440	Global History I	3-0-3		
MS-221	Microeconomics	3-0-3		
OR-301	Transfer Student Orientation	1-0-0		
SS-453	American Government	3-0-3		
TC-151	Theory of Communication	3-0-3		
HU-441	Global History II		3-0-3	
OR-402	Professional Guidance		1-0-1	
TC-111	Introduction to Technical Communication		2-0-2	
TC-233	Introduction to Report Writing/Proposal Writing		4-0-4	
TC-261	Research Methods		3-0-3	
TC-351	Organizational Communication		3-0-3	
HU-431B	Informal Logic			3-0-3
MS-331	Business Law			3-0-3
SS-415	Cultural Dimensions			3-0-3
TC-172	Information Processing			2-2-3
TC-242	Persuasive Speech			3-0-3
TC-452	Interpersonal Communication			3-0-3
	TOTALS	**18-2-18**	**16-0-16**	**17-2-18**

FOURTH YEAR		10	11	12
MS-354	Principles of Accounting	3-0-3		
TC-321	Visual Design Techniques	3-2-4		
TC-432	Writing and Editing for Publication	3-0-3		
TC-451	Mass Communication	3-0-3		
TC-453	Intercultural Communication	3-0-3		
EN-342	Group Discussion		3-0-3	
HU-432	Ethics for Professional Managers and Engineers		3-0-3	
TC-332	Advanced Technical Writing		3-0-3	
TC-499	Internship		6-0-6	
	Elective (HU/SS)[2]		3-0-3	
HU-494	Creative Thinking			3-0-3
SS-461	Organizational Psychology			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
TC-381	Marketing Communications			3-0-3
	Elective (HU/SS)[2]			3-0-3
	Elective (HU/SS)[2]			3-0-3
	TOTALS	**15-2-16**	**18-0-18**	**17-2-18**

[1] Prerequisite for entrance into this program is an associate degree or the equivalent in applied science, business, or science. Students transfer with junior standing and can expect a full two years of advanced credit. In the majority of cases, subjects, if needed, may be scheduled with added time for completion of the degree. Also, course substitutions will be made when necessary to avoid duplication of coursework taken to complete associate degree requirements.

[2] The three HU/SS electives must be taken as one HU, one SS, and either one HU or one SS.

Minor in Technical Communication

A student enrolled in a degree program at Milwaukee School of Engineering may also earn a Minor in Technical Communication. The design of the course of study is to produce a graduate skilled in the specific discipline and evidencing a competence in the art of communication. Such a graduate would be attractive to business, industry, or government since he/she would possess two highly important talents.

The Minor in Technical Communication requires a minimum of 26 quarter credits in English or technical communication. The following courses or their equivalents are required in the minor:

EN-131	Composition
EN-132	Technical Composition
EN-241	Speech
TC-151	Theory of Communication
TC-242	Persuasive Speech
TC-332	Advanced Technical Writing

Three other technical communication or English courses from the following list are required:

EN-332	Applied Technical Communication
EN-342	Group Discussion
EN-432	Business Communication
EN-441	Professional Presentation Techniques* (Only AE students may take this)
TC-261	Research Methods
TC-321	Visual Design Techniques
TC-342	Professional Presentation Techniques*
TC-351	Organizational Communication
TC-381	Marketing Communication
TC-432	Writing and Editing for Publication
TC-451	Mass Communication
TC-452	Interpersonal Communication
TC-453	Intercultural Communication

* Students taking EN-441 may not take TC-342.

Mathematics Department

Main Office: Walter Schroeder Library, L-326
Phone: (414) 277-7351
Fax: (414) 277-7462

The Mathematics Department offers a variety of required and elective courses to support the numerous degree programs at MSOE. It also provides students the opportunity to earn a Minor in Mathematics.

Faculty:

Chairman:

Dr. Karl H. David

Department Administrative Assistant:

Sharisse M. Lussier

Professor:

George L. Edenharder

Associate Professors:

Dr. Karl H. David, Edward J. Griggs, Dr. Ronald W. Jorgensen, Dr. Yvonne Yaz

Assistant Professor:

James P. Carr

Instructor:

Nancy E. Olmsted

Adjunct Professor:

Dr. Terry A. Nyman

Adjunct Associate Professor:

Dr. Badri Varma

Adjunct Assistant Professor:

William Alford, Dr. Bruce O'Neill

Senior Lecturer:

Dr. Robert R. Rice

Lecturers:

John A. Dudek, Carl C. Edmund, Jane R. Nichols

Professors Emeriti:

Stanley J. Guberud, Dorothy J. Johnson, Janet Klein, Dr. Peter K.F. Kuhfittig, Robert P. Schilleman, Andrew B. Schmirler

Mathematics Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
MA-230	Discrete Mathematics	4	0	4
MA-330	Vector Analysis	3	0	3
MA-343	Matrix Methods & Linear Programming	3	0	3
MA-380	Advanced Differential Equations	3	0	3
MA-381	Complex Variables	3	0	3
MA-382	Laplace Transforms	3	0	3
MA-383	Linear Algebra	3	0	3

MINOR IN MATHEMATICS
V1.0

The Minor in Mathematics is offered to those students who wish to expand their background and understanding of mathematics. A mathematics minor will strengthen a student's specialty, make his or her degree more attractive to potential employers, and/or enhance the preparedness of the student for graduate school.

To qualify for a Minor in Mathematics, a student must take 31 credits in eligible courses. This must include a minimum of 9 credits from the list of approved courses below. Six of these 9 credits must come from courses not specifically required for the student's major and must be earned in residence at MSOE. A minimum GPA of 2.0 is required for mathematics courses counted towards the minor.

For clarification of the extent to which free, technical and math/science electives may be used in fulfilling the requirements, or for more information, interested students should contact the mathematics minor coordinator, Dr. Karl David (Office: L-339, Phone: (414) 277-7374, e-mail: david@msoe.edu).

Required Courses (22 credits)

MA-136 Calculus for Engineers I (4)
MA-137 Calculus for Engineers II (4)
MA-231 Calculus for Engineers III (4)
MA-232 Calculus for Engineers IV (3)
MA-235 Differential Equations for Engineers (4)
MA-262 Probability and Statistics (3)

Approved Courses (9 credits)

MA-230 Discrete Mathematics (4)
MA-330 Vector Analysis (3)
MA-343 Matrix Methods and Linear Programming (3)
MA-380 Advanced Differential Equations (3)
MA-381 Complex Variables (3)
MA-382 Laplace Transforms (3)
MA-383 Linear Algebra (3)
MA-384 Functions of a Real Variable (3)
MA-385 Modern Algebra with Applications (3)
MA-401 Topics in Mathematics (variable credit)

Some of the approved courses are offered every year and some only if there is sufficient interest. There is no guarantee of availability of any particular course in any particular quarter. Future changes in course offerings that will meet the requirements of the minor will be indicated in the appropriate *Timetable of Classes* and the *Undergraduate Academic Catalog*.

Alternatives for specific programs: BE-361 Biostatics II may be used in place of MA-262 by biomedical engineering majors.

Mechanical Engineering Department

Main Office: Allen-Bradley Hall of Science, S-110
Phone: (414) 277-7375
Fax: (414) 277-2222

It is the mission of the Mechanical Engineering (ME) Department to provide students with a professional education that is both technically relevant and well-rounded. We strive to prepare our students for professional careers in mechanical engineering, industrial engineering or mechanical engineering technology, and to instill in them an awareness of professional and social responsibility. The Mechanical Engineering Department offers four-year baccalaureate degrees in mechanical engineering, industrial engineering and mechanical engineering technology.

All of the degree programs are committed to delivering high-quality undergraduate education, stressing laboratory experiences and preparation for professional practice in an intimate, personal learning environment.

Laboratories are used extensively to support the undergraduate curricula. The department maintains 14 laboratories and a support staff dedicated to the undergraduate programs.

Faculty:

Chairman:
Dr. Matthew A. Panhans

Secretary:
Gloria J. Schmid

Professors:
Dr. Cynthia W. Barnicki, John H. Farrow, Dr. Robert A. Kern, Lawrence B. Korta, Thomas J. Labus, Dr. Matthew A. Panhans, Paul H. Unangst, Dr. Hermann Viets

Associate Professors:
Lukie L. Christie, John L. Ficken, Dr. William E. Howard, Harvey L. Hoy, Firouzeh Keshmiri, Dr. Subha F. Kumpaty, Dr. John H. Lumkes Jr., Dr. Joseph C. Musto, Dr. Robert Rizza, Michael J. Swedish, Dr. Lisa A. Zidek

Assistant Professor:
Dr. William C. Farrow, Dr. John E. Pakkala, Dr. Vincent Prantil, Dr. Thomas F. Schuppe

Adjunct Professors:
Dr. Burzoe K. Ghandhi, Dennis P. Tronca

Adjunct Associate Professors:

Dale R. Boschke, Peter K. Costello, Constance A. Farrow, David Gerow

Adjunct Assistant Professors:

Soud Al-Mishwit, Dr. David Furrer, Robert D. Harenda, Dr. Gottfried F.J. Hoffmann, Dr. Richard H. Jungmann, Stephen H. Rather

Lecturers:

Niranjan N. Desai, Robin L. Knoll, Douglas V. Shuit, Debra Smith, Thomas S. Wanke

Professors Emeriti:

Edward Allan, Joseph L. Deverse, Paul A. Gutting, Dr. Charles F. James Jr., Arthur B. Michael, Paul P. Perdue, Dr. John Slater, Dr. Warren E. Snyder, Lloyd E. Vlies

Bachelor of Science
Industrial Engineering

Program Director:
Dr. Lisa A. Zidek
Office: S-112C
Phone: (414) 277-7383
Fax: (414) 277-2222
E-mail: zidek@msoe.edu

Industrial engineers seek to make systems better: more efficient, more effective and more productive. Industrial engineers are often seen as facilitators of change. Industrial engineering is primarily concerned with the design and continuous improvement of systems effectively integrating various business and industry resources such as materials, equipment, machines, methods and procedures, information, capital, and, most importantly, people. Quality and productivity improvement are critical issues.

Industrial engineering course work establishes a solid generalist engineering foundation, upon which are then built the specialized technical and management knowledge and skill sets. Educational experiences include a variety of business/industry projects which enable our graduates to make significant contributions in a variety of enterprises such as manufacturing, warehousing and distribution, insurance, banking and health care.

Program Goals

This program was developed in response to the needs of industry. The industrial engineering program has three primary goals addressing students abilities, the learning environment and our relationship with business and industry.

The first goal of the industrial engineering program is to develop students' abilities into baccalaureate engineers:

- with a strong theoretical base, tempered by analytical, design, laboratory and project experience, emphasizing applications
- with sufficient general educational breadth to view engineering and engineering management as professions having significant social and ethical responsibilities, and who understand the global implications of their professional practice
- who fully understand, and are committed to, lifelong learning and personal/professional growth and development

A second program goal is to provide an intimate, interactive learning environment with personal involvement of a faculty with significant industrial and business experience.

Finally, the program seeks to actively collaborate with business and industry on initiatives of mutual benefit to students, faculty and business and industry clients.

Bachelor of Science
Industrial Engineering
Model Full-Time Track – V5.0

FRESHMAN YEAR		QUARTER 1	QUARTER 2	QUARTER 3
MA-136	Calculus for Engineers I	4-0-4		
EN-131	Composition	3-0-3		
CH-200	Chemistry I	3-2-4		
OR-100	Freshman Orientation[1]	1-0-0		
IE-100	Introduction to Industrial Engineering Profession	2-2-3		
AE-1311	Introduction to CAD	1-1-1		
MA-137	Calculus for Engineers II		4-0-4	
HU-100	Contemporary Issues		3-0-3	
ME-190	Computer Applications in Engineering I		2-2-3	
PH-110	Physics of Mechanics		3-2-4	
HU-494	Creative Thinking		3-0-3	
MA-231	Calculus for Engineers III			4-0-4
PH-230	Physics of Electricity & Magnetism			3-2-4
CH-201	Chemistry II			3-2-4
IE-191	Computer Applications in Industrial Engineering			2-2-3
	TOTALS	**14-5-15**	**15-4-17**	**12-6-15**

SOPHOMORE YEAR		4	5	6
MA-235	Differential Equations	4-0-4		
MA-262	Probability & Statistics	3-0-3		
EN-132	Technical Composition	3-0-3		
ME-205	Engineering Statics	4-0-4		
PH-220	Physics of Heat, Wave Motion & Optics	3-3-4		
EE-201	Linear Networks: Steady State Analysis		4-0-4	
IE-202	Application of Statistics in Industrial Engineering		2-0-2	
ME-206	Engineering Dynamics		4-0-4	
MA-232	Calculus for Engineers IV		3-0-3	
MS-221	Microeconomics		3-0-3	
EN-241	Speech			2-2-3
PH-250	Modern Physics			3-2-4
IE-348	Quality: Statistical Process Control			3-0-3
EE-253	Analysis & Control of Electromagnetic Devices			3-2-4
ME-207	Mechanics of Materials			3-2-4
	TOTALS	**17-3-18**	**16-0-16**	**14-8-18**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100, but will be required to satisfactorily complete OR-301, Transfer Student Orientation.

JUNIOR YEAR		QUARTER 7	QUARTER 8	QUARTER 9
IE-381	Deterministic Modeling & Optimization	3-0-3		
EE-354	Digital Circuits & Microprocessor Applications	3-2-4		
OR-402	Professional Guidance	1-0-1		
IE-362	Ergonomics & Methods Development	3-2-4		
SS-461	Organizational Psychology	3-0-3		
MS-358	Managerial Cost Accounting	3-0-3		
IE-390	Industrial Engineering Junior Project		0-2-1	
MS-331	Business Law		3-0-3	
IE-382	Stochastic Processes		3-0-3	
IE-423	Engineering Economy		3-0-3	
IE-426	Materials and Manufacturing Processes		3-2-4	
IE-336	Contemporary Integrated Manufacturing Systems		2-2-3	
IE-383	Simulation			3-2-4
IE-347	Facilities Design			3-2-4
	Elective (technical)[2]			3-0-3
IE-3770	Computer Integrated Manufacturing			3-2-4
IE-340	Project Management			3-0-3
	TOTALS	**16-4-18**	**15-4-17**	**15-6-18**

SENIOR YEAR		10	11	12
IE-4901	Industrial Engineering Senior Design I	2-2-3		
	Elective (HU/SS)[2]	3-0-3		
	Elective (HU/SS)[2]	3-0-3		
IE-4771	Automation I	2-2-3		
	Elective (technical)[2]	3-0-3		
IE-4902	Industrial Engineering Senior Design II		1-3-3	
	Elective (HU/SS)[2]		3-0-3	
HU-432	Ethics for Professional Managers and Engineers		3-0-3	
IE-440	Team Leadership/Facilitation		2-2-3	
	Elective (technical)[2]		3-0-3	
	Management Systems Elective[3]			3-0-3
	Elective (HU/SS)[2]			3-0-3
	Free Elective[2]			3-0-3
MS-327	International Business			3-0-3
	Elective (technical)[2]			3-0-3
	TOTALS	**13-4-15**	**12-5-15**	**15-0-15**

[2] There are 33 credits of elective subjects in the industrial engineering program. Students, in collaboration with their faculty advisers, design their program from the following electives categories:

- 12 credits from approved technical electives list
- 3 credits from management systems electives
- 12 credits from humanities and social science (HU/SS), of which 6 must be in the humanities area (HU) and 6 in the social science (SS) area
- 3 credits (300 or 400 level) course

[3] In order to obtain the Minor in Management, the industrial engineering student must take MS-342 and MS-356, and two courses from the management minor list of electives (MS-340, MS-390, MS-451 and MS-453 may not be taken for credit by IEs.)

Industrial Engineering Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
Technical Electives				
IE-331	Production Planning and Inventory Control	3	0	3
IE-377	Safety in Engineering	3	0	3
IE-425	Advanced Engineering Economy	3	0	3
IE-449	Quality Management	3	0	3
IE-460	Design for Quality	3	0	3
IE-461	Quality Audits and ISO-9000	3	0	3
IE-470	Topics in Industrial Engineering	3	0	3
IE-479	Plant Engineering	3	0	3
IE-483	Advanced Simulation	3	0	3
IE-4772	Automation II	3	0	3
Math/Science Electives				
MA-330	Vector Analysis	3	0	3
MA-380	Advanced Differential Equations	3	0	3
MA-381	Complex Variables	3	0	3
CH-350	Chemistry of Building Materials	3	0	3
CH-352	Introduction to Environmental Chemistry	3	0	3
CH-361	Advanced Topics in Chemistry	3	0	3
CH-499	Independent Study	3	0	3
PH-308	Environmental Issues	3	0	3
PH-320	Lasers and Applications	2	2	3
PH-322	Introduction to Optics and Photonics	2	2	3
PH-325	Acoustics and Illumination	3	0	3
PH-341	Introduction to Astronomy and Astrophysics	3	0	3
PH-360	Physics of Electronics	3	3	4
PH-361	Physics of Materials	3	3	4
PH-370	Introduction to Geology and Geophysics	3	0	3
PH-371	Oceanography	3	0	3
PH-499	Independent Study	3	0	3

With the written consent of the IE program director and after careful review of both student developmental objectives and the science/design content of alternate selections, some engineering elective substitutions may be permitted. In no case may an engineering technology course (MT, ET, etc.) be substituted for an engineering course.

Elective combinations are restricted. Elective selection must be done in consultation with the faculty curriculum adviser.

Students in Air Force ROTC may make the following substitutions in the above program: AF-300 for MS-441, a management science elective; AF-401 for HS-455, an SS political science series elective; AF-402 for MS-331; and AF-301 for the free elective.

Accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone : (410) 347-7700)

Bachelor of Science
Mechanical Engineering

Program Director:
Dr. Joseph C. Musto
Office: S261-A
Phone: (414) 277-7455
Fax: (414) 277-2222
E-mail: musto@msoe.edu

Mechanical engineering covers the design, development, analysis, control and testing of machines for converting energy from one form to another and for performing useful work. Areas of specialization include engineering mechanics (solid mechanics, machine dynamics and mechanical design), energy systems (thermodynamics, fluid mechanics and heat transfer) and materials/manufacturing (materials selection and processing).

Program Goals

The goals of the mechanical engineering program are:

- to produce mechanical engineering graduates with a strong theoretical and applications background, whose analytical, design and laboratory experiences make them attractive to industry
- to produce well-rounded engineers who view engineering as a profession with social and ethical responsibilities
- to provide an intimate learning environment, with personal involvement of faculty with significant industrial experience

In accordance with these goals, a set of educational objectives has been formulated for students pursuing a degree in mechanical engineering.

At the conclusion of the mechanical engineering program, the student will:

- have a knowledge of and an ability to apply multivariable calculus, differential equations, linear algebra and statistical methods to the solution of engineering problems
- have a knowledge of and an ability to apply principles of chemistry and calculus-based physics to mechanical engineering systems
- have an ability to function within a laboratory, including the abilities to plan and execute structured experiments, and analyze and interpret data
- have the ability to prototype processes and components for evaluation
- have the ability to identify, formulate, model and solve engineering problems

- have the ability to design and select components and processes for mechanical and thermal systems
- be able to serve an engineering function on a design team, involving the design of a complex mechanical or thermal system under real-world constraints (i.e. environmental, cost, safety, manufacturing, etc.)
- have an understanding of engineering as a professional pursuit
- have the ability to select and use the modern computer tools and techniques required for professional practice
- have the ability to write technical reports and make technical presentations of their work
- have the desire and ability to keep skills current and up-to-date, through both formal and informal learning

The mechanical engineering program curriculum has been designed to achieve these objectives. The components of the curriculum are:

- the freshman year, consisting of a broad-based education focused on mathematics, basic sciences, the humanities and an introductory sequence in mechanical engineering
- the sophomore year, which serves as a transition year from the broad-based general education to the highly-focused mechanical engineering courses through advanced studies in mathematics and science, and a course sequence in engineering mechanics
- the junior year, in which the student focuses in-depth in each of the three branches of technical specialization through the use of the energy sequence, the materials/manufacturing sequence and the mechanics sequence
- the senior year, in which the focus is on the application of the skills acquired in the first three years of the curriculum to the design of mechanical and thermal systems, with a special emphasis on the senior design project

At the end of this four-year sequence, the student should be proficient in the fundamentals of engineering science and should be capable of applying these fundamentals to the design of engineering systems in a professional environment. Graduates will be prepared for industrial employment in research and development, testing and analysis, and design of products and processes, and to continue their education through graduate study.

Bachelor of Science
Mechanical Engineering
Model Full-Time Track – V10.0

FRESHMAN YEAR		QUARTER 1	QUARTER 2	QUARTER 3
CH-200	Chemistry I	3-2-4		
EN-131	Composition	3-0-3		
MA-136	Calculus for Engineers I	4-0-4		
ME-160	Introduction to Mechanical Engineering and Design	2-2-3		
OR-100	Freshman Orientation[1]	1-0-0		
HU-100	Contemporary Issues		3-0-3	
MA-137	Calculus for Engineers II		4-0-4	
ME-190	Computer Applications in Engineering I		2-2-3	
PH-110	Physics of Mechanics		3-2-4	
CH-201	Chemistry II			3-2-4
EN-132	Technical Composition			3-0-3
MA-231	Calculus for Engineers III			4-0-4
ME-191	Computer Applications in Engineering II			1-2-2
PH-230	Physics of Electricity & Magnetism			3-3-4
	TOTALS	**13-4-14**	**12-4-14**	**14-7-17**

SOPHOMORE YEAR		4	5	6
CS-150	Introduction to Computer Programming	2-2-3		
MA-235	Differential Equations for Engineers	4-0-4		
ME-205	Engineering Statics	4-0-4		
PH-220	Physics of Heat, Wave Motion & Optics	3-3-4		
EE-201	Linear Networks: Steady-State Analysis		4-0-4	
EN-241	Speech		2-2-3	
MA-232	Calculus for Engineers IV		3-0-3	
ME-206	Engineering Dynamics		4-0-4	
	HU/SS Elective[2]		3-0-3	
MA-262	Probability and Statistics			3-0-3
ME-207	Mechanics of Materials			3-2-4
ME-230	Dynamics of Systems			4-0-4
PH-250	Modern Physics			3-3-4
	HU/SS Elective[2]			3-0-3
	TOTALS	**13-5-15**	**16-2-17**	**16-5-18**

[1] Transfer students who have completed 36 quarter or semester credits will be waived from OR-100 but will be required to complete OR-301 Transfer Student Orientation.

[2] See next page.

JUNIOR YEAR		QUARTER 7	8	9
ME-300	Modeling and Numerical Analysis	3-2-4		
ME-309	Intermediate Mechanics of Materials	2-2-3		
ME-311	Principles of Thermodynamics I	3-0-3		
ME-321	Materials Science	3-0-3		
	Elective[2]	3-0-3		
ME-314	Principles of Thermodynamics II		4-0-4	
ME-317	Fluid Mechanics		3-2-4	
ME-322	Engineering Materials		3-2-4	
ME-361	Dynamics of Machinery		2-2-3	
	Elective[2]		3-0-3	
IE-340	Project Management			3-0-3
ME-318	Heat Transfer			4-0-4
ME-323	Manufacturing Processes			3-2-4
ME-363	Design of Machine Components			4-0-4
	Elective[2]			3-0-3
	TOTALS	**14-4-16**	**15-6-18**	**17-2-18**

SENIOR YEAR		10	11	12
ME-416	Thermodynamics Applications	3-2-4		
ME-431	Automatic Control Systems	3-2-4		
ME-460	Finite Element Methods	3-2-4		
ME-490	Senior Design Project I	1-0-3		
SS-461	Organizational Psychology	3-0-3		
IE-423	Engineering Economy		3-0-3	
ME-433	Electromechanical Systems		3-2-4	
ME-491	Senior Design Project II		1-0-3	
	Electives[2]		6-0-6	
HU-432	Ethics for Professional Managers. and Engineers			3-0-3
	Electives[2]			12-0-12
	TOTALS	**13-6-18**	**13-2-16**	**15-0-15**

[2] There are 33 credits of elective subjects in the mechanical engineering program, which must be taken as follows:

- 15 credits from humanities and social sciences (HU/SS), distributed as follows:
  - 3 credits from the sociology series (SS-47X).
  - 3 credits from the political science series (SS-45X).
  - 6 credits from courses with an HU designation.
  - 3 credits with either an HU or SS designation.
- 3 credits from the field of mathematics.
- 12 credits from the ME technical electives list, with at least 9 credits from courses with an ME designation.
- 3 credits from any 200-, 300- or 400-level subject (Free Elective).

Students in Air Force ROTC may make the following substitutions in the mechanical engineering program: AF-300 for the free elective and AF-401 for SS-455 (SS elective).

Accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700).

Mechanical Engineering Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
ME-362	Design of Machinery	3	0	3
ME-401	Vibration Control	3	0	3
ME-402	Vehicle Dynamics	3	0	3
ME-411	Advanced Topics in Fluid Mechanics	3	0	3
ME-419	Internal Combustion Engines	2	2	3
ME-423	Materials Selection	3	0	3
ME-424	Engineering with Plastics	3	0	3
ME-429	Composite Materials	3	0	3
ME-435	Robotics and Mechatronics	3	0	3
ME-462	Advanced Topics in Vehicle Systems	3	0	3
ME-464	Mechanical Systems Design	3	0	3
ME-471	Fluid Power Circuits	3	0	3
ME-472	Modeling and Simulation in the Design of Hydraulic Components	3	0	3
ME-475	Design of Fluid Power Circuits	2	2	3
ME-480	HVAC System Design	3	0	3
ME-481	Aerodynamics	3	0	3
ME-485	Advanced Topics in Energy Systems	3	0	3
ME-492	Senior Design Project III	1	0	3
ME-498	Topics in Mechanical Engineering	3	0	3
ME-499	Independent Study	3	0	3
CH-352	Introduction to Environmental Chemistry	3	0	3
CH-361	Advanced Topics in Chemistry	3	0	3
PH-308	Environmental Issues	3	0	3
PH-320	Lasers and Applications	2	2	3
PH-322	Introduction to Optics and Photonics	2	2	3
PH-325	Acoustics and Illumination	3	0	3
MS-340	Production Management	3	0	3
MS-3405	Advanced Operations Management	3	0	3
MS-390	Quantitative Management	3	0	3
MS-462	Technical Selling	3	0	3

Note: Any 300 or 400 level engineering course from outside the ME Program (IE, EE, CE, SE, AE, BE) may also be used as a technical elective, assuming there is no duplication of material with any other required or elective course.

Bachelor of Science
Mechanical Engineering Technology

Program Director:
Dr. W. Edward Howard
Office: S-205D
Phone: (414) 277-7431
Fax: (414) 277-2222
E-mail: howard@msoe.edu

The mechanical engineering technology program emphasizes the application of mathematics and sciences to the implementation and extension of existing technology in the areas of mechanics, thermal sciences and materials.

The program is designed to accommodate transfer students, especially those with associate degrees in mechanical design and related fields. In particular, the program is offered in the evenings only, and is designed for working part-time students. Typically, students will enroll for two classes per quarter. The classes shown in the curriculum tracks are paired so that the required courses can be taken on the same nights of the week.

The curriculum introduces technical courses at an early stage. Mathematics and sciences are integrated as they are applied in the technical courses. General studies courses are spread throughout the curriculum. With this arrangement of courses, part-time students experience a continuous blend of technical and support classes throughout the program.

Two technical electives and one free elective allow students to focus on an area of interest; however, the program is designed to produce well-rounded graduates who are competent in all areas of mechanical engineering technology.

Program Goals

The mechanical engineering technology program strives to produce graduates who are well-prepared for productive and rewarding careers in industry by:

providing a well-rounded and up-to-date technical curriculum taught by faculty with significant industrial experience;

affording students the opportunity to achieve a well-rounded education through quality humanities, social science and business-related offerings; and

offering an intimate learning environment through small classes and personal attention of faculty.

Completion of the program results in granting the Bachelor of Science in Mechanical Engineering Technology degree. Graduates will obtain industrial employment in product design, sales, automated equipment design, testing, field service and start-up, and applications, as well as in manufacturing, production processes, plant facilities and automated machinery service.

Bachelor of Science
Mechanical Engineering Technology
Model Part-Time Track – V2.1
190 Credit Hours – Evening Classes Only

Required courses that are typically transferred (24 credits total):

MA-126	Trigonometry	4-0-4	SS-471*	Sociology	3-0-3
EN-131	Composition	3-0-3	EG-125	CAD Graphics II	2-2-3
MA-127	Algebra II	4-0-4	PH-113	College Physics I	3-2-4
EG-124	CAD Graphics I	2-2-3			

** Any SS-course may be substituted here, in which case one of the social sciences electives below must be SS-471.*

		QUARTER		
YEAR ONE		**FA**	**WI**	**SP**
MT-1201	Materials and Processes	3-0-3		
	Social Sciences Elective	3-0-3		
OR-307S	Transfer Orientation Seminar	1-0-0		
MT-267	Dimensioning and Tolerancing		2-2-3	
FP-2701	Basic Fluid Power		3-0-3	
	Free Elective		3-0-3	
MT-228	Machining Processes			2-2-3
PH-123	College Physics II			3-2-4
YEAR TWO				
MT-200	Statics	4-0-4		
	Social Sciences Elective	3-0-3		
MT-205	Strength of Materials		4-0-4	
TC-452	Interpersonal Communications		3-0-3	
MT-2601	Mechanical Components			4-0-4
	Economics Elective			3-0-3
YEAR THREE				
MA-128	Analytic Geometry and Calculus I	4-0-4		
MT-2611	Mechanisms	4-0-4		
MA-225	Calculus II for Technologists		4-0-4	
EN-132	Technical Communications		3-0-3	
MA-226	Calculus III for Technologists			4-0-4
HU-100	Contemporary Issues			3-0-3
YEAR FOUR				
MA-262	Probability and Statistics	3-0-3		
CH-310	Applied Chemistry	3-2-4		
MT-3401	Quality in Manufacturing		3-0-3	
ET-1520	Electric Circuits		3-2-4	
EN-241	Speech			3-0-3
ET-2550	Electronics			2-2-3

YEAR FIVE		QUARTER FA	QUARTER WI	QUARTER SP
MT-3901	Computer Tools	2-2-3		
IE-423	Engineering Economy	3-0-3		
MT-3611	Solid Modeling		3-2-4	
	Humanities Elective		3-0-3	
MT-3601	Finite Element Analysis			3-2-4
	Technical Elective			3-0-3

YEAR SIX				
MT-3101	Fluid Mechanics	2-2-3		
MT-3301	Electromechanical Instrumentation	2-2-3		
MT-3111	Thermodynamics I		4-0-4	
MT-303	Dynamics		3-0-3	
MT-3121	Thermodynamics II/Heat Transfer			3-2-4
MT-4001	Advanced Mechanics			3-0-3

YEAR SEVEN				
ET-4500	Electric Motors	2-2-3		
HU-432	Ethics for Professional Managers and Engineers	3-0-3		
MT-4201	Advanced Materials		3-2-4	
SS-461	Organizational Psychology		3-0-3	
IE-340	Project Management			3-0-3
MT-4301	Feedback Control Systems			3-2-4

YEAR EIGHT				
MT-4401	Hardware in Manufacturing	3-2-4		
	Technical Elective	3-0-3		
FP-4701	Advanced Fluid Power		3-2-4	
	Business Elective		3-0-3	
MT-4901	Capstone Project			3-0-3
OR-402	Professional Guidance			1-0-1
	Humanities Elective			3-0-3

There are 18 credits of elective subjects of elective subjects in the MET program which must be taken as follows:

- 12 credits from humanities and social sciences (HU/SS), of which 6 must be in the humanities area (HU) and 6 in the social sciences area (SS).
- 3 credits of Free Electives.
- 3 credits of Economics Electives.
- 3 credits of Business Electives.
- 6 credits of Technical Electives.

Accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410) 347-7700).

Main Office: Allen-Bradley Hall of Science, S-201
Phone:
Local: (414) 277-7158
Toll Free: (888) 676-3687 (MSOE-NUR)
Fax: (414) 277-4540
E-mail: nursing@msoe.edu

Accreditation

The baccalaureate program in nursing at Milwaukee School of Engineering is accredited by the Commission on Collegiate Nursing Education (CCNE) and has full approval from the Wisconsin Board of Regulation and Licensing, 1400 E. Washington, Madison, WI 53703.

Mission

The School of Nursing at MSOE is grounded in the beliefs of the faculty and driven by the needs of society. Its mission is to provide a balanced nursing education program that promotes the integration of technology with the diagnosis and treatment of human responses to health states.

Vision

The School of Nursing will prepare students who, at the time of graduation, demonstrate the ability to function at the competent level, as defined by Benner (Benner, P. 1984).

Program Goals

- to educate men and women who will function as generalists in serving the nursing care needs of a diverse global community and who are prepared to engage in advanced study
- to expand and improve technology used in nursing education, in collaboration with the business community
- to prepare graduates who can critically reflect on and evaluate the effects of their nursing care and who are guided by ethical principles and professional standards of care

In support of this mission, the School of Nursing maintains home care and critical care labs as well as basic care labs on campus. All labs are equipped with state-of-the-art technology. Clinical experiences occur in a variety of hospitals and health care agencies in Milwaukee and the surrounding communities.

Upon successful completion of the program, graduates are awarded the Bachelor of Science in Nursing (BSN) degree and are eligible to sit for the national licensing examination (NCLEX-RN).

Faculty:

Professor and Chairperson:
Dr. Mary Louise Brown
Department Administrative Assistant:
Naomi Zirkle
Associate Professor:
Linda K. Young
Assistant Professors:
Sherrill Leifer, David J. Rohde, Josanne Wollenhaupt
Instructors:
Michele Nelson, Jane Paige
Adjunct Assistant Professors:
Connie Ecklund, Dr. Debra Jenks

Bachelor of Science
Nursing

Program Objectives

Upon successful completion of the program, the graduate is expected to:

- provide competent, caring, holistic nursing care to clients
- employ appropriate and effective communication skills in nursing practice
- incorporate principles of health promotion, maintenance and restoration to empower clients to achieve optimal health
- assume a professional role that is responsive to the needs of society
- integrate knowledge gained from historical perspective into one's nursing practice
- Participate in lifelong learning
- employ appropriate technology when providing professional nursing care
- provide leadership when collaborating with other health care team members and communities in assuming accountability for nursing care outcomes
- demonstrate critical thinking skills in diverse situations
- integrate relevant research findings and knowledge, based on the humanities, sciences and nursing, into nursing practice

Clinical Admission Requirements

Admission to the School of Nursing's clinical courses is guaranteed to any applicant who has been granted admission to MSOE and who meets the following criteria:

- has submitted the required health forms and met the health requirements
- has completed a CPR course approved by the American Heart Association or Red Cross, which includes one- and two-person rescue, infant and child rescue, and choking
- has not been convicted of any crime that would substantially relate to the practice of nursing and who has met Wisconsin requirements for health care providers

Admission for anyone who fails to meet any of the above criteria will be considered on an individual basis.

Health Requirements

Students admitted to the nursing program will be required to undergo a health assessment by a physician or nurse practitioner prior to participating in any clinical course work and annually thereafter. This assessment will include a health history, including a history of communicable diseases and immunizations; a physical examination by a physician or nurse practitioner; and the tuberculin skin test described below. Information gathered during this assessment will be treated confidentially and will not be used for discriminatory purposes.

A tuberculin skin test, with date of administration and results, is necessary within three (3) months prior to admission to MSOE. Subsequent annual TB skin tests will be required. These tests are available at MSOE's Health Services Department. A chest X-ray, on admission, is required for persons who previously had a positive skin test. More frequent retests for tuberculosis infection may be required, if indicated by prevalence of tuberculosis in the community.

The following immunizations must be completed and the dates must be recorded:

1. **Tetanus Diphtheria Booster -** within the past 10 years

2. **Polio -** date of last booster

3. **Measles, Mumps, Rubella (MMR) -** All college students born prior to 1/1/57 must demonstrate immunity to **Rubella (German Measles)** by proof of one MMR vaccine or a positive Rubella titer per copy of lab report. If born after 1/1/57, immunity to both **Rubella and Rubeola (Measles)** must be demonstrated by proof of two MMR vaccines or positive Rubella and Rubeola titers. (Vaccinations may have been given separately. **If unable to provide date of vaccinations you must provide laboratory evidence of a positive titer.** Titers can be ordered by your doctor.)

4. **Hepatitis B -** three doses; list dates. If not completed, must be in process before clinicals begin.

5. **Varicella -** history, positive titer, or two doses of vaccine given at least one month apart if immunized at the age of 13 or older.

Anyone with a chronic illness must meet with the director of health services to evaluate ability to participate in the program.

Persons with a seizure disorder must present certification from a physician that they are currently free of seizures and that it is not reasonably foreseeable that they will experience seizures during their clinical course work.

Students with symptoms or signs of communicable disease or infected skin lesions must immediately contact the director of health services for evaluation of appropriate limitations (if any) in clinical course activities.

Students must present proof of adequate health insurance coverage.

The School of Nursing reserves the right to deny a student's admission to a clinical course, or to limit or terminate his or her participation in a clinical course, if the student's health status poses a significant risk to the health or safety of patients.

Liability Insurance Policy

All students must present evidence of liability insurance coverage annually in amounts of $1 million/$3 million. Participation in a group policy at cost is available and mandatory through the School of Nursing.

CPR Policy

All students must present evidence, annually, of CPR certification by the American Heart Association or the Red Cross. This certification must include the following:

one- and two-person rescue
infant and child rescue
choking

Failure to meet the requirements of the health, liability insurance and CPR policies will result in an administrative withdrawal from clinical courses.

Criminal Background Check

Students must not have been convicted of any crime that would substantially relate to the practice of nursing. All students enrolling in their first clinical course will be required to complete a background information disclosure form. All students participating in clinical experience in public schools must have a state(s) criminal history check completed prior to the clinical experience.

Clinical Experiences

Clinical experiences commence in the sophomore year and occur in a variety of settings in Milwaukee and surrounding counties. Students are expected to provide their own transportation. Public transportation is available to many but not all of the clinical sites.

Uniform Purchase

Students are responsible for acquiring their MSOE student nurse uniform prior to their first off-campus laboratory experience. In order to ensure that uniforms will be available by the start of the Winter Quarter, students must order their uniforms no later than Sept. 30.

Clinical name badges will be available through the Registrar's Office.

Laboratory Supplies

Students are expected to procure the following supplies:

1) Lab Pack – contains supplies for individual use in on-campus laboratory – may be purchased in the MSOE Bookstore

2) dual-head stethoscope, bandage scissors, hemostat, pen light, EKG calipers and reflex hammer for use in off-campus and on-campus laboratory – available from NSNA or any nursing uniform supplier

3) black ballpoint pen, VHS tapes

Curricular Information

Additional Academic Requirements

The following requirements are in addition to the academic regulations and policies that are cited in this *Catalog* for all students in Section A.

A grade of "C" or better is required in all NU courses.

Repeating courses: A maximum of five required courses in which a student earns a grade of "F" or "D" may be repeated for a change in grade. A maximum of two of the five repeats may be NU courses. Any NU course in which a student receives a grade of "X," "W," or less than "C" must be repeated. Students who fail to achieve a grade of "C" or better when repeating an NU course will be academically dismissed from the School of Nursing.

All senior students are required to satisfactorily complete a comprehensive nursing examination and their portfolios as a condition of graduation.

Students must complete their course of studies within six years of enrollment in their first NU major course. Any course that does not meet this guideline must be repeated in order to qualify for graduation.

Clinical nursing courses are assigned one final grade for each course based on student performance in both the clinical and theory portions of the course. Students must demonstrate competency in both theory and clinical performance in order to meet the requirements of the course.

Curriculum Description

The nursing program consists of 12 quarters of 16 to 18 quarter hours each of general education and professional nursing courses (see Model Full-Time Track). Students who wish to enroll in fewer than 16 to 18 hours each quarter are advised to notify their adviser as soon as possible so that a satisfactory, comprehensive program plan can be designed.

Upon successful completion of the required course work and the comprehensive examination, the Bachelor of Science in Nursing (BSN) degree is awarded. Graduates from the MSOE School of Nursing are eligible to sit for the National Council Licensing Exam for RNs (NCLEX-RN).

Bachelor of Science
Nursing
Model Full-Time Track – V4.1

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
OR-102	Orientation to Nursing	0-2-1		
	-OR-			
OR-301	Transfer Orientation	0-0-0		
	-OR-			
OR307S	Transfer Orientation	0-0-0		
EN-131	Composition	3-0-3		
MA-127	College Algebra II	4-0-4		
MS-184	Intro. to Computer Methods and Applications	3-0-3		
SS-460	Foundations of Psychology	3-0-3		
SS-471	Sociology	3-0-3		
BI-102	Biology		3-3-4	
CH-200	Chemistry I		3-2-4	
EN-241	Speech		2-2-3	
NU-105	Concepts of Health		3-0-3	
BI-172	Human Anatomy & Physiology I		3-0-3	
HU-100	Contemporary Issues in Humanities			3-0-3
CH-222	Organic Chemistry I			2-2-3
BI-256	Microbiology			3-3-4
TC-452	Interpersonal Communication			3-0-3
BI-273	Human Anatomy & Physiology II			3-3-4
	TOTALS	**16-2-17**	**14-7-17**	**14-8-17**

SOPHOMORE YEAR		4	5	6
NU-200	History & Theories of Nursing	3-0-3		
CH-223	Biochemistry	3-2-4		
BI-274	Human Anatomy & Physiology III	3-3-4		
SS-462	Developmental Psychology	3-0-3		
PH-130	Application of Physics	3-3-4		
NU-201	Health Assessment of Individual		3-3-4	
NU-202	Health Assessment of Family & Community		3-3-4	
SS-473	World Societies		3-0-3	
BI-290	Pathophysiology I		4-0-4	
BI-281	Pharmacology I		2-0-2	
NU-252	Primary Dynamics of Professional Nursing Care			3-12-7
BI-260	Nutrition			2-0-2
BI-391	Pathophysiology II			4-0-4
BI-382	Pharmacology II			2-0-2
	TOTALS	**15-8-18**	**15-6-17**	**11-12-15**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
NU-330	Nursing Care Of Clients with Episodic Health Challenges I	3-12-7		
MA-315	Introductory Applied Statistics	3-0-3		
HU-431-B	Informal Logic	3-0-3		
HU-332	Bioethics	3-0-3		
NU-331	Nursing Care of Clients with Episodic Health Challenges II		3-12-7	
NU-390	Nursing Research		3-0-3	
SS-466	Abnormal Psychology		3-0-3	
HU-433	Philosophy		3-0-3	
NU-340	Nursing Care of Clients with Chronic Health Challenges			3-12-7
NU-360	Nursing Care of the Community			3-3-4
HU-420, 430, 440 or 480	Humanities Elective[1]			3-0-3
MS-221	Microeconomics			3-0-3
	TOTALS	**12-12-16**	**12-12-16**	**12-15-17**

SENIOR YEAR		10	11	12
NU-460	Nursing Care of Clients with Mental Health Challenges	3-9-6		
NU-470	Nursing Care of Clients with Complex Chronic Health Challenges	3-9-6		
HU-420, 430, 440 or 480	Humanities Elective[1]	3-0-3		
NU-491	Nursing Leadership & Professional Orientation I	1-0-1		
NU-471	Nursing Care of Clients with Complex Episodic Health Challenges		3-15-8	
HU-420, 430, 440 or 480	Humanities Elective[1]		3-0-3	
HU-420, 430, 440 or 480	Humanities Elective[1]		3-0-3	
SS-461	Organizational Psychology		3-0-3	
NU-493	Nursing Leadership & Professional Orientation II		0-3-1	
NU-485	Nursing Clinical Elective			2-12-6
NU-486	Synthesis of Nursing Care			4-0-4
NU-497	Nursing Leadership & Professional Orientation III			2-3-3
	TOTALS	**10-18-16**	**12-18-18**	**8-15-13**

One HU elective may be taken in Spring Quarter rather than Winter Quarter.
Total Credits: Program - 197, NU - 84, Electives - 15

[1] Nursing students must take 12 credits of Humanities electives: 3 in the HU-420 series, 3 in the HU-440 series, 3 in the HU-480 series, and 3 in HU-420, 430, 440, or 480 series.

RN to Bachelor of Science in Nursing

The BSN completion program is for RN students who hold a current nursing license in Wisconsin. The objectives of the program are identical to those of the BSN program. Many of the nursing courses may be exempted by means of successfully completing the teacher-made exam for the course. See "Exemption Exams" on page 151.

Prerequisite courses for NU-200

EN-131	Composition
EN-241	Speech

Prerequisite or Corequisite courses for NU-202

SS-471	Sociology
SS-473	World Societies
NU-105	Concepts of Health
TC-452	Interpersonal Communication
NU-200	History and Theories of Nursing

Prerequisite courses for NU-252 or to qualify for the exemption exam

BI-102	Biology
BI-256	Microbiology
BI-260	Nutrition
BI-274	Anatomy and Physiology III
CH-200	General Chemistry
CH-220	Organic Chemistry
CH-221	Biochemistry
SS-460	General Psychology
SS-462	Developmental Psychology
HU-431B	Informal Logic
MA-125	College Algebra I
MS-184	Introduction to Computer Methods and Applications
NU-201	Health Assessment of Individual
PH-113	Introduction to Physical Science
OR-301	Transfer Orientation

Prerequisite for NU-330 or NU-340 or to qualify for the exemption exam

BI-281	Pharmacology or successful completion of the exemption exam
NU-252	Primary Dynamics of Professional Nursing Care or successful completion of the exemption exam

Prerequisite for NU-331 or to qualify for the exemption exam

BI-382	Pharmacology II or successful completion of the exemption exam
BI-391	Pathophysiology or successful completion of the exemption exam
HU-332	Bioethics
NU-330	Nursing Care of Clients with Episodic Health Challenges I or successful completion of the exemption exam

Prerequisite for NU-360

NU-202	Health Assessment of Family and Community
NU-331	Episodic Health Challenges II or successful completion of the exemption exam
NU-390	Nursing Research

Prerequisite for NU-470 or to qualify for the exemption exam

BI-391 Pathophysiology or successful completion of the exemption exam
HU-332 Bioethics
NU-340 Nursing Care of Clients with Chronic Health Challenges or successful completion of the exemption exam

Prerequisite for NU-460

NU-340 Nursing Care of Clients with Chronic Health Challenges or successful completion of the exemption exam
SS-466 Abnormal Psychology
Additional prerequisite to qualify for the exemption exam is two years experience in mental health nursing.

Prerequisite for NU-471

NU-470 Nursing Care of Clients with Complex Chronic Health Challenges or successful completion of the exemption exam
Additional prerequisite to qualify for the exemption exam is two years experience in critical care nursing.

Prerequisite for NU-486 and NU-490

All required courses

The following required courses may be taken at any time prior to NU-486 and NU-490

HU-433 Philosophy
HU-420 Literature Elective
HU-440 History Elective
HU-480 Fine Arts Elective
HU-420, 430, 440 480, Elective
Free Elective
NU-495 Role Transition (may not be taken until successful completion of NU-202, Assessment of Family and Community, has been demonstrated)

NOTE: Fifty percent of the total credits of the 197 credits in the nursing program must be taken at MSOE. Credit for required courses and courses which may be exempted by exam total 74 of the total 197 credits. Thus, of the courses which may be transferred, a student must enroll in 23 credits at MSOE.

Exemption Exams

MSOE School of Nursing will provide syllabi for any courses which an RN student might wish to exempt by examination. The exams will be teacher made exams, with questions drawn from the test pool used for examinations for the pre-licensure students. The passing score, as for pre-licensure students, is 77. Credit for successful completion of exemption exams will be awarded identical to the credits awarded for successful completion of the exempted course. These exams are equivalent to other MSOE advanced placement exams for which a nonrefundable fee is charged. Contact Student Financial Services at (414) 277-7130 for the current fee.

Clinical Experiences

Clinical experiences for RN students enrolled in a clinical course will be considered on an individual basis. Depending upon the needs of the student, these experiences may be completed with pre-licensure students or they may be arranged as preceptored experiences. Preceptored experiences cannot be completed in a student's employment environment.

RN to Bachelor of Science in Nursing
Model Full-Time Track – V 4.1

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
OR-301	Transfer Orientation[1]	0-0-0		
	-OR-			
OR-307S	Transfer Orientation[1]	0-0-0		
EN-131	Composition[2]	3-0-3		
MA-127	College Algebra II[2]	4-0-4		
MS-184	Intro. to Computer Methods and Applications[2]	3-0-3		
SS-460	Foundations of Psychology[2]	3-0-3		
SS-471	Sociology[2]	3-0-3		
BI-102	Biology[2]		3-3-4	
CH-200	Chemistry I[2]		3-2-4	
EN-241	Speech[2]		2-2-3	
NU-105	Concepts of Health[3]		3-0-3	
BI-172	Human Anatomy & Physiology I[2]		3-0-3	
HU-100	Contemporary Issues in Humanities[2]			3-0-3
CH-222	Organic Chemistry I[2]			2-2-3
BI-256	Microbiology[2]			3-3-4
TC-452	Interpersonal Communication[2]			3-0-3
BI-273	Human Anatomy & Physiology II[2]			3-3-4
	TOTALS	**16-0-16**	**14-7-17**	**14-8-17**

SOPHOMORE YEAR		**4**	**5**	**6**
NU-200	History & Theories of Nursing[1]	3-0-3		
CH-223	Biochemistry[2]	3-2-4		
BI-274	Human Anatomy & Physiology III[2]	3-3-4		
SS-462	Developmental Psychology[2]	3-0-3		
PH-130	Application of Physics[2]	3-3-4		
NU-201	Health Assessment of Individual[2]		3-3-4	
NU-202	Health Assessment of Family & Community[1]		3-3-4	
SS-473	World Societies[2]		3-0-3	
BI-290	Pathophysiology I[2]		4-0-4	
BI-281	Pharmacology I[2]		2-0-2	
NU-252	Primary Dynamics of Professional Nursing Care[3]			3-12-7
BI-260	Nutrition[2]			2-0-2
BI-391	Pathophysiology II[2]			4-0-4
BI-382	Pharmacology II[2]			2-0-2
	TOTALS	**15-8-18**	**15-6-17**	**11-12-15**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
NU-330	Nursing Care of Clients with Episodic Health Challenges I[3]	3-12-7		
MA-315	Introductory Applied Statistics[2]	3-0-3		
HU-431B	Informal Logic[2]	3-0-3		
HU-332	Bioethics[2]	3-0-3		
NU-331	Nursing Care of Clients with Episodic Health Challenges II[3]		3-12-7	
NU-390	Nursing Research[2]		3-0-3	
SS-466	Abnormal Psychology[2]		3-0-3	
HU-433	Philosophy[2]		3-0-3	
NU-340	Nursing Care of Clients with Chronic Health Challenges[3]			3-12-7
NU-360	Nursing Care of the Community[3]			3-3-4
HU-420, 430, 440 or 480	Humanities Elective[2, 4]			3-0-3
MS-221	Microeconomics[2]			3-0-3
	TOTALS	**12-12-16**	**12-12-16**	**12-15-17**

SENIOR YEAR		10	11	12
NU-460	Nursing Care of Clients with Mental Health Challenges[3]	3-9-6		
NU-470	Nursing Care of Clients with Complex Chronic Health Challenges[3]	3-9-6		
HU-420, 430, 440 or 480	Humanities Elective[2, 4]	3-0-3		
NU-491	Nursing Leadership & Professional Orientation I[1]	1-0-3		
NU-471	Nursing Care of Clients with Complex Episodic Health Challenges[3]		3-15-8	
HU-420,430, 440 or 480	Humanities Elective[2, 4]		3-0-3	
HU-420, 430, 440 or 480	Humanities Elective[2, 4]		3-0-3	
SS-461	Organizational Psychology[2]		3-0-3	
NU-493	Nursing Leadership & Professional Orientation II[1]			0-3-1
NU-495	(RN students only) Role Transition[1]			4-6-6
NU-486	Synthesis of Nursing Care[1]			4-0-4
NU-497	Nursing Leadership & Professional Orientation III[1]			2-3-3
	TOTALS	**10-18-18**	**12-18-18**	**10-9-13**

One HU elective may be taken in Spring Quarter rather than Winter Quarter
Total Credits: 197- Program, 84- NU, 15- Electives

[1] Required MSOE courses.
[2] Courses accepted for transfer if taken somewhere else.
[3] Courses which may be exempted by exam with evidence of current Wisconsin RN licensure.
[4] Nursing students must take 12 credits of humanities electives (HU) of which 3 are in the HU-420 series, 3 credits in the HU-440 series, 3 credits in the HU-480 series, and 3 credits in either HU-420, HU-430, HU-440 or HU-480 series.

Physics and Chemistry Department

Main Office: Fred F. Loock Engineering Center, S-236
Phone: (414) 277-7349
Fax: (414) 277-2878

The Physics and Chemistry Department offers a selection of required and elective courses in support of the various programs at MSOE. Students are also given the opportunity to earn a Minor in Physics and/or broaden their educational experience by taking elective courses in various areas of basic science:

Biotechnology – An introduction to an exciting new field of science that will, to an increasing degree, affect our lives in the future. Courses: CH-371, Modern Biotechnology, and CH-373, Advanced Biotechnology.

General and Applied Physics – Preparation for graduate work and personal enrichment. Courses: a variety of course offerings leading to a Minor in Physics.

General and Organic Chemistry – Preparation for graduate work in science or medicine. Courses: General Chemistry: CH-200, -201, -302, -303 and Organic Chemistry: CH-222, -223, -322, -323.

Materials Science – Complements any engineering education through a more in-depth study of how microscopic properties determine macroscopic properties. Courses: Independent Study or special topics.

Optics and Photonics – Optical communication and the extension of electronics to the optical realm. Courses: a special emphasis option for a Minor in Physics.

Faculty:

Chairman:
Dr. J. William Dawicke
Administrative Assistant:
Paula A. Harrold
Technical Support Staff:
Carl J. Hick, Richard A. Wolter
Professors:
Dr. J. William Dawicke, Jeffrey B. Korn, Dr. A. James Mallmann, Dr. Steven P. Mayer, Dr. Anders H. Schenstrom, Darrell L. Seeley
Associate Professors:
Dr. Gul Afshan, James W. Dieball, Dr. N. Glenn Gratke, Dr. Richard R. Mett
Assistant Professors:
Dr. Matey G. Kaltchev, Dr. Anne-Marie Nickel, Dr. Robert J. Olsson, Dr. Vipin Paliwal
Instructors:
Ruth A. Schwartz, Joyce M. Solochek

Adjunct Professors:

Brigita Kore-Kakulis, Dr. Michael H. Patrick

Adjunct Associate Professors:

Dr. George Gurria, Dr. Timothy M. Herman

Lecturers:

Stephen J. Augustine, Joseph J. Herro, Rosemary D. Wehnes

Professors Emeriti:

Dr. Robert W. Braun, Dr. Ronald A. Kobiske, Janina Levy, Harry A. Schopler

Physics and Chemistry Department Electives

The department offers a variety of elective courses. The specific courses and the number of courses offered in any given quarter vary depending on enrollment and student interest. For 2003-2005, the tentative schedule is as follows:

Fall 2003	PH-322	Introduction to Optics and Photonics
	PH-352	Quantum Physics
Winter 2003-04	CH-322	Organic Chemistry II
	CH-371	Modern Biotechnology
	PH-320	Lasers and Applications
	SC-308	Environmental Science
Spring 2004	CH-323	Organic Chemistry II Lab
	CH-373	Advanced Biotechnology
	PH-324	Fiber Optics and Fiber Optic Sensors
	PH-325	Acoustics and Illumination
Fall 2004	PH-320	Lasers and Applications
	PH-354	Nuclear Power, Applications and Safety
Winter 2004-05	CH-302	Chemistry III
	PH-322	Introduction to Optics and Photonics
	PH-342	Relativity and Cosmology
	SC-308	Environmental Science
Spring 2005	CH-303	Chemistry III Lab
	PH-324	Fiber Optics and Fiber Optic Sensors
	PH-341	Astronomy and Astrophysics

Chemistry

Advisers:

Biochemistry
Dr. Gul Afshan
Office: S-238-4
Phone: (414) 277-7211
Fax: (414) 277-2878
E-mail: afshan@msoe.edu

General Chemistry
Joyce Solochek
Office: S-246
Phone: (414) 277-7444
Fax: (414) 277-2878
E-mail: solochek@msoe.edu

Regularly scheduled elective courses in chemistry include:

CH-302/-303	Chemistry III and Chemistry III Lab Third quarter of General Chemistry to complement CH-200/-201
CH-322/-323	Organic Chemistry II and Organic Chemistry II Lab Completes a year of Organic-/Bio-Chemistry together with CH-222/-223
CH-371	Modern Biotechnology - Genes, proteins and viruses
CH-373	Advanced Biotechnology – Cells, bacteria and more about genes and proteins

In addition to scheduled electives, the chemistry faculty offers students with interest in particular areas an opportunity to work one-on-one with a faculty member as part of an Independent Study, CH-499. (Freshmen and sophomores may request a "Project" course, CH-199.) Groups of students may also petition the faculty to offer a course different than the scheduled electives. Faculty areas of expertise under which they will offer Independent Study and specialty courses include:

Application of Surface Science to Modern Technology – Professor Matey Kaltchev

The number and importance of these applications provide wonderful opportunity for the students to choose project topics and enhance their knowledge in various areas of cutting-edge technology. Possible course topics include, but are not limited to:

- Application of surface science in heterogeneous catalysis: the design and future of automotive and environmental catalysis for pollution abatement in the 21st century, the fundamentals, application and development of fuel cell technology, new energy sources, etc.
- Surface Science and Nanotechnology: the discussion of the unique properties materials exhibit when their size is dramatically reduced and the application of these novel systems to various areas of modern technology – new electronic devices, chemical sensors and surface heterostructures.
- Surface Science and Tribology: the science of friction, so important and so much studied and yet so poorly understood. This course will offer a unique approach to understanding the fundamentals of friction from a microscopic point of view (nanotribology) and how lubricants actually work by studying the various processes that occur in the system lubricant-rubbing surfaces.

All courses include basic introduction to surface science. Hands-on experience with state-of-the-art equipment and scientific tools commonly used to study processes at surfaces. This will help to better prepare the students for the challenges of their modern engineering professions.

Biology of Viruses – Professor Gul Afshan

Mankind has always been under the threat of a new, more dangerous virus emerging and causing massive epidemics. Modern transportation systems and ways to access previously unexplored places by humans make it all the easier for such a virus to spread quickly throughout the world. It is important to realize that viruses have always been with us, evolving ways to reproduce and spread. Viruses, like humans, are just playing the evolution game. But VIRUSES CHEAT! Because viruses are a great cause for concern internationally, they are subject of great deal of concentrated research. Course topics include:

- The origin of viruses, which is still poorly understood
- Classes of animal and plant viruses and their characteristics.
- Mechanisms and tactics used by viruses to invade their hosts.
- Vaccinia, Virus or small pox vaccine?
- Effects of Viral infections on host cells.
- Discussions on new and often extremely virulent viruses, such as those causing Ebola and Marburg, HIV-1 and HIV-2.

Chemistry of Materials – Professor Anne-Marie Nickel

The chemical structure and composition of metals, semiconductors, metal alloys, solid solutions, polymers, and crystalline and magnetic materials play a significant role in the properties of these materials. Tools of materials chemistry including scanning probe microscopes (SPM) and x-ray diffraction. Using the fundamentals of chemistry, we will investigate these properties and understand how subtle changes in atomic structure can yield dynamic changes in how the materials can function and be used.

Chemical Sensors – Professor Anne-Marie Nickel

Discussion of the critical requirements of commercially viable sensors. We will apply this knowledge to evaluating some current and future chemical sensors.

Environmental Chemistry – Instructor Joyce Solochek

The student can investigate several topics, select one of the following and develop it further, or design his/her own project.

The Analysis of Lake Water
The Water Project, an analytical chemistry project
Quantitative Analysis of Hard Water Samples
Determination of the Surface Chemical Properties of Simple, Natural Solids
Chemical Recycling of Soda Bottles
Measurement of Trace Metals in Tobacco and Cigarette Ash

Inorganic Chemistry – Professor Anne-Marie Nickel

Inorganic chemistry surveys the diverse chemistry of all of the elements in the periodic table. This makes the subject very diverse and includes many different and exciting subjects in chemistry including main group, coordination, solid-state, materials, bioinorganic and organometallic chemistries. The relevance of each topic to real life applications and current research will be investigated.

Nanotechnology – Professor Anne-Marie Nickel

Extraordinary materials and properties can be obtained from the control of materials at the nanoscale by manipulating atoms and molecules. We will discuss how properties of materials understood at the macro- and microscale can differ significantly at the nanoscale. The tools used to manipulate atoms, molecules and materials will be covered. A survey of current research in nanotechnology will demonstrate how the topics discussed in the course apply to new technological advances.

Nuclear Chemistry and Society – Professor Anne-Marie Nickel

Whether through the treatment or cause of cancer, the consumption of irradiated foods, or the benefits of nuclear power, nuclear chemistry plays a role in nearly everyone's life. In fact, nuclear chemistry has influenced and affected entire populations. A survey of the uses of nuclear chemistry will be discussed. Included in these discussions will be the benefits and costs of using nuclear chemistry to society.

MINOR IN PHYSICS
V1.1

Coordinator:
Dr. N. Glenn Gratke
Office: S-240
Phone: (414) 277-7267
Fax: (414) 277-2878
E-mail: gratke@msoe.edu

The Minor in Physics is offered to those who wish to expand their background and understanding of physics. A physics minor can also augment any student's specialty, and make their degree more attractive to potential employers.

To qualify for a Minor in Physics, a student must take 28 credits of eligible courses. This must include a minimum of 12 credits from the list of Approved Courses, 6 of which must be from courses not specifically required for the student's major. These 6 credits must have been earned in residence at MSOE and a minimum GPA of 2.00 is required for courses that are counted towards the minor.

Primary Introductory Sequence (16 credits)

PH-110 Physics of Mechanics (4)
PH-220 Physics of Heat, Wave Motion and Optics (4)
PH-230 Physics of Electricity and Magnetism (4)
PH-250 Modern Physics (4)

Alternate Introductory Sequence:
PH-113 or PT-110, PH-123 or PT-220, PH-361, and 16 additional credits from the list of Approved Courses.

Approved Courses (balance of credits to reach 28 credits)

PH-320 Lasers and Applications (3)
PH-322 Introduction to Optics and Photonics (3)
PH-324 Fiber Optics and Fiber Optic Sensors (3)
PH-325 Acoustics and Illumination (3)
PH-341 Astronomy and Astrophysics (3)
PH-342 Relativity and Cosmology (3)
PH-352 Quantum Physics (3)
PH-354 Nuclear Power, Applications and Safety (3)
PH-360 Physics of Electronics (4)
PH-401 Topics in Physics (variable credits)
PH-499 Independent Study (1-3) (subject to department approval)
EE-320 Electric and Magnetic Fields (4)
or
ET-3201 Electromagnetic Field Concepts (4)

Some of the Approved Courses are offered as part of the regular course offerings, others are only offered if there is sufficient student interest, and many are on a 2-year rotating schedule. There is no guarantee of availability of any particular course in any particular quarter. A tentative 2-year schedule is listed on a previous page. Although any combination of Approved Courses may be used to satisfy the requirements for a Minor in Physics, a concentration may be pursued to best complement a student's major or personal interest

Applied Optics and Photonics Emphasis:

PH-320 Lasers and Applications (3)
PH-322 Introduction to Optics and Photonics (3)
PH-324 Fiber Optics and Fiber Optic Sensors (3)
PH-360 Physics of Electronics (4) Regular course scheduled each Fall and Winter Quarter.

Applied Physics Emphasis:

PH-325 Acoustics and Illumination (3)
PH-354 Nuclear Power, Applications and Safety (3)
PH-360 Physics of Electronics (4) Regular course scheduled each Fall and Winter Quarter.
EE-320 Electric and Magnetic Fields (4) Regular course offering from the EECS department.

General Physics:

PH-341 Astronomy and Astrophysics (3)
PH-342 Relativity and Cosmology (3)
PH-352 Quantum Physics (3)
EE-320 Electric and Magnetic Fields (4) Regular course offering from the EECS department.

In addition to scheduled electives, the physics faculty offers students with interest in particular areas an opportunity to work one-on-one with a faculty member as part of an "Independent Study," PH-499. (Freshman and sophomores may request a "project" course, PH-199.) Groups of student may also petition the faculty to offer a course different than the scheduled electives. Faculty areas of expertise under which they will offer Independent Study and specialty courses include, but are not limited to, the areas of:

Renewable Energy
Unification Theories
Quantum Computing

Interested students may contact any department faculty member or Professor Gratke at (414) 277-7267.

The purpose of MSOE's two-degree programs is to build a strong and broad education, as each major study area puts the other in perspective. Students have until their junior year to enroll in a two-degree program, but they may begin earlier. If students decide to enroll after their junior year has begun, they may still do so, but late enrollment may extend completion of the program beyond five years.

Two-Degree Program Options

The following chart indicates which bachelor of science degree programs are eligible for a two-degree option:

	Bachelor of Science in Business	Bachelor of Science in Construction Management	Bachelor of Science in Management	Bachelor of Science in Technical Communication	Master of Science in Environmental Engineering	Master of Science in Structural Engineering
Bachelor of Science in Architectural Engineering	X	X		X	X	X
Bachelor of Science in Computer Engineering			X	X		
Bachelor of Science in Electrical Engineering			X	X		
Bachelor of Science in Industrial Engineering			X	X	X	
Bachelor of Science in Management Information Systems		X				
Bachelor of Science in Mechanical Engineering			X	X	X	
Bachelor of Science in Technical Communication	X		X			

Bachelor of Science in Architectural Engineering and Construction Management

The construction management program is specialized for the building and construction industry. This management path is for those wishing to pursue a career combining managerial skills with construction technology.

Combining architectural engineering and construction management provides the person in the construction industry with the emphasis required in construction management, general business management and principles, plus an engineering degree with a design speciality in building structural, electrical or environmental systems.

There are 17 courses from the construction management program taken in the junior, senior and fifth years combined with the architectural engineering courses.

When registering for both of these degrees, students must see the B.S. construction management program director.

Bachelor of Science in Construction Management and Management Information Systems

Construction and project management is being driven by the adoption of computers to assist in the management and coordination functions now required by the "build environment." People who understand construction, design and information systems are widely sought after and important in the decision strategies of an organization.

Combining construction management and management information systems provides the person in the construction industry with an emphasis in construction management, and general business management and principles, along with a substantial amount of computer information technology. The program is designed to prepare students to assume positions of responsibility and leadership in the computer-oriented, information- and technology-based construction organizations of the future.

Bachelor of Science in Business

The BSB degree offers students the unique blend of technical and management courses. This program provides you with the skills and knowledge needed to manage and lead in a technically oriented organization. In addition, students will have the opportunity to further develop specialized skills and capabilities in financial, marketing, e-business and operations management.

Bachelor of Science in Management

MSOE's management program was established with the understanding that business is driven by rapidly changing technology. Since computers are the most important tools in business, MSOE's management curricula is centered around the latest technological developments in computers.

MSOE's Rader School of Business offers a Bachelor of Science in Management degree to complement an engineering degree through MSOE's two-degree program. By taking management courses concurrently with engineering courses, students learn how to apply their technical skills to real-world business and financial situations.

Approximately 17 courses in management are taken concurrently with a student's chosen engineering curriculum to give the student two degrees in five years. Some key classes in the program include the following:

> American government, business and government relations, employment law, economics, accounting, finance, marketing, business forecasting, international business, operations management, management policies, leadership skills and business communications

When registering for a two-degree program in engineering and management, students should see the chairman of the Rader School of Business.

Bachelor of Science in Technical Communication

MSOE's technical communication program produces graduates who are able to communicate technical knowledge effectively to others. There is a growing need for technical communicators, since we live in an era of technological change.

With MSOE's two-degree program, the engineer is trained to communicate facts about technical devices and operations to the public, consumers, employers and co-workers – including those in nonengineering functions. Since courses in engineering and communication are taken simultaneously, students may enjoy hands-on laboratory work in one class and write about that experience in the next class. These are vital skills for the engineer in today's rapidly changing technological frontier.

Approximately 19 courses in technical communication are taken concurrently with a student's chosen engineering curriculum for this option of the two-degree program. Some key classes in the technical communication program include the following:

> composition, report and proposal writing, information processing, mass communication, writing and editing for publication, visual design techniques, research methods, speech, persuasive speech, professional presentation techniques, human communication, group discussion, intercultural communication, interpersonal communication, organizational communication, marketing communication and student internship

The number of required technical communication courses in a two-degree program varies with the engineering program selected. A course schedule can be designed for students upon commitment to the program.

When preregistering for a two-degree program that includes technical communication, students should meet with the chairman of the General Studies Department.

Master of Science in Environmental Engineering

Engineers in a variety of positions – manufacturing, design, research and development, management and plant engineering – need a firm grounding in various aspects of environmental engineering in order to perform effectively on the job and to understand the implications of their decisions on the environment.

This program builds upon the student's already solid foundation in engineering principles and presents topics in areas such as waste minimization, environmental law and regulations, air and water pollution control, hazardous waste management and environmental risk assessment.

The two-degree program follows the first three years of the curriculum for the selected undergraduate engineering degree. In the fourth and fifth years, undergraduate engineering courses are intermixed with graduate courses required for the completion of the Master of Science in Environmental Engineering degree. Upon completion of the fifth year, the bachelor's and master's degrees are awarded simultaneously.

Master of Science in Structural Engineering

This program emphasizes building structural design and analysis, and meets the needs of students who desire increased knowledge to design modern building structural systems.

Courses focus on structural design topics such as advanced design of structural steel members and systems, light gage metal members and structures, reinforced concrete members and structures, wood structures, masonry structures and foundations, and selection of structural systems. Courses on advanced structural analysis, including applications of the finite element method, structural dynamics and structural stability, are also presented to provide a broader theoretical background for structural design.Students with an appropriate undergraduate degree can complete the program in five years on a part-time basis or as little as two years on a full-time basis. (See the MSOE *Graduate Catalog* for more information.)

The two-degree program allows a student to obtain a bachelor's degree in architectural engineering and a master's degree in structural engineering in five years. The two-degree program follows the first three years of the undergraduate curriculum for the B.S. in architectural engineering, and then mixes undergraduate and graduate courses during the fourth and fifth years. Upon completion of the fifth year, the bachelor's and master's degrees are awarded simultaneously.

An alternative program allows a student to replace select undergraduate level courses with graduate level courses during the fourth year of the B.S. in architectural engineering program. Upon completion of the fourth year the bachelor's degree is offered, the student can return and complete the M.S. in structural engineering program in one additional year on a full-time basis, or take up to four years to complete the graduate program on a part-time basis.

Students who intend to pursue the B.S. in architectural engineering and the M.S. in structural engineering degree programs should met with the Master of Science in Structural Engineering program director during their sophomore and junior years for further explanation of their options. Students apply to the two-degree program at the beginning of the Spring Quarter in their junior year.

Graduate Studies Programs

For a *Graduate Catalog* and more information on any of these programs, please call (800) 332-6763, or (414) 277-6763 in the Milwaukee area.

Master of Science in Engineering

The Master of Science in Engineering (MSE) degree program is an interdisciplinary program, based on the philosophy that there is a need for engineers who can use a variety of disciplines to solve technical problems. The program has a strong applications orientation and draws from the mechanical, electrical systems and computer engineering disciplines.

Engineering Options – These specific engineering options provide students with an opportunity to take classes that are concentrated in an area of interest within the program: electrical, fluid power (by petition) and mechanical.

This program is available for part-time study.

Master of Science in Engineering Management

The engineering management program is best described as a technical master's degree in the overall management of organizations with an orientation to manufacturing, engineering, technology or production.

This program is available for part-time study and in an accelerated format.

Master of Science in Environmental Engineering

This program is designed to provide expertise in environmental systems and environmental management issues. It is tailored to the student who already has a bachelor of science degree in a traditional engineering discipline. Topics in areas such as environmental law, pollution control, solid and hazardous waste management, water and wastewater treatment, plant safety and OSHA issues, environmental risk assessment, and soil and groundwater remediation are presented.

This program is available on a part-time basis, on a full-time basis and as a five-year, two-degree program.

Master of Science in Medical Informatics

Medical informatics is information science applied to health care. More specifically, it is the applied science at the junction of the disciplines of medicine, business and information technology, which supports the health care delivery process and promotes measurable improvements in both quality of care and cost-effectiveness. The mission of the program is to provide an applied graduate educational experience that prepares professionals to participate in and lead multidisciplinary teams in the development, implementation and management of information technology solutions in health care.

This program is available on a full- or part-time basis.

Master of Science in Perfusion

Perfusion, the science of supporting or replacing a patient's circulatory or respiratory function, is a hospital operating room discipline of critical importance in invasive surgery. The program includes extensive clinical experience and emphasizes the technology involved in perfusion. This is an excellent advanced degree opportunity for graduates of biomedical engineering, life and physical sciences, nursing and allied health.

This is a full-time program.

Master of Science in Structural Engineering

This program emphasizes building structural design and analysis, and meets the needs of architectural, civil or structural engineers who desire increased knowledge to design modern building structural systems.

This program is available on a part- or full-time basis.

Reserve Officer Training Corps

Main Office: Student Life and Campus Center, CC-101
Phone: (414) 288-7682
Fax: (414) 288-7627

Reserve Officer Training Corps (ROTC) is an educational program that trains students to be officers in the United States military. ROTC students learn leadership skills in college in order to have a successful military or civilian career. Each branch of the armed services has an ROTC program.

Scholarship opportunities are available through all of the ROTC programs in a variety of academic majors. To find out more information on the ROTC programs offered at MSOE, see the following pages:

Air Force ROTC
Army ROTC
Navy ROTC

Air Force ROTC

Air Force Reserve Officer Training Corps (AFROTC) is an educational program designed to give men and women the opportunity to become Air Force officers while completing a college degree. AFROTC gives students the chance to develop leadership skills in college and prepares students for a successful career as an officer in the United States Air Force.

Air Force ROTC offers scholarships that cover most or all of a student's college expenses. These scholarships are offered in one-, two-, three-or four-year lengths, and may be granted to high school students or current college students. High school students wishing to compete for a scholarship prior to entering college must apply following their junior year and prior to Dec. 1 of their senior year of high school. The scholarship application and application procedures can be viewed at www.afrotc.com. If a high school student does not apply by the Dec. 1 deadline, normally the soonest they can receive scholarship benefits is their sophomore year in college. Interested students do not need a scholarship offer to participate in AFROTC; scholarships are available to qualified students based on their academic and cadet corps performance. The AFROTC office at MSOE is located on the first floor of the Student Life and Campus Center. The required AFROTC courses are taught by the Aerospace Studies faculty from Marquette University. The required freshman and sophomore academic courses are taught at MSOE, and the junior and senior courses are taught at the nearby Marquette campus. All AFROTC students participate in Leadership Laboratory at Marquette's campus one morning per week.

Air Force ROTC units are located on 144 campuses nationwide and have cross-town agreements with more than 1,000 additional institutions. For more information, students are encouraged to visit www.afrotc.com or call (414) 288-7682.

Army ROTC

Army Reserve Officer Training Corps (AROTC) is a four-year program offered at hundreds of colleges and universities nationwide. This program trains college students to be officers in the active Army, Army reserve or Army National Guard. AROTC students will learn the leadership and management skills essential to becoming an Army officer or having a successful civilian career. The Army ROTC mission is to commission the future officer leadership of the U.S. Army.

Hundreds of AROTC scholarships are available to students each year. These scholarships are awarded on merit, not financial need. Merit includes academic achievement and extracurricular activities, such as sports, student government or work. AROTC scholarships are awarded to students studying science, engineering, nursing, business and a variety of other academic majors. Any student may enroll in AROTC, regardless of whether he or she has been awarded a scholarship.

Army ROTC for Milwaukee colleges and universities is based at Marquette University. Basic AROTC classes are offered on the MSOE campus depending on the number of cadets enrolled from MSOE. Advanced classes are taught on the Marquette campus. All AROTC classes are taught by the Military Science faculty from Marquette University.

Navy ROTC

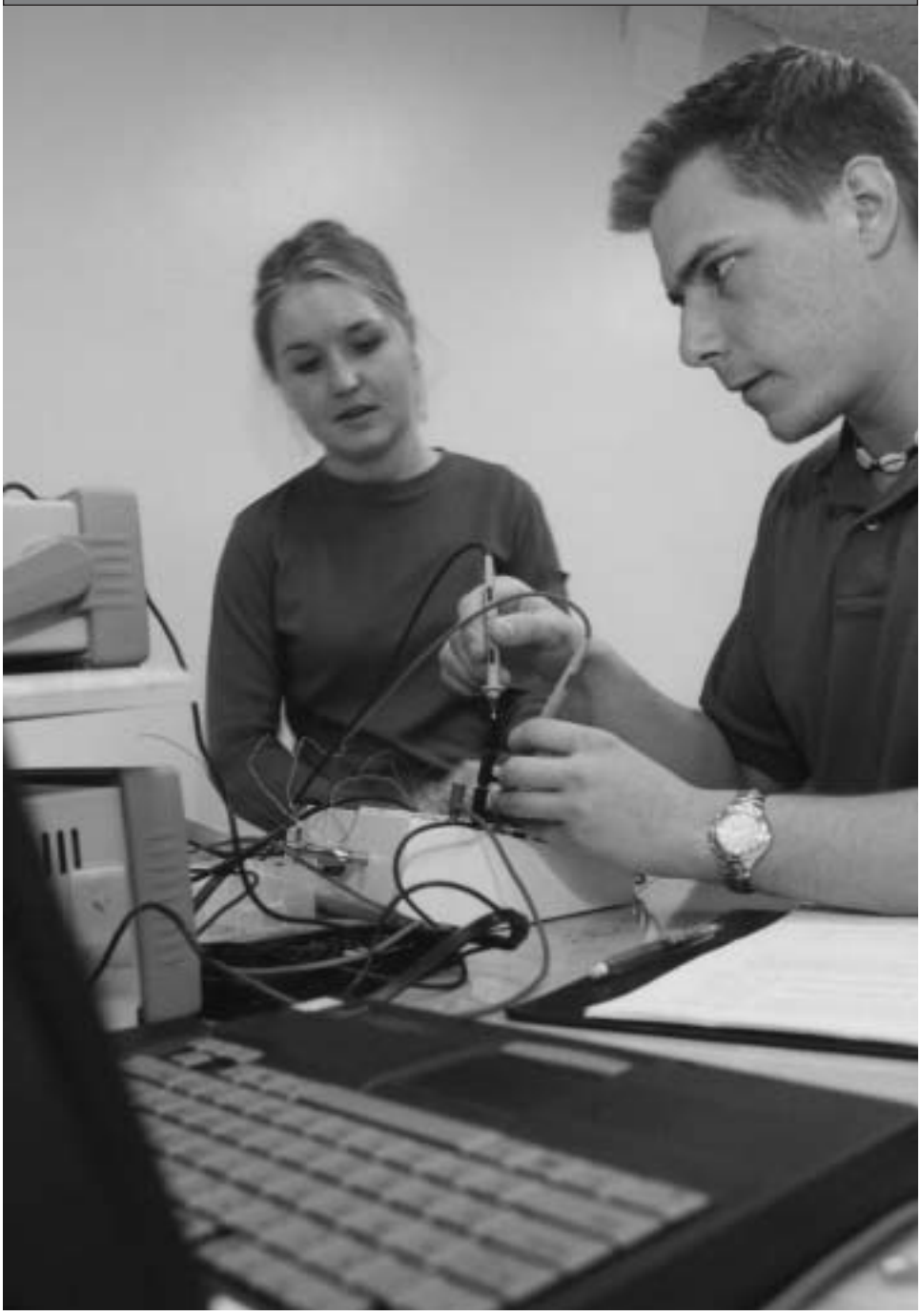
The Naval Reserve Officer Training Corp (NROTC) Program was established to educate and train qualified young men and women for service as commissioned Marine Corps Reserve. As the largest single source of Navy and Marine Corps officers, the NROTC Program plays an important role in preparing mature young men and women for leadership and management positions in an increasingly technical Navy and Marine Corps.

The Navy offers money for college as well. Selected applicants for the Four-Year NROTC Scholarship Program are awarded the scholarship through a highly competitive national selection process. Winners receive full tuition, books, fees and other financial benefits at many of the country's leading colleges and universities, including MSOE. Upon graduation, midshipmen are commissioned as officers in the unrestricted line Naval Reserve or Marine Corps Reserve. The NROTC Four-Year Scholarship Program is available to qualified students who graduate from high school before Aug. 1 of the year they intend to start college. However, if this deadline is missed, students have the opportunity to earn two- or three-year scholarships as well.

At MSOE, the mission of the NROTC unit is to develop midshipmen morally, mentally and physically, and imbue them with the highest ideals of duty, honor and loyalty. We commission college graduates as officers in the United States Navy who possess a basic professional background, are motivated toward careers in the naval service, and have a potential for future development in mind and character. These graduates are then prepped to assume the highest responsibilities of command, citizenship and government.

Students who enroll in NROTC at MSOE do so as “cross-town” students. Required NROTC courses are taught by the Naval Science faculty at the Marquette University campus. The remainder of their major is completed at MSOE.

C
COURSE DESCRIPTIONS



	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
A-300/NM 301 Introduction to Aviation Science	**3**	**0**	**3 or 3.3 CEUs**

This course is designed to provide study necessary to pass the FAA written test for a private pilot license. It is designed to familiarize the student with the dynamics of the contemporary aviation environment. Topics include the following: aerodynamics and performance aircraft systems, airport traffic procedures, navigation aircraft limitation, meteorology, pilot judgement, decision making and accident analysis. (prereq: none)

AE-100 Introduction to Architectural Engineering & Construction Management	**2**	**2**	**3**

This is an interdepartmental, team-taught course. The following topics are presented from the AE&BC Department: an overview of the architectural engineering and construction management programs and five-year and dual degrees; career paths in architectural engineering and construction management; and the constructor's role and the design process in architecture, structural, environmental and electrical systems engineering. An architectural conceptual design project is completed by a team of students and the design process is discussed. Presentations of student projects are required in the various phases of completion. The students also learn team building skills and relationships in this team project. The General Studies Department faculty introduce topics to develop the students' academic, personal and interpersonal skills that help in college and create a sense of campus involvement. The oral presentation and written expression skills are enhanced with class participation and feedback.

AE-1231 Building Construction Materials	**3**	**2**	**4**

This course is a study of the properties of construction materials, methods of manufacturing and installation. Materials include wood, steel, concrete, masonry, asphalt and gypsum as components of architectural engineering. A laboratory reinforces the principles presented in lecture. (prereq: 1 yr. high school chemistry or CH-090)

AE-130 Architectural Engineering Graphics	**2**	**2**	**3**

This is an introduction to basic graphic communication skills needed by architectural engineers. Topics covered include lettering and line weights, views of structures in plan elevation, section, isometric and perspective. Also, as part of this course the student is exposed to basic building systems. Introductory AutoCAD is used in two drawings. (prereq: AE-1311)

AE-1311 Introduction to CAD	**1**	**1**	**1**

This class teaches the basics of 2-D CAD architectural drafting. The CAD program used is AutoCAD. No previous CAD experience is required. General CAD topics include basic drawing, editing and copying, along with dimensioning and text insertion. Specific AutoCAD functions include blocks, attributes and the use of layers.

AE-200 Statics	**4**	**0**	**4**

Statics is a study of force systems acting on rigid bodies not in motion. The analysis includes forces acting in and on beams, trusses and frames in equilibrium. Topical content includes 2-D and 3-D systems, free body diagrams, pulley systems, friction, centroids and moments of inertia. Analysis includes both scalar and vector methods. (prereq: MA-137; coreq: PH-110)

AE-201 Strength of Materials	**4**	**0**	**4**

This course is the study of stress and strain of elastic bodies. Areas covered are analysis of statically determinate beams; shear and moment equations and diagrams; flexural and shear stress; double integration method; and axial, torsional and thermal loads of statically indeterminate systems and columns. (prereq: AE-200)

AE-2121 Fundamentals of Thermodynamics	**4**	**0**	**4**

For architectural engineering and construction management students, this course covers the basic principles of engineering thermodynamics, as applied to the AE and CM student's field of interest. Topics include: determination of thermodynamic properties; First Law of Thermodynamics for closed and open systems; selected topics in Second Law of Thermodynamics; refrigeration and heat pump cycles; and psychrometrics. (prereq: MA-137, PH-110)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AE-213 Introduction to Fluid Mechanics 4 0 4

This course covers the basic principles of fluid mechanics necessary for the design of building plumbing and fire protection systems, and for the design of air duct systems in building HVAC systems. Specific topics covered include: (1) introduction to basic fluid properties such as specific weight and viscosity, and an introduction to the concept and measurement of pressure, (2) the continuity equation for incompressible, steady flows, (3) the steady flow energy equation for incompressible, adiabatic fluid flow, and its simplified form the Bernoulli equation, (4) computation methods for frictional and minor losses in closed channel flow, (5) Manning's equation for open channel flow, (6) introduction to flow measuring devices, (7) basic principles of pumps, fans, compressors, and blowers, and (8) an introduction to plumbing and fire protection system design through the use of various, applicable case studies throughout the course, but especially during the last week of the course. (prereq: AE-2121)

AE-2211 Building Construction Methods 3 2 4

This course provides familiarity with the labor and equipment activities typically applied in architectural construction. Emphasis is placed on assembly techniques for the more common materials, as studied in the Building Construction Materials course. Laboratories highlight teamwork for the labor tasks applied to common assemblies and drawings of the architectural details necessary for their proper construction. (prereq: AE-1231, AE-130)

AE-225 Specifications and Contracts 3 0 3

This course starts with an overview of the different contractual relationships and project delivery methods within the building industry. Then, standard bidding, contracting and specifications documentation is presented. Contract document standards, as related to the CSI MasterFormat, are studied. The student is acquainted with specifying construction methods and materials. Standard industry contracts are compared and contrasted for risk allocation to the parties. (prereq: AE-2211)

AE-3011 Principles of Structural Analysis 3 0 3

Material in this course is an extension of engineering science concepts into the analysis of real structures by classical and approximate methods. All examples are taken from framing plans, so the concept of load path is included. Applications of computerized structural analysis are introduced. (prereq: AE-201)

AE-3021 Principles of Structural Steel and Concrete Design 4 0 4

Students study the fundamentals of both structural steel design and reinforced concrete design. Behavior under shear, moment, and axial load is analyzed and the proper design considerations for each material is explained. This course is an extension of the study of the concepts learned in Strength of Materials. The theoretical and allowable stresses are evaluated and compared for compliance with AISC LRFD Code and the American Concrete Institute Code. (prereq: AE-201)

AE-3023 Advanced Structural Analysis 3 2 3

Theory and application of computerized structural analysis, with an emphasis on developing an understanding of structural behavior. Laboratory experience includes tension, tension with stress concentration, beam and truss. (prereq: AE-3011)

AE-303 Soil Mechanics and Foundations 4 0 4

This course provides a basic understanding of the interaction between soil conditions and the design of the foundation system. Methods of soil testing and site investigation are described and analysis of data is performed. Topics include soil types and classifications, physical properties, subsoil stresses, shear strength, bearing capacity, settlement, consolidation and lateral earth pressure. Foundation design topics include load transfer through the structural system, shallow and deep foundation types, design of foundation size, shape and reinforcement. Also included is pedestal, base plate and anchor bolt design. The course utilizes the latest American Concrete Institute (ACI) Code and other pertinent reference materials. (prereq: AE-3021)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AE-304 Advanced Steel Design 3 2 4

Students study the fundamentals of the integrated systems of steel structures. This study involves theoretical analysis combined with practical design projects. The specification of AISC LRFD Code is also studied. Connections, members and structural systems are evaluated. (prereq: AE-3011, AE-3021)

AE-3111 Basic Principles of HVAC 3 0 3

This course introduces the student to the basics of building heating, ventilating, and air conditioning design. Emphasis is on introducing the topics within the context of the basic fundamentals of thermodynamics and heat transfer. Topics include introduction to comfort parameters, building heat loss calculation methods, building heat gain calculation methods, basic heating and cooling processes, and heating and cooling equipment. (prereq: AE-213)

AE-3121 Principles of Fire Protection and Plumbing Design 4 0 4

This course is an introduction to plumbing and fire suppression systems principles. The plumbing systems components to be examined include water supplies and domestic water distribution systems, plumbing fixtures and components, sanitary drainage systems, sewage treatment and disposal, and storm drainage systems. Health and safety standards will be discussed using plumbing codes and system configuration standards. The fire suppression systems components to be examined include fire science, fire safety design, fire detection and fire alarm systems, fire suppression systems, automatic sprinkler systems and smoke control principles. Industry standards and variations will be discussed using NFPA codes and building codes. The architectural engineer's responsibilities to understand the purpose and configuration of these systems will be emphasized whether they are the designer of these systems or the designer of associated building systems. (prereq: AE-213)

AE-3131 Building Environmental Systems I 3 2 4

This course will continue the development of a basic design of a heating, ventilating and air conditioning system, emphasizing component selection and system design. The student will be required to perform manual calculations and selections of HVAC equipment. Emphasis will be on code requirements and equipment performance. (prereq: AE-3111)

AE-3132 Building Environmental Systems II 3 2 4

This course continues the development of a basic design of a heating, ventilating and air conditioning system, adding computer generated design procedures. Students' manual calculations and selections are compared to the computer generated values. Computer programs are those currently used in the industry for system design. (prereq: AE-3131)

AE-3141 Plumbing and Fire Suppression Systems Design 3 2 4

This course is a continuation of plumbing and fire suppression systems principles and then transitions into the system design, layout and specification concepts of plumbing and fire suppression systems. The plumbing systems components to be examined include water treatment, heating and pumping equipment, plumbing fixtures, plumbing specialties and plumbing piping, and installation materials. Design standards and variations will be discussed using plumbing codes and master specifications. The fire suppression systems components to be examined include standpipes and hose systems, gaseous fire suppression systems, wet sprinkler systems, pumping equipment and fire suppression systems piping, and installation materials. Design standards and variations will be discussed using NFPA codes and master specifications. The architectural engineer's responsibilities in design and specification writing will be emphasized through examples of construction document components, including plans, details and specifications. (prereq: AE-3121)

AE-3321 Architectural History 3 0 3

This course introduces ideas and goals of architectural expression as they have developed from ancient civilizations to the present. Topics include historical development of architectural reasoning and construction techniques. Specific structures are analyzed for their impact on architecture and urban/rural form. (prereq: junior standing or consent of instructor)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
AE-3431	**Construction Finance and Economics**	**3**	**0**	**3**

This course provides an introduction into financial and economic concepts that confront the building construction and design professional. Topics such as market analysis, competition evaluation, financing a building project, labor markets, investing, interest rates, local economic conditions, financial forecasting and government policies are included. (prereq: junior standing)

AE-3611	**Principles of Electrical Systems Design**	**4**	**0**	**4**

This introductory electrical systems design course covers topics in motors, switches, power quality, and safety, plus the basics in distribution systems, controls and the electrical code. (prereq: EE-201)

AE-3621	**Basic Principles of Illumination and Communications**	**3**	**0**	**3**

An introductory illumination and communications systems course with lighting basics, which includes illumination, interior lighting design, energy use and electrical codes and communication basics in security and fire alarm systems. (prereq: AE-3611)

AE-3631	**Building Electrical Power Distribution I**	**3**	**2**	**4**

Topics include power systems below 600 volts, totalizing loads, feeder and branch circuits, power transformers, overcurrent protection, fault currents, circuit breaker selection, and electrical code application. Panelboard and switchboard selection, electric service entrances, power factor correction, power company coordination, small and medium motors, motor control and electrical measuring devices are covered. Laboratory experiments relating to equipment and analysis, as well as a case study, provide students with an opportunity to demonstrate application of course material. An electrical design project is started in this course. (prereq: AE-3611)

AE-3641	**Building Electrical Power Distribution II**	**3**	**2**	**4**

Campus power plants and distribution, large and tall building power distribution, totalizing loads, large and medium voltage services, power company coordination, emergency generators, power factor correction, underground duct banks, electrical vaults, per unit fault current calculations, medium voltage equipment, working clearances around equipment, large motors, motor control, and feeder and branch circuit design are all covered in this course. Case studies are presented to reinforce theory and application of electrical code. Continuation of the electrical design project started in AE-3631. (prereq: AE-3631)

AE-3651	**Building Illumination and Communications Design**	**4**	**0**	**4**

The illumination design topics include outdoor lighting and specifications. Communication topics include telephone systems, cable systems, LAN systems, emergency systems, exit lighting, backup batteries and generators. The electrical design project is continued in this course. (prereq: AE-3641, AE-3621)

AE-401	**Advanced Concrete Design**	**3**	**2**	**4**

This course is the second course in reinforced concrete design. Basic design of beams, one-way slabs and short columns is reviewed. Emphasis is on beams and slabs subjected to torsional loading, long columns and two-way slabs. Frame analysis with computer-aided applications is introduced, along with the concepts of prestressed concrete and composite design. (prereq: AE-3011, AE-3021)

AE-407	**Wood and Masonry Design**	**3**	**0**	**3**

Engineering properties and behavior of wood and masonry are determined by their unique characteristics. Design techniques for wood beams and columns, and nailed and bolted connections are presented. Design of reinforced and un-reinforced masonry bearing walls is covered. (prereq: AE-3011)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AE-411 Building Systems Control 3 2 4

This course familiarizes the students with a basic knowledge of HVAC system controls and control theory. Topics covered will be pneumatic, electric, and electronic control systems and components. Building energy management and its connection to control systems will be introduced. In addition to this, basic motors starters and power sources will be reviewed. Reinforcement of the various topics will be provided through laboratory tests and observations using the various HVAC equipment located in the Johnson Controls Energy Laboratory. (prereq: AE-3611)

AE-412 Energy Management Techniques 3 0 3

Using the information from the previous energy systems courses, the student will study basic energy management from an energy conservation perspective. This will include various methods of energy conservation and the savings afforded by them, evaluation of equipment and system performance, along with calculation procedures required for system economic evaluations. The course will emphasize the retrofit of existing systems for energy conservation. As part of the course, the students will be required to use an energy analysis computer program and spreadsheet analysis to calculate equipment performances. In addition, actual methods in management of a building for energy conservation will be discussed. (prereq: AE-411)

AE-4121 Environmental Science in Building Construction 3 0 3

This course introduces students to environmental aspects and impacts of construction-related activities. Topics include an introduction to environmental laws, regulations and policies; environmental exposures to hazardous chemicals; management and minimization of construction and demolition waste; stormwater management; air quality management and the hazardous communications standard. (prereq: junior standing)

AE-417 Advanced Plumbing Systems Design 3 0 3

This course further expands the student's knowledge of plumbing systems design learned in AE-315. Topics covered include advanced systems analysis and design of high-rise plumbing systems, domestic water heating systems, hot water maintenance systems, gas and vacuum systems for medical facilities and industrial applications, and high purity water systems. Coordination with other building systems including electrical, fire protection and HVAC systems will be included to aid in the understanding of conflicts during the design process. (prereq: AE-3141)

AE-4311 Architectural Design 2 2 3

This course offers the student an opportunity to understand and demonstrate skills in problem solving and design of building projects. Areas stressed in this course include problem analysis and solving, project design, graphic and oral presentation techniques, architectural programming, building code search and working drawing standards. (prereq: senior standing; coreq: AE-4711)

AE-4411 Engineering Economy and Building Investment Economics 3 0 3

This course is based on the principle that in order to properly meet a client's goals on a building project, the architect/engineer must understand the economic factors that motivate the client to build. The student is taught their role in predevelopment analysis along with the basic principles of real estate investment, cash flow, depreciation, equity, appreciation and tax shelter. Also covered are engineering economics, development history, sustainable development and LEED, zoning, tax laws, investment finance, property management and appraisal techniques. (prereq: junior standing)

AE-461 Advanced CAD with AE Applications 2 2 3

In previous courses, the student gained a knowledge of using a CAD system to create 2-D and 3-D drawings. In this course, the emphasis is on 3-D drawing. Emphasis also is placed on the potential for AE presentations. The 3-D aspects are used to illustrate site planning and layout. (prereq: junior standing or consent of instructor.)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AE-463 Electrical Power Quality for Buildings **3** **0** **3**

This course covers topics involving typical equipment utilizing solid state devices for power quality, such as uninterruptible power supplies, transient voltage suppressors, power line conditioners and voltage regulators. Grounding and neutral systems are studied. The student is exposed to basic electronic concepts, devices monitoring and analysis associated with this equipment. (prereq: AE-3641)

AE-466 Project Management for Electrical Engineers **3** **0** **3**

A study of methods and operations of an electrical project from the perspective of the electrical engineer. Topics to include electrical estimating, specification writing, project code review, project scheduling, safety awareness and building code review. (prereq: senior standing, AE-463)

AE-4711 Architectural Engineering and Construction Management Design-Build Senior Project I **1** **1** **1**

This course is the first of a three-part series in designing a building for an actual client using the design-build project delivery system. The course emphasizes development of the required building program a designer must complete in order to understand a client's building requirements of users, spaces, building function and budget. This program is then used in the other two senior project courses, AE-4721/CM-4721 and AE-4731/CM-4731, as a basis for the design of the building. Other topics include organization, team building, client interviewing skills, LEED and sustainable development, space analysis, building code review, building type research, value engineering and CADD. Note: BSAE students should register for AE-4711; BSCM students should register for CM-4711; five-year, two-degree BSAE/BSCM students should register for AE-4711 in their fourth year and CM-4711 in their fifth year. Students must take this course in consecutive terms with AE-4721/CM-4721, followed by AE-4731/CM-4731. (prereq: senior standing or fifth year standing in BSAE/BSCM five-year program.)

AE-4721 Architectural Engineering and Construction Management Design-Build Senior Project II **1** **3** **3**

This is the second of the three-part senior project series. This is a team taught course, taught by architects, structural engineers, HVAC engineers, plumbing and fire protection engineers, building electrical power distribution engineers and construction managers. It continues to emphasize the design-build process and requires an interdisciplinary team of students to utilize their respective engineering design specialty courses or construction management expertise as they design a building and plan for its construction by using estimating, scheduling, budgeting and construction project management techniques. The following phases will be completed: (1) site analysis; (2) preliminary architectural drawings and presentations; (3) architectural design development drawings; (4) preliminary engineering (structural, environmental, electrical) systems analysis; (5) preliminary budget analysis; (6) project scheduling and (7) ongoing project management responsibilities; (8) presentation to clients and other professionals. Note: Four-year BSAE students must register for AE-4721; four-year BSCM students must register for CM-4721; five-year BASE/BSCM two-degree students must register for AE-4721 in their fourth year and four CM-4721 in their fifth year. The three-course sequence 4711/4721/4731 must be taken in consecutive quarters during the same academic year. (prereq: senior standing and either AE-4711 or CM-4711.)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
AE-4731	**Architectural Engineering and Construction Management Design-Build Senior Project III**	**1**	**3**	**4**

This is the final course in the senior project series, a continuation of the team taught senior project. Emphasis is on the design-build process and the interdisciplinary team of students to utilize their respective engineering design specialty courses or construction management expertise. This course emphasizes the engineering design and construction project management work begun in AE-4721/CM-4721. The topics in this course include (1) analysis and calculations for all engineering systems; (2) continued constructability analysis and value engineering; (3) life cycle cost analysis; (4) construction quality control systems; (5) project scheduling, estimating; (6) ongoing project management; and (7) project startup procedures. Students also make a presentation to industrialists in defense of their engineering design or CM project analysis. Note: Four-year BSAE students must register for AE-4731; four-year BSCM students must register for CM-4731; five-year BSAE/BSCM two-degree students must register for AE-4731 in year four and for CM-4731 in year five of their programs. The three-course sequence, 4711/4721/4731, must be taken in consecutive quarters during the same academic year. (prereq: senior standing, AE-4721 or CM-4721)

AE-4733 AE Senior Project Working Drawings **2** **2** **3**

This course integrates previous studies in materials, construction methods, structural systems, mechanical systems, specifications and architectural design to produce a full set of detailed construction drawings. Projects utilize the students' designs from senior project, which allows the fullest development, to the finest detail, of the students' ideas.

AE-490 Independent Study **3** **0** **3**

This subject provides an advanced student with an opportunity to develop an in-depth understanding of an area within their major field of study by means of a practical architectural or engineering project. Students are required to research, analyze and develop design solutions. Completed projects are submitted to the faculty adviser in a formal technical communication form as prescribed by the adviser. (prereq: consent of department chairman)

AF-100 Foundations of the Air Force I **1** **2** **1**

This course is an introduction to the organizational structure and missions of Air Force organizations; officership and professionalism; and communicative skills. (prereq: none)

AF-101 Foundations of the Air Force II **1** **2** **1**

This is a continuation of AF-100. (prereq: AF-100)

AF-102 Foundations of the Air Force III **1** **2** **1**

This is a continuation of AF-101. (prereq: AF-101)

AF-150 Air Force Leadership Laboratory

Students average two hours per week in laboratory throughout their enrollment in AFROTC. Supervised instruction is conducted within the framework of organized cadet corps activities designed to develop each student's leadership potential. Students also are instructed in Air Force customs and courtesies, drill and ceremonies, career opportunities, and the life and work of an Air Force junior officer. All students pursuing an Air Force commission must attend the laboratory portion of each Air Force course.

AF-200 Evolution of the Air Force/Air and Space Power I **1** **2** **1**

This course focuses on factors contributing to the development of air power from its earliest beginnings through two world wars; the evolution of air power concepts and doctrine; and an assessment of communicative skills. (prereq: none)

AF-201 Evolution of the Air Force/Air and Space Power II **1** **2** **1**

This is a continuation of AF-200. (prereq: AF-200)

AF-202 Evolution of the Air Force/Air and Space Power III **1** **2** **1**

This is a continuation of AF-201. (prereq: AF-201)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AF-300 Air Force Leadership Studies I 3 2 3

This is a study of leadership and quality management fundamentals, professional knowledge, leadership ethics, and communicative skills required of an Air Force officer. Case studies are used to examine Air Force leadership and management situations as a means of demonstrating and exercising practical application of the concepts being studied. (prereq: none)

AF-301 Air Force Leadership Studies II 3 2 3

This is a continuation of AF-300. (prereq: AF-300)

AF-302 Air Force Leadership Studies III 3 2 3

This is a continuation of AF-301. (prereq: AF-301)

AF-400 National Security Affairs/ Preparation for Active Duty I 3 2 3

This course examines the need for national security; analyzes the evolution and formulation of the American defense policy, strategy and joint doctrine; investigates the methods for managing conflict; and outlines regional security, arms control and terrorism. Special topics of interest focus on the military as a profession, officership, the military justice system and current issues affecting military professionalism. Within this structure, continued emphasis is given to the refinement of communicative skills. (prereq: none)

AF-401 National Security Affairs/ Preparation for Active Duty II 3 2 3

This is a continuation of AF-400. (prereq: AF-400)

AF-402 National Security Affairs/ Preparation for Active Duty III 3 2 3

This is a continuation of AF-401. (prereq: AF-401)

BE-103 Freshman BE Design 1 3 2

The objective of this course is to introduce students to an engineering design methodology applicable to biomedical engineering design problems. This course is the first of a ten course sequence resulting in the engineering design of a product, system or service. The student is assigned to a team design project and a faculty adviser. Students are required to develop a plan covering the next ten quarters of work on the design project. In the laboratory, students are required to demonstrate proficiency in using an engineering logbook, perform calculations using a scientific calculator and use more advanced features of previously introduced computer tools. This course contains two credits of engineering design. (prereq: BI-102, MA-136)

BE-104 Computing in Biomedical Engineering 2 3 3

The objective of this course is to familiarize students with the computer systems available at MSOE and to present the basics of computer programming using C++. Each student is required to demonstrate proficiency using various software packages deemed necessary and to demonstrate a proficiency in solving problems by writing computer programs. Particular emphasis is placed on the design, documentation and testing of programs. Each student is required to give a classroom presentation of a computer programming topic related to his/her biomedical engineering design team project. (prereq: BE-103, MA-137)

BE-200 Sophomore BE Design I 1 0 1

This course is a continuation of the BE design sequence and the first in a series of sophomore-level design courses. Particular emphasis is given to: the application and use of project management techniques and software; structured searching of the medical and engineering literature; use of available engineering and graphics software; and exploring biomedical engineering career opportunities. Continued emphasis on design team development and the proper use and maintenance of the engineering logbook is also included. (prereq: BI-102, BE-103, BE-104)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

BE-201 Sophomore BE Design II 1 0 1

This course is a continuation of the sophomore BE design sequence. In this course particular emphasis is given to intellectual property (IP) issues; creation and use of engineering specifications and human factors issues and software design topics. Design team development and the proper use and maintenance of the engineering logbook is also included. (prereq: BE-200)

BE-202 Sophomore BE Design III 1 0 1

This course is a continuation of the sophomore BE design sequence. Emphasis is given to biomedical engineering career options; block diagrams and the systems approach to design; incorporation of safety considerations into the design process; introductory electrical safety; and an introduction to codes and standards (including NFPA, NEC, AMMI and ANSI codes and standards). (prereq: BE-201)

BE-205 Computing in Biomedical Engineering II 1 3 2

The intent of this course is to advance the computer programming skills of students. This includes an understanding of and capability to develop console procedure-oriented and windows event-driven programs. Each student is required to demonstrate proficiency in solving problems by writing computer programs meeting the required specifications. Particular emphasis is placed on concepts of object-oriented design such as encapsulation and inheritance. Many of the programs are related to general engineering applications or biomedical applications of computing. (prereq: BE-104)

BE-206 Signals and Systems I 3 3 4

This course introduces students to transient analysis of systems using linear component models. System differential equations are set up and solved using both classical and Laplace techniques. In addition to the analysis of electrical circuits with step-function and sinusoidal sources, it includes impulse function methods, transfer functions and Bode plots, used with mechanical, thermal and other linear systems. SPICE is also used to simulate system response. (prereq: EE-201, MA-235, PH-230)

BE-261 Biostatistics I 3 0 3

This course provides an introduction to biostatistics for biomedical engineering students. As a result of this course the students are expected to understand and prepare statistical analyses to data from physiological systems in the laboratory and clinical environment. Students learn basic probability theory that includes discrete and continuous probability distributions. They learn how to apply that theory to hypothesis testing and understand the difference between a z-test and t-test, and one- and two-sample inference hypothesis testing. These statistical procedures may be presented in current research publications or used by students in preparation of course project and design reports. (prereq: BE-104, MA-136, MA-137)

BE-300 Junior BE Design I 1 0 1

This is the fifth course in the biomedical engineering design sequence. Lecture topics include software tools useful in the design process, manufacturing processes, and codes and standards (ISO 9000 and GMP). A major portion of student activity involves preparation for junior design presentations. (prereq: BE-202)

BE-301 Junior BE Design II 1 0 1

This is the sixth course in the biomedical engineering design sequence. Lecture topics including engineering economics and how it may be related to a design project. Prototype design is also addressed. A major activity for students is the formal presentation of their projects to an audience composed of other faculty, students and people from outside of the university. (prereq: BE-300)

BE-302 Junior BE Design III 1 0 1

This is the seventh course in the biomedical engineering design sequence. Lecture topics include engineering economics and system design at a functional level. Career options, graduate school and professional registration are discussed. (prereq: BE-301)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

BE-306 Biomedical Electronics and Systems I 3 3 4

This course introduces circuits and devices that are useful in the design of biomedical instrumentation. Included are general purpose operational amplifiers and more specialized integrated circuits such as timers, regulators and modulators. Physiological data are converted to electrical signals using displacement, force, pressure or temperature transducers. Circuits are designed to amplify, filter and detect events in the biological signals. Systems for blood pressure, flow and volume measurements are analyzed and evaluated. Basic techniques for waveform generation, and amplitude and frequency modulation are introduced. Laboratory experiments parallel and reinforce the lecture material. (prereq: EE-310, BE-305, BI-373; coreq: BE-400)

BE-307 Signals and Systems II 4 0 4

This course is intended to provide a modern treatment of signals and systems at the introductory level. Further, it provides a balanced and integrated treatment of continuous-time and discrete-time forms of signals and systems intended to reflect their roles in engineering practice. The course is designed to prepare students for upper-level courses in biomedical digital signal processing, advance medical instrumentation, medical imaging,and feedback control systems. (prereq: BE-206, EE-201, ME-206)

BE-330 Bioelectric Fields 4 0 4

The objective of this course is to introduce the junior biomedical engineering student to the topic of bioelectric fields. Topics include those associated with vector calculus, biophysics, electromagnetic wave propagation, transmission lines, and the application of these topics to the understanding of the nervous system. (prereq: BE-307, BE-381, PH-230; coreq: BI-373)

BE-352 Survey of Biomedical Engineering 3 0 3

The objective of this course is to present the nonbiomedical engineering student with an overview of how biomedical engineering contributes to various areas of the health care system. Topics include examples of diagnostic, therapeutic, and monitoring devices and systems. (prereq: junior standing)

BE-361 Biostatistics II 3 0 3

As a continuation of BE-261, this course addresses the broader issues of the design of experiments. Included are the concepts associated with measurement validity and reliability, hypothesis formulation and testing, and the experimental and statistical control of error. Particular emphasis is given to the appropriate selection and use of parametric statistical tests including t-tests, analysis of variance, repeated-measures designs, and simple and multiple regression. Statistical software tools are used throughout the course. (prereq: BE-261)

BE-381 Biophysical Phenomena: Thermodynamics and Heat Transfer 4 0 4

The objective of this course is to present fundamental principles of classical thermodynamics and heat transfer, and to apply these principles to the solution of both classical and biological problems. (prereq: BE-104, MA-231, PH-250)

BE-382 Biophysical Phenomena: Fluid and Mass Transport 4 0 4

The objective of this course is to present the fundamental principles of classical fluid mechanics and mass transport, and to apply these principles to the solution of both classical and biomedical problems. (prereq: BE-361, BE-381, MA-232)

BE-404 Biomedical Engineering Design I 1 3 2

As a continuation of the biomedical engineering design sequence, this course gives particular emphasis to system design and testing. Included is the development of detailed system and device specifications, block diagrams, and in identification of signal and/or energy flow pathways. The first of two comprehensive and formal design reviews also occurs during this course. Issues related to the testing of human subjects, and the concepts and requirements associated with Institutional Review Boards, are also covered. (prereq: BE-302)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

BE-405 Biomedical Engineering Design II 1 3 2

As a continuation of the biomedical engineering design sequence, this course gives further emphasis to design including life-cycle, reliability, human factors and usability, and maintainability. Also included is a thorough treatment of electrical, mechanical, radiation and biological safety issues unique to biomedical design. The second of two comprehensive, detailed and formal design reviews occurs during this course. (prereq: BE-404)

BE-406 Biomedical Engineering Design III 1 3 2

As the final course in the biomedical engineering design sequence, this course is focused on design completion, testing, documentation and formal presentation at the biomedical engineering senior design show. Issues associated with software testing are also included early in the course. (prereq: BE-405)

BE-410 Introduction to Biomaterials 3 0 3

The objective of this course is to present the principles which apply to the properties and selection of materials used in medical applications. Topics include metals, ceramics, polymers, composites, biological tissues, wound healing, and the interaction between biological tissues and artificial materials. (prereq: BI-374, BE-381, ME-207)

BE-411 Biomechanics 3 0 3

This course is an introduction to the biomechanics of human movement, with applications to occupational, rehabilitation, forensic and sports biomechanics. Topics covered include kinematics; anthropometry; kinetics; mechanical work, energy, and power; synthesis of human movement; muscle mechanics;and kinesiological electromyography. (prereq: BE-410, BE-433, BI-374, ME-206, ME-207)

BE-417 Biomedical Electronics 3 3 4

This course is similar to BE-306 in philosophy and structure and should be taken immediately following BE-306. It expands the electronics coverage begun in BE-306 and combines it with topics previously studied in biology, chemistry and physiology to develop more complete measurement systems. Of particular interest are the production and distribution of biological signals, such as the ECG, EMG or EEG, and the electrodes and sensitive amplifiers needed to record them. Methods for reducing electrical noise and interference in the signals and conversion between analog and digital forms are included. Electronic feedback principles are applied to enhance system performance. (prereq: BE-306, BE-330)

BE-433 Biomedical Digital Signal Processing 3 3 4

The objective of this course is to present the principles of digital signal processing and to have students apply these methods to the analysis of biological signals such as EEG and ECG. Topics covered include sampling, quantization, discrete-time system analysis, Z-transform, discrete and fast Fourier transform, transfer functions and digital filtering. In the laboratory, students are required to design software to perform analysis on various biopotential signals. (prereq: BE-307, BE-361, BI-374, EE-291)

BE-460 Medical Imaging Systems 3 3 4

The objective of this course is to introduce students to the modalities of clinical medical imaging. Students will learn the physics of how an image is created and how imaging equipment acquires the image. Medical image processing techniques are also practiced. Topics include image formation, X-ray, computed tomography, ultrasound, magnetic resonance, nuclear and image processing. (prereq: PH-250, BE-417, BE-433, BI-374)

BE-471 Biomedical Control Systems: Analog 4 0 4

The objective of this course is to present topics in classical feedback control theory, introduce modern control theory, and to apply these topics to the solution of both classical and biological feedback control problems. This course contains one credit of engineering design. (prereq: BE-305, BI-374, BE-417, BE-382)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

BE-472 Biomedical Control Systems: Digital 3 3 4

This course is a continuation of BE-472. The topics covered include feedback control system frequency response, discrete-time systems, sampled-data systems, analysis and design of digital control systems, and an introduction to nonlinear system analysis. In the laboratory students are required to design, construct and test both analog and digital feedback control systems. (prereq: BE-433, BE-471)

BE-499 Clinical Internship 0 9 3

The senior biomedical engineering student has an elective option of working at one of the affiliated hospitals or medical laboratories. Students may apply for clinical internship positions – they are not assigned to students. Each clinical internship must be approved by the biomedical engineering program director and the Electrical Engineering and Computer Science Department chairman prior to registration. Comprehensive documentation in the form of an engineering log book including all aspects of the internship must be submitted to the biomedical engineering program director a the end of the internship. (prereq: senior standing, written consent of the BE program director, and the EECS department chairman)

BI-102 Biology 3 3 4

The objective of this course is to introduce students to cell biology and genetics. Topics include chemical bonds, macromolecules, cell structure and function, cellular respiration, cell signaling, cellular reproduction and genetics. In the laboratory students must demonstrate proficiency in the scientific process, including experimental design, basic laboratory techniques, data recording and scientific report writing. (coreq: CH-200)

BI-172 Human Anatomy and Physiology I 3 0 3

The objective of this course is to present the basic principles of functional human anatomy and physiology that apply to homeostasis, histology, the integumentary system, bone tissue, the skeletal system, muscle tissue, the muscular system, nervous tissue and the central and peripheral nervous systems. (coreq: BI-102)

BI-256 Microbiology 3 3 4

This course introduces students to the basics of microbiology and the importance of this topic to the health care professional. Topics include microbial characteristics and pathogenesis, and general and specific immune reactions to bacteria, viruses, fungi and parasites. Epidemiology and infection control of the more common microbial diseases is also covered. The laboratory includes topics of microscopy, staining techniques, and elements of microbial nutrition, growth, metabolism and antibiotic sensitivity. (prereq: BI-102)

BI-260 Nutrition 2 0 2

This course introduces nutritional concepts as they relate to human health and fitness. Topics include a basic introduction to nutrition covering carbohydrates, lipids, proteins, vitamins and minerals. Further topics include “what is a healthy diet,’’ metabolism, energy balance and eating disorders. Practical applications of nutrition include discussions of nutrition during pregnancy and lactation,and changing nutritional needs of infants, children, adolescents and adults. (prereq: BI-102, CH-221)

BI-273 Human Anatomy and Physiology II 3 3 4

The objective of this course is to present the basic principles of functional human anatomy and physiology that apply to homeostasis, the sense organs, the circulatory system and the immune system. (prereq: BI-172)

BI-274 Human Anatomy and Physiology III 3 3 4

The objective of this course is to present the basic principles of functional human anatomy and physiology that apply to homeostasis, the endocrine system, the respiratory system, the urinary system, water and electrolyte balance, the digestive system and the reproductive systems and development. (prereq: BI-273)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

BI-281 Pharmacology 2 0 2

This course introduces the students to the effects of drugs on biological systems. Topics covered include general principles of pharmacology, cancer, chemotherapy, chemotherapy of infectious agents, modulators of immune function, peripheral nervous system pharmacology, cardiovascular pharmacology and respiratory pharmacology. (prereq: BI-274)

BI-290 Pathophysiology I 4 0 4

This course provides students with an understanding of the disease process, including etiologics, manifestations, diagnoses and treatment modalities. Topics covered include central concepts of pathophysiology, alterations in cellular function, alterations in host defense mechanisms, cardiovascular alterations and alterations in respiratory functions. Further topics include alterations in fluid, electrolyte and acid-base homeostasis, and imbalances. (prereq: BI-274)

BI-372 Anatomy 2 0 2

This course provides students with an introduction to certain topics in human anatomy, including cells, skin, the skeleton, the muscular system, the nervous system, the thoracic and abdominal organs, and the special senses. (prereq: BI-102, CH-221)

BI-373 Physiology I 3 3 4

The objective of this course is to present the basic principles of human physiology, which apply to homeostasis, cell membrane potentials and transport mechanisms, nerve and muscle, and heart and the circulatory system. Credit for BI-373 is granted after students have also successfully completed all of the requirements for BI-374. (prereq: BI-372)

BI-374 Physiology II 3 3 4

The objective of this course is to present the basic principles of human physiology, which apply to microcirculation and the lymphatic system, the blood, the respiratory system, the renal system, the gastrointestinal system and the endocrine system. (prereq: BI-373)

BI-382 Pharmacology 2 0 2

This course introduces students to the effects of drugs on the biologic systems. Topics covered include central nervous system drugs, drugs affecting fluid and electrolyte balance, drugs for endocrine disorders, drugs for bone and joint disorders, gastrointestinal drugs and drugs affecting women's health. (prereq: BI-281)

BI-391 Pathophysiology II 4 0 4

This course provides a continuation of knowledge in the understanding of the disease process, including etiologics, manifestations, diagnoses and treatment modalities. Topics covered include alterations in functions of the genitourinary system, gastrointestinal system, endocrine functions and metabolism. Further topics include alterations in neural function, neuropsychological function, musculoskeletal functions, integumentary system, and selected multisystem alterations and considerations in critical illness. (prereq: BI-290)

CH-090 Preparations for Chemistry 3 3 4

This is a prerequisite course to be taken by students who have not had one year of high school chemistry or equivalent at a grade level of B or better. This course includes: classification and properties of matter, atomic structure, chemical bonding, chemical equations, physical states of matter, and chemical and physical properties of matter and solutions. Laboratory experiments support lecture topics. (prereq: MA-125 or one year of high school algebra)

CH-103 Principles of Chemistry 3 2 4

This course is intended to provide students in nontechnical fields with the fundamentals in chemistry. Topics include atomic structure, chemical bonding, and properties of matter and solutions. This course satisfies the science laboratory portion of the general education requirement. (prereq: MA-125 or one year of high school algebra)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CH-199 Project in Chemistry 0 0 0

Students are given the opportunity to pursue an approved subject not covered in regularly scheduled course work. This may take the form of individual or small group studies, literature surveys, and laboratory or research projects. Weekly meetings with the course adviser are required. A final report to be filed in the Physics and Chemistry Department may also be required. This course is offered to students with freshman or sophomore standing and may be taken for variable credit. Students with junior or senior standing should request CH-499. (prereq: consent of the course adviser, and the Physics and Chemistry Department Chairman)

CH-200 Chemistry I 3 2 4

This is a general chemistry course for students in engineering and nursing degree programs. Students will design and conduct experiments, analyze and interpret data and relate experimental results to theoretical understandings of chemical phenomena. Specifically, students will more thoroughly understand such subjects as basic chemical calculations, nomenclature, atomic structure, intra- and intermolecular forces, kinetic molecular theory, and properties of gases, liquids, solids and solutions. Not for credit for students who have credit for CH-100 or CH-310. (prereq: CH-090 or one year of high school chemistry)

CH-201 Chemistry II 3 2 4

This is a general chemistry course that continues from CH-200 for students in engineering programs and students interested in chemistry. Students will design and conduct experiments, analyze and interpret data and relate experimental results to theoretical understandings of chemical phenomena. Corrosion, electrochemistry, oxidation-reduction, types of solids, semiconductors, crystalline materials, rates of reactions, acid-base theory, buffers and chemical equilibria are covered. (prereq: CH-200)

CH-222 Organic Chemistry I 2 2 3

Organic chemistry is a beautifully logical subject unified by broad themes. The major concepts of organic chemistry are pointed out in this course, as well as the clarification of the patterns and themes of this class of chemistry. Theory and laboratory work on the principles of organic chemistry, properties and interrelationships of important classes of organic compounds and the roles of such compounds in the metabolism of living systems are covered. Students are introduced to the understanding of the mechanisms of organic reactions and alerted to the industrial, commercial, academic and personal applications and uses of organic matter. (prereq: CH-200)

CH-223 Biochemistry 3 2 4

Biochemistry is the field that is observed to have its influence on diverse disciplines like medicine, nutrition, pharmacology, environmental studies and agriculture, to name a few. Completion of the “human genome sequence project” has brought the field into a new light. This course is designed to train and educate students with essential and central concepts of biochemistry, and principles of biochemistry and its applications. The design of the course enhances the ability of students to address changes, needs and demands of their own major fields as well. The course covers theory and lab-practice to prepare students for the higher technical and intellectual challenges in the field of biochemistry. (prereq: CH-200, CH-222)

CH-302 Chemistry III 3 0 3

This elective has been designed to provide students with the third quarter of a one-year general chemistry course. This allows students to more thoroughly understand such subjects as the structure of materials, thermochemistry, electrochemistry, solution chemistry and the chemical theories relevant to conductors, semiconductors and transition metals. CH-302, a three-credit course, allows students to meet the general chemistry requirements for graduate school and medical school when taking the CH-303 Lab component (a one-credit laboratory course offered in a subsequent quarter), and specifically covers material that is normally found on the MCAT and FE/PE exams. (prereq: CH-201 and junior standing or consent of instructor)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CH-303 Chemistry III LAB 0 2 1

This elective has been designed to provide students with the third-quarter lab part of a one-year general chemistry course. This allows students to more thoroughly understand such subjects as thermochemistry, the chemistry of the various phases of matter, transition metals, solution chemistry and various new technologies such as memory metals and hydrogen fuel. CH-303 Lab, a one-credit lab course (when taken along with CH-302, a three-credit course), allows students to meet the general chemistry requirements for graduate school and medical school, and covers material normally found on the MCAT and FE/PE exams. (prereq: CH-201 and junior standing or consent of instructor)

CH-310 Applied Chemistry 3 2 4

This is a junior- level general chemistry course for students taking only one quarter of chemistry. The course includes classification and properties of matter, atomic structure, chemical bonding, chemical equations, physical states of matter and intermolecular forces. The relationship between chemical properties and the mechanical and electrical properties of materials is also studied. Not for credit for students who have credit for CH-100 or CH-200. (prereq: MA-128 or MA-129, PH-113 or PT-110)

CH-322 Organic Chemistry II 3 0 3

This elective has been designed together with CH-222, CH-223 and CH-323 laboratory to meet the organic chemistry requirement for admission to medical school. (prereq: CH-222, CH-223)

CH-323 Organic Chemistry II LAB 0 4 2

This elective has been designed together with CH-222, CH-223 and CH-322 to meet the organic chemistry laboratory requirement for admission to medical school. (prereq: CH-322)

CH-350 Chemistry of Building Materials 3 0 3

This course is for undergraduate architectural engineering and construction management students. It provides an introduction to the chemistry of , using and deterioration of hazardous building construction materials, and shows how chemical bonding at the microscopic level explains macroscopic properties of common construction materials, including metals (steel, aluminum, copper), inorganics (cement, concrete, masonry) and molecular materials (wood, asphalt, polymers). (prereq: CH-200)

CH-352 Introduction to Environmental Chemistry 3 0 3

The purpose of this course is to introduce engineering students with little previous chemistry background to chemical principles used in the study of environmental chemistry. One theme of this course is the importance of understanding how natural biogeochemical processes operate and have operated over a variety of timescales. Such an understanding provides baseline information against which the effects of human perturbations of chemical processes can be quantified. Another theme covered is the importance of understanding how engineering choices impact environmental chemistry. (prereq: CH-200 and junior standing)

CH-371 Modern Biotechnology 2 2 3

The field of biotechnology is the science of the future for all of humanity. The techniques used in biotechnology are presently (and shall continue to) bringing changes of unfathomable magnitude in every possible aspect of our life including careers, economy and all natural and social sciences. This elective course is designed for all interested students at MSOE and beyond. The subject matter of this course changes every time it is offered in order to keep pace with the fastest growing field of scientific progress. Lectures are focused on important and timely topics, as well as the theory of most critical techniques that are the backbone of areas like bioengineering, protein engineering and the biotech industry. Students have hands-on learning of the techniques during lab sessions. The course also covers the history, ethics and societal impact of biotechnology. (prereq: CH-200)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CH-373 Advanced Biotechnology 2 2 3

Biotechnology is an applied science that is part of our daily lives. Agriculture, the chemical industry, the environment, the food industry, medicine, veterinary practice, vaccine production, fertility control and livestock breeding are a few examples of the fields in which biotechnology is used and directly affect the social and economical aspects of life. This elective course is designed for any students. The core of the course covers the specific concepts, procedures and equipment usage in the areas of protein engineering. The course produces individuals ready for entry-level research in unlimited areas of modern science. The course also offers independent research projects. (prereq: CH-200)

CH-401 Topics in Chemistry 0 0 0

This course covers current topics in chemistry that are not covered in other classes. Topics and structure, as well as credits, may vary. Faculty areas of expertise and possible topics for this course are listed on the Physics and Chemistry Department pages in the undergraduate catalog and on the Web. Groups of students interested in a particular topic should contact the appropriate faculty member well in advance of registration for the quarter. Credit in this course will be determined after consultation with the instructor. (prereq: consent of instructor)

CH-499 Independent Study 1 0 3

Students are given the opportunity to pursue an approved subject not covered in regularly scheduled course work. This may take the form of individual or small group studies, literature surveys, and laboratory or research projects. Weekly meetings with the course adviser are required. A final report to be filed in the Physics and Chemistry Department may also be required. This course is offered to students with junior or senior standing. Students with freshman or sophomore standing should request CH-199. (prereq: consent of the course adviser, and the Physics and Chemistry Department chairman.)

CM-212 Surveying 2 3 3

Surveying presents the methods and principles of field execution and office procedures required in construction surveying. The topics presented are leveling, traversing, site considerations, circular curves, measuring distances and angles, and general instrument usage. Required mathematical analysis and theory are also presented. (prereq: MA-126, sophomore standing)

CM-224 Construction Estimating I 3 0 3

This course provides a working knowledge of the order-of-magnitude and budget-level conceptual estimating processes that designers and construction managers apply during design development phases. Students develop a working knowledge of the components of direct and indirect construction costs, including risk and automated techniques for cost estimating. Students become familiar with some concerns and techniques for detailed construction estimates. (prereq: AE-225)

CM-3011 Project Management 3 0 3

A study of methods and operations in managing projects from both the perspective of the constructor and designer. Topics include elements of the construction process, project delivery types, record keeping, TQM, managing the design process, motivational skills, professional organizations, contract management, role of the project manager, project scheduling basics, value engineering, partnering, project feasibility, dispute resolution and risk management. (prereq: AE-225)

CM-3013 Construction Project Financial and Cost Control 3 0 3

This course provides a working knowledge of financial and cost accounting records, including their content and analysis, in the context of decision-making techniques and controls to optimize construction project financial returns. (prereq: CM-3011, MS-354)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

CM-3021 Business and Construction Law **3** **0** **3**

Material presented covers construction law, contracts and labor relations. Topics include Davis-Bacon Act, national labor relations, closed vs. open shop, dual shop, joint venture, national and international policies and contracts, and construction liability. (prereq: MS-221 or AE-3431, junior standing)

CM-311 Construction Issues **2** **2** **3**

This course provides a working knowledge of assorted construction site activities including soil properties and geotechnical construction, expedient surface drainage, concrete forming and shoring, and extreme weather construction. (prereq: AE-2211, CM-3011)

CM-316 Building Electrical and Communication Systems for Construction Management **3** **2** **4**

Students will develop a working knowledge of building electrical and communication systems components and their functioning, to enable effective installation planning, scheduling and cost estimation by the construction manager. (prereq: AE-3611, CM-3011)

CM-318 Building Environmental and Mechanical Systems for Construction Management **3** **2** **4**

Students will develop a working knowledge of building HFAC, sanitary, and other mechanical systems components and their functioning, to enable effective installation planning, scheduling and cost estimation by the construction manager. (prereq: AE-3111, CM-3011)

CM-321 Construction Scheduling **2** **2** **3**

This course covers a construction project schedule as a network of activities. An understanding of the logic diagram; network analysis through forward pass, backward pass, critical path and float; and updating, evaluation and use of schedule in cost crashing and resource leveling are explained. Application software systems are utilized. (prereq: CM-224)

CM-325 Construction Estimating II **3** **2** **4**

This course teaches the methodology, procedures and organizational techniques involved in preparing a competitive bid. Detailed estimates for each major construction discipline are prepared, based upon real construction project documents. The final project is the preparation of a formal competitive bid on a project. (prereq: CM-224)

CM-3411 Construction Equipment and Safety Management for CMs **3** **0** **3**

Purpose is to develop the construction manager's working knowledge of equipment types associated with building construction, their functions and management, and aspects of general job safety management. (prereq: junior standing)

CM-4311 Project Management I **3** **2** **4**

Team building is a key skill to be developed by the project manager. This course covers the principles and techniques required to implement, staff, motivate and evaluate the project team. Current management information systems available are examined. Special topics on negotiating, arbitrating and minimizing claims are also covered. (prereq: senior standing)

CM-4321 Construction Project Management II **2** **2** **3**

This course builds on the basic concepts of the project management process by specifically covering topics such as preliminary project planning, quality management through the project submittal process, project cost management and project schedule applications. Communication skills required to manage subordinates and subcontractors are developed. The procedures of managing claims and project changes are reviewed. (prereq: AE-4311)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
CM-4711 Architectural Engineering and Construction Management Design-Build Senior Project I	**1**	**1**	**1**

This course is the first of a three-part series in designing a building for an actual client using the design-build project delivery system. The course emphasizes development of the required building program a designer must complete in order to understand a client's building requirements of users, spaces, building function and budget. This program is then used in the other two senior project courses, AE-4721/CM-4721 and AE-4731/CM-4731, as a basis for the design of the building. Other topics include organization, team building, client interviewing skills, LEED and sustainable development, space analysis, building code review, building type research, value engineering and CADD. Note: BSAE students should register for AE-4711; BSCM students should register for CM-4711; five-year two-degree BSAE/BSCM students should register for AE-4711 in their fourth year and CM-4711 in their fifth year. Must take in consecutive terms with AE-4721/CM-4721, followed by AE-4731/CM-4731. (prereq: senior standing or fifth year standing in BSAE/BSCM five-year program.)

CM-4721 Architectural Engineering and Construction Management Design-Build Senior Project II	**1**	**3**	**3**

This is the second of the three-part senior project series. This is a team taught course, taught by architects, structural engineers, HVAC engineers, plumbing and fire protection engineers, building electrical power distribution engineers, and construction managers. It continues to emphasize the design-build process and requires an interdisciplinary team of students to utilize their respective engineering design specialty courses or construction management expertise as they design a building and plan for its construction by using estimating, scheduling, budgeting and construction project management techniques. The following phases will be completed: (1) site analysis; (2) preliminary architectural drawings and presentations; (3) architectural design development drawings; (4) preliminary engineering (structural, environmental, electrical) systems analysis; (5) preliminary budget analysis; (6) project scheduling and (7) ongoing project management responsibilities; (8) presentation to clients and other professionals. Note: Four-year BSAE students must register for AE-4721; four-year BSCM students must register for CM-4721; five-year BASE/BSCM two-degree students must register for AE-4721 in their fourth year and four CM-4721 in their fifth year. The three-course sequence 4711/4721/4731 must be taken in consecutive quarters during the same academic year. (prereq: senior standing and either AE-4711 or CM-4711.)

CM-4731 Architectural Engineering and Construction Management Design-Build Senior Project III	**1**	**3**	**4**

This is the final course in the senior project series, a continuation of the team taught senior project. Emphasis is on the design-build process and the interdisciplinary team of students to utilize their respective engineering design specialty courses or construction management expertise. This course emphasizes the engineering design and construction project management work begun in AE-4721/CM-4721. The topics in this course include (1) analysis and calculations for all engineering systems; (2) continued constructability analysis and value engineering; (3) life cycle cost analysis; (4) construction quality control systems; (5) project scheduling, estimating; (6) ongoing project management; and (7) project startup procedures. Students also make a presentation to industrialists in defense of their engineering design or CM project analysis. Note: Four-year BSAE students must register for AE-4731; four-year BSCM students must register for CM-4731; five-year BSAE/BSCM two-degree students must register for AE-4731 in year four and for CM-4731 in year five of their programs. The three-course sequence, 4711/4721/4731, must be taken in consecutive quarters during the same academic year. (prereq: senior standing, AE-4721 or CM-4721)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CS-150 Introduction to Computer Programming 2 2 3

In this course, students develop a working knowledge of designing and implementing computer programs to solve problems encountered in engineering practice. Structured programming technique is introduced in this course. Particular emphasis is placed on problem investigation, algorithm development, flowchart development, pseudocode development, coding, execution, debugging and documentation. Topics covered include data types, assignment statements, I/O statements, I/O files, control constructs, looping techniques, arrays and vectors, user defined functions, library functions and modules. Data visualization is also discussed. Problems related to engineering applications are emphasized. The high-level computer language C++ is used to illustrate and implement the topics. (coreq: MA-127 or equivalent)

CS-182 Computer Programming 3 3 4

This course provides an introduction to software development using an object-oriented approach and the C++ programming language. Particular emphasis is placed on the design process and the reuse of existing software components, which are critical to the development of large software systems. (prereq: GE-110 or high school programming course or equivalent; coreq: MA-127 or equivalent)

CS-183 Software Design 3 3 4

This course continues the study of software development using an object-oriented approach and the C++ programming language. Students design, document and implement software components and incorporate these components into larger software systems. A group project reinforces the application of the software design process in a team context. (prereq: CS-182)

CS-250 Introduction to Object-Oriented Programming 2 2 3

This course introduces object-oriented programming to students who have experience in C/C++ structured programming technique. Particular emphasis is placed on the design and implementation of computer programs to solve problems encountered in engineering practice. Topics covered include introduction to object concepts; describing, declaring and developing user-defined classes and objects; constructors and destructors; abstraction; inheritance; polymorphism; encapsulation; operator overloading; pointers and dynamic memory; standard template library (STL); and stack, queue and linked lists data structure. C/C++ topics are briefly reviewed. Problems related to engineering applications and numerical methods are emphasized. The high-level computer language C++ is used to illustrate and implement the topics. (prereq: CS-150, MA-137 or, MA-225)

CS-280 Embedded Systems Software 3 2 4

This course presents assembly language programming concepts. Topics covered include addressing modes, low-level architecture, use of library functions, and interrupts. Software control of hardware is stressed. In the laboratory, students apply learned principles to real systems. (prereq: CS-183, EE-290)

CS-285 Data Structures 2 2 3

This course covers the organization of data and the algorithms that act upon them. The topics of stacks, queues, trees and sets are introduced. Fundamentals of algorithm performance are also introduced, with an emphasis placed on time complexity analysis. Applications to data structure searching and sorting, memory allocation and file management are included. Laboratory activities include the application of data structures from the C++ standard library. (prereq: CS-183)

CS-321 Computer Graphics 3 3 4

This course introduces students to computer applications for the visualization of information. Algorithms, data structures, graphics primitives and graphics standards are discussed in addition to hardware aspects of interactive computer graphics. Topics such as 2-D and 3-D transformations, graphics databases and clipping algorithms are presented. Laboratory exercises using workstations and industry-standard graphics packages provide opportunities for students to develop interactive graphics algorithms and applications. (prereq: CS-183, CS-285)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
CS-381	**Engineering Systems Analysis With Numerical Methods**	**3**	**2**	**4**

This course provides numerical methods for the solution of engineering problems. Particular attention is devoted to algorithm development and error analysis. Topics presented are roots of nonlinear equations, methods for the solution of simultaneous linear equations, matrix inversion, interpolation, splines, curve fitting, differentiation and numerical integration, ordinary and partial differential equations, and an introduction to Monte Carlo methods. Data visualization and the design and analysis of parallel algorithms are discussed. Applications to system stability criteria are also developed in this course. (prereq: CS-183, CS-285; coreq: MA-343)

CS-384 Design of Operating Systems **3** **2** **4**

This course introduces the design and implementation of modern operating systems. Topics covered include the history of operating systems, process synchronization and scheduling, deadlock detection and avoidance, memory management, file systems, protection and security, and input/output systems. Laboratory projects provide experience in using and implementing operating system facilities. (prereq: CS-183, CS-280, CS-285, EE-290, UNIX software development skills)

CS-385 Algorithms **3** **2** **4**

This course extends the study of algorithms introduced in CS-285. Topics covered include searching, sorting, selection, graph structures and traversal algorithms. Applications such as dynamic memory management, data compression, optimization problems and database indexing are also discussed. Laboratory activities include the implementation and comparison of problem-specific algorithms, as well as the use of generic algorithms from the C++ standard library. (prereq: CS-285, MA-230, SE-280)

CS-386 Introduction to Database Systems **2** **2** **3**

This course introduces the theory and practice of database design and application, with emphasis on relational and object-oriented models. Topics include relational algebra and calculus, data manipulation languages, normalization, data protection, optimization and client/server systems. Lab assignments reinforce the lecture material. (prereq: CS-285)

CS-391 Embedded Computer System Design **3** **3** **4**

In this course, students construct a single-board microcomputer system to be used in the control of an electromechanical device. Components needed for the project are purchased by the students in kit form. The completed board is used as an embedded control system for a mobile robot. The tasks the robot must perform are specified by the instructor. Topics covered include a review of assembly language programming, design of memory interfaces, the operation of programmable I/O subsystems, interrupt driven I/O, A/D conversion and interfacing concepts. In addition, the operation of a variety of sensors is presented. (prereq: CS-280, CS-384, EE-201, EE-290)

CS-393 Computer Architecture I **3** **2** **4**

This course introduces the concepts of computer architecture and performance trade-offs that must be made in the design of computer systems. Topics covered include reduced instruction set computers, instruction set design options, processor implementation, pipelining and memory hierarchy. The lectures are re-inforced through projects in which students design and simulate portions of the central processing unit including the data path and control unit. (prereq: CS-280, EE-290)

CS-400 Senior Design Project I **3** **0** **3**

This is the first course in the two-course senior design sequence in which each student team works on a design project from conception through implementation and testing. The team first explores technology issues related to the project and then prepares a complete design. Teams meet regularly with the instructor to track technical and project management issues. Written reports and oral presentations are required. (prereq: senior standing and consent of program director)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CS-401 Senior Design Project II 3 0 3

This is the second course in the two-course senior design sequence. In this course, the student team implements the design developed in CS-400. Teams meet regularly with the instructor to track technical and project management issues. Complete project documentation, written reports and oral presentations are required. (prereq: CS-400)

CS-409 Ethical and Professional Issues in Computing 1 0 1

This course provides an opportunity for students to deepen their understanding of ethical and professional issues encountered by engineers in computing-related disciplines. Typical course topics include privacy and security, safety and risk, conflict of interest, environmental concerns, professional codes of ethics, whistle-blowing, liability, intellectual property, registration and certification, and the impact of computing on society. (prereq: HU-432, senior standing or consent of instructor)

CS-421 Advanced Computer Graphics 2 2 3

In this course students explore the field of interactive 3-D computer graphics. Lecture topics provide theoretical and practical knowledge of common 3-D graphics algorithms and techniques. Laboratory exercises focus on the creation of interactive 3-D applications using existing software libraries. The course culminates in a student-chosen design project implementing various aspects of 3-D graphics. (prereq: CS-321)

CS-422 Web Application Development 2 2 3

This course deals with applying software engineering practices to the development of Web sites of varying complexity and functionality, from a simple Web page to a data-driven commercial Web site capable of secure e-commerce transactions. Topics covered include image processing, client-side scripting (JavaScript) and server-side (Perl and PHP) scripting that interacts with relational databases (PostgreSQL). HTML and XML are covered in some depth, including Cascading Style Sheets and XSLT. (prereq: junior standing)

CS-470 Computer Modeling and Simulation 3 2 4

This course introduces students to modeling and simulation of continuous and discrete-event engineering systems. The course topics also include computer simulation of communication and computer networks. Applications of artificial intelligence methods such as expert systems, neural networks and fuzzy logic are discussed, as is the use of parallel processing in computer simulation. In the laboratory portion of this course, students develop computer models for engineering systems using higher-level general computer language and commercially available simulation software such as OPNET. (prereq: CS-381, MA-235, MA-262)

CS-4802 Digital Image Processing 2 2 3

This course provides an introduction to digital image processing techniques. Topics covered include point processes, area processes, geometric processes, digital- half toning and image transforms. Applications such as image enhancement, image restoration, image analysis and color enhancement are also discussed. Laboratory activities include the implementation and comparison of digital image processing techniques. (prereq: CS-183 or CS-250, MA-262, senior standing or consent of instructor)

CS-4811 Java Programming 2 2 3

Students familiar with the object-oriented programming aspects of C++ are introduced to the fundamentals of the Java enterprise programming environment. Much of the language's basic features are covered quickly by contrasting Java's approach to data types, control structures, inheritance, polymorphism and run-time libraries with similar elements from the C++ language. Special emphasis is placed on the important differences between the two languages, such as multiple inheritance, event handling and the interface with graphic windowing systems. Areas of Java that have no counterpart in C++ are also covered; these include applets, interfaces, inner classes and finalization. (prereq: CS-285)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CS-484 Graphical User Interface Design 2 2 3

Graphical user interfaces are a fundamental part of many software systems. This course introduces the fundamental concepts underlying modern graphical user interface (GUI) systems and the development of application software that operates in this environment. Basic principles are illustrated with examples taken from contemporary GUI systems. Student design projects reinforce the course material. (prereq: CS-321)

CS-4881 Artificial Intelligence (AI) 3 0 3

The objective of this course is to introduce the basic concepts of artificially intelligent systems. Topics covered include knowledge representation, search strategies, control and pattern recognition. Formal logic, natural language understanding and "expert'' systems are also covered, along with their applications in science, medicine and mathematics. Special attention is given to fundamental AI representation and problem- solving techniques. An introduction to expert system ''shells'' and other AI languages is provided. (prereq: CS-285, MA-262)

CS-489 Software Engineering Design 3 3 4

Software development techniques are studied, with an emphasis on life cycle issues of requirements analysis, specifications, design, implementation, testing and maintenance of complex software systems. Computer-aided software engineering (CASE) tools are used to support the development process. Students participate in a team project to design, implement and test a complete software system. (prereq: CS-321, CS-384)

CS-493 Computer Architecture II 2 2 3

This course introduces students to the use of VHDL as a simulation and synthesis tool for the design of digital systems. Case studies are presented to illustrate the use of VHDL in providing both behavioral and structural design descriptions. Students complete several projects in which they design, simulate and synthesize a variety of digital systems. (prereq: CS-391, CS-393, EE-290)

CS-495 Data Communications and Networking 3 3 4

This course presents principles of data communications and computer networks. Topics covered include network topology, the principles of signaling on physical links, modulation, error control, flow control, LANs, packets, protocols, network applications and network simulation. Laboratory projects involve both hardware and software aspects of network systems. (prereq: CS-280 or EE-291)

CS-496 Computer Networking Protocols 2 2 3

This course deals primarily with the communication protocols of the Internet. The class is introduced to the standard form of publication, review and approval of protocols, and several specific protocols are studied in detail. Laboratory projects provide an opportunity for teams of students to implement servers/clients using some of the protocols. (prereq: CS-384, CS-495 or EE-424)

CS-499 Independent Study 1 0 3

A student enrolled in this course is afforded the opportunity to pursue a specialized topic in his or her chosen field of study. After an approved area of study has been selected, weekly meetings with the course adviser are required. A final report, the format of which is left to the discretion of the adviser, is required at the end of the term. (prereq: senior standing, consent of program director)

EE-100 Introduction to Electrical Engineering 1 2 2

This course provides an introduction is provided to common practices and ideas of electrical engineering, including terminology, problem solving methodology, basic analytical tools, laboratory practice, working in teams and the engineering design process. (prereq: EE freshman status or consent of EE program director)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EE-201 Linear Networks: Steady-State Analysis 4 0 4

This course introduces the topics of steady- state analysis of networks using time and frequency domain methods with linear circuit models. It includes mesh and nodal analysis, source transformations, network theorems, complex power and resonance. The computer application SPICE is also introduced for analysis of steady-state DC and AC circuits. (prereq: MA-137)

EE-202 Linear Networks: Transient Analysis 3 3 4

This course introduces students to transient analysis of networks using linear circuit models. System differential equations are set up and solved using both classical and Laplace techniques. In addition to analysis of circuits containing R, L and C components, and step-function and sinusoidal sources, it includes impulse function methods, transfer functions and Bode plots. SPICE is also used to simulate system responses. (prereq: EE-201, MA-235)

EE-210 Electronic Devices and Computer Interfacing 3 3 4

This course covers the theory and application of various semiconductor devices. An emphasis is placed on how these devices are used to interface a digital system to the analog world. Devices that are covered include diodes, transistors, operational amplifiers, SCRs, triacs, opto-isolators, analog-to-digital converters and digital-to-analog converters. Students are required to complete a number of design projects. The designs are prototyped and tested in the laboratory and each student must submit a formal design report. (prereq: EE-201; coreq: EE-202)

EE-230 Special Network Applications 3 0 3

Special types of linear networks are analyzed using the circuit analysis techniques learned in EE-201. These special applications include three-phase balanced AC circuits, circuits containing coupled coils (including the linear and ideal transformer) and two-ports. Analysis techniques include both classical methods and computer simulation using SPICE. (prereq: EE-201)

EE-250 Electrical Systems 4 0 4

This course is an introduction to electric power systems in buildings. Mathematical laws of electricity are studied with emphasis on electrical power. System components such as conductors, fuses, circuit breakers, transformers, motors and motor controllers are analyzed focusing on application, physical properties and circuit design. System components are then engineered into functional building systems using modern design techniques. Electrical safety, power quality and utility company operations are introduced. (prereq: MA-231, PH-230, (not an EE elective))

EE-252 DC and AC Circuit Analysis 4 0 4

This course introduces the nonelectrical engineering student to basic DC and AC circuit analysis. It includes solutions to series and parallel circuits using loop and nodal analysis. Complex power, power factor correction and three-phase systems are also studied. (prereq: MA-137)

EE-253 Analysis and Control of Electromechanical Devices 3 2 4

This course introduces the nonelectrical engineer to DC and AC motors and transformers, as well as control of these devices using programmable logic controllers and variable speed drives. Electronics includes rectifiers and SCRs. Laboratory work emphasizes motors and their control. (prereq: EE-201 or EE-252, MA-231)

EE-290 Combinational and Sequential Logic 3 3 4

The goal of this course is to develop the ability to design both combinational and sequential logic circuits used to construct digital systems. The first part of the course covers number systems, codes, Boolean algebra, and the analysis and design of combinational logic circuits. The second part of the course deals with the analysis and design of sequential logic circuits with an introduction of the ASM chart. SSI, MSI and programmable logic devices are used to implement the design circuits. Commercially available software is used for CAD. Experiments, design problems and projects in lecture and laboratory sessions support material discussed in the course. (prereq: CS-150 or equivalent)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EE-291 Microprocessor Systems 3 3 4

This course introduces students to programming and design of microprocessor-based systems. Concepts covered include microprocessor architecture, machine language and assembly language programming, serial and parallel I/O, interfacing of hardware components to a typical 8-bit microprocessor and microcomputer system design. Laboratory and design projects utilize the popular Motorola 68HC11 Microcontroller. Students develop 68HC11 assembly language source files which are then cross-assembled and downloaded to a target system. The target system is used for development of both software and hardware. Each student designs at least two microcomputer subsystem interfaces entailing both hardware and software. (prereq: EE-290)

EE-303 Signal Analysis 4 0 4

Signals may be represented in either the time or frequency domain, and signal/system interaction is often more meaningful or more easily described in one of the two domains. This course focuses on methods used to handle various types of signals, namely the Fourier Transform, Discrete Fourier Transform, convolution, Fourier series, signal and system representations, digital filtering and computer programs for transform calculations. (prereq: CS-150 or equivalent, EE-202)

EE-310 Electronic Devices and Circuits 3 3 4

This course considers the mathematical modeling of active solid state devices, and the analysis and design of single stage circuits incorporating them. Small signal amplifiers are analyzed and designed, and the circuits are implemented in a series of laboratory experiments and projects closely related to the lecture material. Students are required to complete two design projects. The designs are prototyped and tested in the laboratory and each student submits a formal design report. Design content accounts for about 30 percent of the course grade. Topics covered include the study of device characteristics and applications of the following: diodes, bipolar junction transistors and field effect transistors. The circuit analysis program SPICE is utilized as an engineering design tool. (prereq: EE-202)

EE-311 Electronic Networks 3 3 4

This course continues the small signal analysis of single stage bipolar and FET transistor amplifiers. In addition, the various midband gains and impedances of many popular discrete multitransistor amplifiers are studied. Frequency responses of amplifiers are investigated as well as the characteristics of feedback amplifiers and oscillators. Laboratory experiments are conducted using selected discrete transistor circuits to reinforce the classroom presentations. Major emphasis is placed on design procedures, and about 50 percent of the course grade is based on student performance on assigned design projects. Students are expected to use previously learned design tools such as SPICE to explore alternative designs and to document their designs. Designs must be constructed and tested in the laboratory, and a formal design report submitted. (prereq: EE-310)

EE-320 Electric and Magnetic Fields 4 0 4

The objective of this subject is to develop an understanding of the physical properties of static electric and magnetic fields and an appreciation of the corresponding mathematical descriptions of these fields. Vector analysis techniques are applied to electric and magnetic fields using various coordinate systems. Topics covered include Gauss's Law, the Divergence theorem, Poisson's and Laplace's equations, Ampere's Law, Stokes Theorem and Maxwell's equations. (prereq: MA-330, PH-230)

EE-340 Electromechanical Energy Conversion 3 3 4

This course provides an introduction to the basic principles of electromechanical energy conversion devices. Topics covered include magnetic circuits, theory, construction and operation of transformers, performance characteristics and analysis of common rotating machines and their control. The laboratory work is designed to illustrate the concepts and characteristics of these devices including the use of programmable controllers. Computer programs are used to aid in the analysis of transformers and induction motors. (prereq: EE-230, PH-230)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

EE-351 Electrical Power Distribution Systems I **4** **0** **4**

Course content includes DC circuit analysis, multiple sources, network reduction, power, energy storage in capacitors and inductors and transient response. AC circuit analysis, phasors, reactance, complex power and impedance, generation of single- and three-phase power, real and reactive power, and power factor are also covered. Power utilization equipment (transformers and motors) is also studied. (prereq: EE-250)

EE-353 Electrical Power Distribution Systems II **3** **2** **4**

Topics covered include power systems below 600 volts, totalizing loads, feeder and branch circuits, power transformers, overcurrent protection, fault currents and circuit breaker selection. Panelboard and switchboard selection, electric service entrances, power factor correction, power company coordination, small and medium motors, motor control and electrical measuring devices are also covered. Laboratory experiments relating to equipment and analysis, as well as a case study, provide students with opportunities to demonstrate application of course material. (prereq: EE-202 and, EE-230 or EE-351)

EE-354 Digital Circuits and Microprocessor Applications **3** **2** **4**

This course extends the electronic concepts previously introduced to nonelectrical engineers in EE-252 and EE-253. Digital devices with emphasis on their application to mechanical systems are developed. Digital concepts are used to introduce their application in microprocessors. The microprocessor applications exemplify how various chips can be utilized to control mechanical and other systems. Laboratory experiments support the theory. (prereq: CS-150 not an EE elective, EE-253)

EE-355 Electrical Power Distribution Systems III **3** **2** **4**

Campus power plants and distribution, large and tall building power distribution, totalizing loads, large and medium voltage services, power company coordination, emergency generators, power factor correction, underground duct banks, electrical vaults, per unit fault current calculations, medium voltage equipment, working clearances around equipment, large motors, motor control, and feeder and branch circuit design are all covered in this course. Case studies are presented to reinforce theory (prereq: EE-353)

EE-371 Control Systems **3** **2** **4**

Students are introduced to the fundamentals of automatic control systems, including the analysis and design of control systems for various engineering applications. Topics covered include: modeling of physical systems using both transfer function and state space models; system responses, performance and design criteria; control system characteristics, stability, sensitivity, steady-state errors and transient response; stability analyses using Routh-Hurwitz, Root-locus, Nyquist and Bode methods; lead and lag compensators and PID controllers design using root-locus method;and frequency-response analysis. MATLAB and SIMULINK are used to aid in the analysis and design of control systems. The laboratory work is designed to introduce students to modern techniques needed for the design and implementation of automatic control systems. (prereq: EE-202)

EE-383 Computer Aided Design **3** **3** **4**

This course considers the application of computer software to the decision-making process necessary in electrical engineering design and project documentation. Engineering analysis software, including analog and digital circuit analysis/design software, is used for the iterative process necessary to achieve optimal solutions to design problems. (prereq: CS-150 or equivalent, EE-310, EE-290)

EE-392 Digital Systems Design **3** **3** **4**

The objective of this course is to give students a solid foundation in the design, simulation and implementation of advanced digital systems. A variety of representations of digital systems are covered including state diagrams, algorithmic state machine (ASM) charts and hardware description languages. The lectures present the theory of logic design and the labs provide students with the opportunity to apply the theory. Designs are tested using simulation and implemented using PLDs and/or Field Programmable Gate Arrays (FPGAs). (prereq: EE-290)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EE-393 VLSI Design 3 3 4

This course introduces students to the design and fabrication of custom-made integrated circuits. The course draws on students' knowledge of electronic circuit theory, semiconductor device physics and digital logic design to perform the design of an integrated circuit. Topics covered include review of semiconductor physics, CMOS static combinational logic implementation, MOS transistor theory, clocked CMOS logic, device parameter and performance estimation, integrated circuit mask layout design rules and integrated circuit fabrication techniques. (prereq: EE-290, EE-310 or EE-210, PH-360)

EE-401 Principles of Communications 3 0 3

In this course continuous-time communication signals and systems are studied from a mathematical analysis and engineering design viewpoint. Modulation and demodulation techniques for AM, FM, PM, DSB and SSB are analyzed, and modern analog communication circuits and system designs are considered. (prereq: EE-303, MA-232)

EE-404 Active Filters 3 0 3

This course introduces students to the design of low-frequency active filters. Students learn how to realize various types of filters using some of the more popular network configurations and response functions. (prereq: EE-412)

EE-407 Senior Design Project I 3 0 3

This is the first course in the three-course EE senior design sequence. Students form three- or four-person design teams and define a design problem which has alternative solutions. These alternatives are analyzed and evaluated to determine the most feasible solution(s). A formal feasibility study is required of each team, culminating in a written report and an oral presentation. Topics discussed in class include conceptual thinking and problem definition, ideation techniques, feasibility studies, technical specifications, design aids and research techniques, prototype development and testing, and verbal and written communications. Each student is required to keep a design log in a bound engineering notebook. (prereq: senior standing in electrical engineering)

EE-408 Senior Design Project II 2 3 3

This is a continuation of the EE design project defined by each design team in EE-407. The most feasible solution is now explored in-depth and design options are detailed starting with block diagrams and progressing to detailed schematics. Each team's goal should be to have a detailed paper design complete by the end of the course, and to have ordered any parts which may have unusually long lead times. A formal design report and presentation is required. The two-hour lecture is used to discuss design techniques, and to have guest lecturers on practical design considerations such as manufacturability, testability, and packaging. (prereq: EE-407)

EE-409 Senior Design Project III 2 3 3

This is a continuation of the EE design project defined by each design team in EE-407 and designed in EE-408. The design is now built, tested, modified, retested and completely documented in this final course of the senior design sequence. It is expected that each team will have a working prototype to demonstrate by the end of this course. The two-hour lecture is used to discuss problems, and to have guest lecturers on practical design considerations such as compliance to standards, noise testing, legal considerations, safety and cost. (prereq: EE-408)

EE-412 Electronic Systems Design 3 3 4

This subject covers the terminal behavior of linear operational amplifiers, and nonlinear active circuit analysis and design. Topics covered include basic operational amplifier design, function generation, active filters and digital-to-analog converters. Course emphasis is on state-of-the-art integrated circuits. Laboratory experiments and design projects reinforce the lecture material. (prereq: EE-311)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EE-420 Transmission Line Circuits 3 0 3

The study of optical fibers, microwave lines, RF circuits and high-speed digital circuits are all based on an understanding of high-frequency transmission lines. Hence, the purpose of this course is to examine the concepts and theory behind high frequency signal transmission. Initially, electromagnetic waves are covered to illustrate the concept of propagation. This concept is then thoroughly developed from a circuits viewpoint in the study of transmission lines. The Smith Chart is utilized to graphically determine and display transmission line results. Finally, scattering parameters are introduced as the two-port parameters used in high-frequency circuits. (prereq: EE-320)

EE-421 Digital Communication Systems 3 0 3

This course covers important concepts and signaling techniques commonly used in digital communication systems. Pulse modulation methods including PAM, PWM, PPM and PCM are studied. ASK, FSK and PSK modulations are also studied. Random processes are introduced and are used to model noise. The effects of noise on bit-error probabilities are analyzed for various systems. Other topics covered include the matched filter, correlation and an introduction to error-correction coding. (prereq: EE-401, MA-262)

EE-422 Digital Signal Processing (DSP) 3 0 3

This introduction to the digital processing of signals includes the topics of impulse sampling,reconstruction, discrete time system transfer functions, steady-state frequency response, analog filters, Z-transforms, and FIR and IIR digital filter design. Discrete and fast Fourier transforms are developed and applied to signal analysis and signal/system interaction. (prereq: EE-303 or consent of instructor)

EE-423 Applications of DSP 2 2 3

This course builds upon the EE-422 DSP lecture course. It is heavily laboratory- and applications-oriented, enabling students to implement powerful algorithms on actual DSP hardware utilizing the C programming language. Such algorithms as FIR and IIR digital filters, adaptive and multirate filters (interpolator), modulators and demodulators, correlators and discrete and fast Fourier transforms are programmed. The hardware is capable of processing audio signals in realtime, effectively demonstrating the power of the techniques. Both software and hardware design techniques are considered. (prereq: EE-291 or equivalent, EE-422)

EE-424 Data Communications 3 0 3

This course is designed to provide students with the technical aspects of data communication. It extends the concepts of communication system theory, applying them to data communications situations. Topics covered include data coding, error detecting and correcting techniques, data format, spectral analysis of baseband and modulated signals, modems, interface standards, multiplexing and computer communication network concepts. (prereq: EE-303)

EE-425 Radio Frequency Circuit Design 2 2 3

The objective of this course is to develop an understanding of fundamental radio frequency (RF) design techniques and the difficulties encountered in RF design. After an overview of RF systems, microstrip transmission media is covered. This is followed by the design of filters, amplifiers and oscillators in the RF region. Computer-aided engineering software is utilized in the laboratory to help realize actual RF circuit designs. (prereq: EE-420)

EE-429 Microwave Engineering 2 2 3

This course emphasizes microwave transmission lines, especially microstrip, coax and rectangular waveguides. The theory is developed for each line in order to gain insight into transmission characteristics and operation. This is followed by a study of microwave resonant circuits, nonreciprocal ferrite devices and other microwave components. Fundamental and modern high-frequency measurement techniques and components are covered in the laboratory. (prereq: EE-420)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EE-444 Power Electronics 3 0 3

In this course students are given background in device selection and power conditioning circuits that have application at high power levels. Topics covered emphasize the use of various active devices in inverters, converters, motor drives and power conditioning circuits. Topics include nonlinear magnetic circuits, and the use of integrated circuitry in closed-loop power systems. (prereq: EE-202, EE-230, EE-310)

EE-447 Power System Analysis I 3 0 3

This course provides an introduction to the classical methods and modern techniques in power system analysis with the aid of a personal computer. Topics covered include the concepts of complex power, balanced three-phase circuits, transmission line parameters, transmission line performance and compensation, system modeling and per-unit analysis, circuit theory as applied to power systems and load flow analysis. (prereq: EE-230)

EE-449 Power System Analysis II 3 0 3

This course is a continuation of EE-447, which provides students with a working knowledge of power system problems and computer techniques used to solve some of these problems. Topics covered include optimal dispatch of generation, symmetrical three-phase faults, symmetrical components, unsymmetrical faults, technical treatment of the general problem of power system stability and its relevance. (prereq: EE-447)

EE-460 Quality in Electronic Systems 3 0 3

Critical to all engineers is an understanding of the meaning of quality and the impact that understanding has on how tasks, engineering and otherwise, are performed. Through the entire gamut of activities resulting in industrial products, the engineer is a key factor of every process and has the responsibility of assuring that quality is implemented in an intentional, deliberate manner. This course seeks to instill the required understanding of quality via experiential activities, demonstrate its impact, and develop the needed statistical and organizational tools and techniques for quality analysis. (prereq: MA-262, senior standing in EE or consent of instructor)

EE-462 Communication Systems 3 0 3

The concepts common to high- frequency communication systems are covered initially in this course. The actual signal transmission performance is emphasized over signal processing aspects. This includes the study of scattering parameters, noise, typical system components, antennas, radio wave propagation and high-frequency transmission line performance. The theory behind link performance is then developed and is illustrated in a satellite communications system and other RF communication systems to consolidate the concepts in this course. (prereq: EE-401, EE-420)

EE-464 Fiber Optic Communications 3 0 3

This course is designed for introducing fiber optics and their applications. It covers the structure and characteristics of optic fibers, and the operational and physical properties of various optical components. Optical communications systems and the application of optic sensor systems are also covered. (prereq: EE-310, EE-320)

EE-474 Programmable Controllers 2 2 3

This course provides the theory and hands-on experience necessary to enable students to design programmable controller system applications. This course highlights the systems approach as an aid to understanding modern industrial programmable controllers. Coverage begins with a review of controller basics and conventional approaches and proceeds through the concept of programmable logic including the use of microprocessors as controller elements. In addition, programming, input/output elements, peripherals, and standards and codes that govern interfacing aspects are covered. Development, design and understanding of analog input/output devices are also covered. The use of PCs as a device to program PLCs is developed. The material is reinforced by laboratory sessions that provide the opportunity to learn to develop several popular system applications. (prereq: EE-290)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EE-479 Digital Control Systems 3 0 3

This course extends the classical control techniques from EE-370 to the area of sampled data and discrete-time control systems. These systems are analyzed using z-transform and state-space techniques. The sampling theorem, reconstruction, frequency response, system design and digital compensators are also covered. (prereq: EE-370)

EE-481 Fuzzy Sets and Applications 3 0 3

This course introduces students to the basic concepts of modeling uncertainty in systems through the use of fuzzy sets. The underlying concepts of fuzzy sets are introduced and their role in such applications as semantic interpreters, control systems and reasoning systems is presented. Students gain firsthand experience of fuzzy sets through programming assignments and a short research project. (prereq: EE-290, senior standing)

EE-484 Neural Networks 3 0 3

This course introduces students to the basic concepts of modeling and simulating adaptive and learning systems using neural networks. The underlying concepts of neural networks are introduced, as well as a number of common topologies and learning rules used in neural networks. Students gain firsthand experience of neural networks through computer assignments and a short research project. (prereq: CS-150 or equivalent, EE-290, MA-330 or MA-343, senior standing)

EE-486 C Language 3 0 3

A major computer language in several areas of engineering is the C programming language. It is structured, portable and exists on all types of computer systems. It is used in areas such as robotics, controls, data acquisition systems, numerical analysis, operating systems, artificial intelligence and graphics. This course covers the syntax, the set of operators, the variety of data types and usage of the language in design applications. The modular structure of program design using C and the standard library are demonstrated. (prereq: CS-150, junior standing)

EE-487 Machine Vision 2 2 3

This course introduces machine vision and its applications. Topics include lighting and optics, image formation and cameras. Image processing algorithms, processors and interfaces to other manufacturing systems are also covered. Laboratory sessions begin with introductions to various kinds of vision systems, followed by a group design project which develops and implements an inspection process. (prereq: senior standing in EE)

EE-488 Introduction to Artificial Intelligence and Expert Systems 3 0 3

The objective of this course is to provide students with an overview of topics in the field of artificial intelligence. The course also provides students with a working knowledge of designing an expert system and applying expert system technology in designing and analyzing engineering systems. The first part of the course covers historical background, knowledge acquisition, knowledge representation including propositional calculus, predicate calculus, semantic networks, frame systems and production rules. Various search techniques are discussed. Fuzzy logic systems, neural network systems and computer vision systems are briefly discussed in the second part of the course. Languages for AI problem solving such as Prolog and/or LISP will be introduced. The third part of this course is devoted to the design of expert systems. Applications of expert system in engineering system design and analysis are stressed throughout. Case studies are discussed. Students design expert systems for their own engineering applications, and an expert shell is used to implement the design. (prereq: CS-150, MA-262)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
EE-493	**Architecture and Programming of a 16-Bit Microprocessor**	**2**	**2**	**3**

This course gives students an understanding of the architecture and assembly language programming techniques for a 16-bit microprocessor using the Intel 8086 family. It covers the organization of the 8086 CPU, data formats, instruction formats, addressing modes, the instruction set and a variety of basic programming techniques, including the use of the PC BIOS routines. Students learn to write and debug assembly language programs using a powerful Macro Assembler and Debugger. The course also introduces students to interfacing memory and I/O devices to the 8086 CPU, and how to build a basic minimum mode system. In particular, students learn how to use the 8086 timing diagrams to determine the speed requirements for memory and I/O devices. (prereq: EE-291)

EE-499 Independent Study **3** **0** **3**

Students enrolled in this course are afforded the opportunity to pursue a specialized topic in their chosen field of study. After an approved area of study has been selected, weekly meetings with the course adviser are required. A final report, the format of which is left to the discretion of the adviser, is required at the end of the term. (prereq: senior standing and consent of department chairman)

EE-502 Systems Analysis and Control **3** **0** **3**

This course covers the modeling of systems with electric circuits or blocks representing system operators. The course also covers transient and steady-state responses of systems,feedback control systems, interconnection diagrams, and an introduction to nonlinear systems analysis and state space techniques. (prereq: EE-201 or EE-252, MA-235 or equivalent)

EE-815 Analog VLSI Circuit Design **0** **0** **0**

This is a one-quarter course to introduce students to the concepts of modern circuit design techniques using MOS transistors. (prereq: EE-412 or equivalent, EE-814 or equivalent)

EG-103 Technical Drawing and Visualization **3** **2** **4**

The objective of this course is to acquaint students with 3-D relationships existing in the world around us, and graphical conventions utilized to depict those relationships. Course topics include shape and orientation recognition, isometric sketching, and mechanical and architectural layout conventions, including normal views, scales, sections and dimensioning. The students are introduced to chart and graph formats as well as CAD as a medium for creating, retrieving and manipulating special and quantitative data in a visual form. (prereq: none)

EG-120 Engineering Graphics I **1** **3** **2**

Students are introduced to topics including linear measurement systems, orthographic and axonometric sketching, projection theories, visualization, auxiliary views, sectioning, dimensioning and tolerances, as well as an introduction to 3-D CADD. (prereq: none)

EG-122 Engineering Graphics and Visualization **1** **3** **2**

This course is designed to develop within the student the skills necessary to visualize 3-D relationships existing in the world around us and to represent, with standard graphic conventions, those relationships in a visual form. Course topics include shape and orientation recognition, pictorial sketching and mechanical layout conventions including normal views, auxiliary views, sections, dimensioning and scales. In addition, projective geometry theory is presented as a basis for analysis of true size, shape and distance. (prereq: none)

EG-123 Applied Engineering Graphics and CAD **1** **3** **2**

The objectives of this course are to acquaint the student with the operation of a true 3-D CADD system and to apply projective geometry knowledge, acquired in EG-122, to spatial problems both manually and on the computer. Specific topics include perpendicularity, clearance distance, parallelism, piercing points and intersections. (prereq: EG-122)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EG-124 CAD Graphics I 2 2 3

This course is intended to introduce the student to the history and fundamentals of the graphic language. Topics include three-dimensional visualization, orthographic and axonometric sketching, projection theories, auxiliary views, basic concepts of dimensioning and CAD. (prereq: none)

EG-125 CAD Graphics II 2 2 3

This is a study of applications and various aspects of spacial projective geometry. Topics include specifications of lines and planes, parallelism, perpendicularity, connectors, rotation, intersections and CAD. (prereq: EG-124)

EN-131 Composition 3 0 3

The objective of this course is to acquaint students with the basic principles of effective writing and give them extensive practice in applying them through frequent ungraded and graded writing. Since revision is considered an important and integral part of the writing process, students will be expected to submit several drafts of essays which they will develop and polish throughout the quarter before the essays are submitted for grading. In addition to writing, students will read and analyze essays on contemporary issues and take part in peer evaluation exercises which will help them and their peers perfect their writing. (prereq: none)

EN-131H Honors Composition 3 0 3

This course is an advanced-level composition course. Its purpose is to review the basic principles and techniques of effective writing and give students practice in applying them through frequent ungraded and graded writing. Since revision is considered an important and integral part of the writing process, students will be expected to submit several drafts of essays, which they will develop and polish through the quarter before the essays are submitted for grading. In addition to writing, students will read and analyze essays on contemporary issues and take part in peer evaluation exercises, which will help them and their peers perfect their writing. (prereq: none)

EN-132 Technical Composition 3 0 3

The purpose of this course is to acquaint students with the principles of effective, audience-centered technical communication and provide them with practice in writing letters, memorandums, proposals, and an informal and a formal report. The course also requires students to become familiar with accepted research techniques and to apply them in a written formal report and in an oral presentation. They also learn the principles of graphical design and the importance of visual representation in technical communication, both oral and written. (Students are expected to incorporate appropriate graphics into their written and oral communication.) Finally, students are taught how to organize and present technical material orally in an effective manner. (prereq: EN-131)

EN-241 Speech 2 2 3

The aim of this course is to develop effective public speaking skills, gain confidence and poise, and understand the basics of speech communication. The assignments afford practice in various public speaking situations similar to those which graduates will encounter in their careers. Typical assignments require the student to explain, describe, persuade or discuss in a group. A banquet speech is also required. Time is taken to develop the self-awareness of the student and his/her consciousness of the reactions to his/her audience. (prereq: EN-131)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EN-332 Applied Technical Communication 3 2 4

The objective of this course is to build on students' experiences in their basic technical writing course (EN-132) and provide them with additional writing of the kind they might expect to do in a real industrial setting. Unlike the basic technical writing course, this course focuses on collaborative writing and "real-world" communication problems. During laboratory periods, students engage in a variety of different writing projects: letters, memorandums, definitions, descriptions and instruction manuals. They gather data from engaging in interviews, on-site observations, and developing and administering questionnaires. Students also complete a team project which involves skill in both oral and written communication as well as effective collaboration. The project culminates in a written formal report and an oral presentation. Effective collaborative writing techniques, meeting management and international communication are also discussed. (prereq: EN-132 and EN-241)

EN-333 Applied Technical Communication 3 2 4

The purpose of this course is to further develop the written and oral communication skills of electrical engineering technology students. This course will provide students with writing and presentation assignments typically encountered in the industrial setting. Computer-based presentation tools will be utilized. Oral presentations will be both individual and group. Students also complete a team project that involves oral and written communication as well as effective collaboration. The project, normally coordinated with ET-3000, culminates in a written formal report and a formal oral presentation. (prereq: EN-132 or equivalent; coreq: ET-3000)

EN-342 Group Discussion 3 0 3

Through this course, the student will learn the theories, principles and dynamics of group interaction and, through practice, the skills essential for both leading and participating in small group discussion. (prereq: EN-241)

EN-432 Business Communications 3 0 3

Effective communication requires an understanding of how varying perceptions and emotions influence the reception of meaning. This course emphasizes appropriateness, diplomacy, effectiveness, readability and sincerity as desirable qualities for memorandums, letters and reports. Revision of both textbook exercises and personal assignments further serves to reinforce the importance of these qualities. Students prepare a formal report dealing with a real business problem, culminating in an oral presentation that includes appropriate visual aids. (prereq: EN-132, EN-241)

EN-441 Professional Presentation Techniques 2 2 3

The purpose of this course is to develop effective presentation skills, to learn to incorporate graphics into presentations, to understand the basics of communication skills in professional settings, and to appreciate the role of the team in preparing a formal presentation. The assignments reflect experiences that graduates will encounter in their careers. Typical assignments include a formal group presentation, a presentation graphic and presentation reviews. (prereq: EN-241; coreq: AE-431)

ET-1520 Electric Circuits 3 2 4

This course is an introduction to the fundamental concepts and laws of electric circuits and their application to DC and AC circuit analysis. Topics covered include Ohm's law, Kirchhoff's laws, capacitance, magnetism, inductance, series-parallel circuits, single- and three-phase AC circuits, transformers, and electric power. Phasors and complex numbers are utilized in AC analysis. The laboratory is used to illustrate electric circuit concepts and electric circuit measurement techniques. Note: this course is not intended for the electrical engineering technology major. (prereq: MA-126, MA-127, PH-123)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-215 Microcontroller Applications 3 2 4

This course is an extension of ET-295. The hardware and programming concepts developed in ET-295 are reviewed. The more advanced features of the microcontroller, such as input capture, output compare, pulse accumulator, analog-to-digital conversion, the serial communications interface and the serial peripheral interface, will be examined. In addition the various sensors and actuators that will allow the microcontroller to be used in control applications are discussed along with how to interface them to the microcontroller. The lectures are reinforced by laboratory exercises in which various features of the microcontroller are utilized. (prereq: ET-295; coreq: ET-213)

ET-224 Electronic Communications Concepts 3 2 4

The fundamental relationship that exists between time dependent signals and their unique representation in the frequency domain is introduced. The concepts of modulation, demodulation, and frequency shifting are studied when amplitude modulation, frequency modulation, and digital communications are covered. Noise and its effects are emphasized, and decibels are reviewed and used throughout the course. The functional operation of the various communication processes are examined and the spectrum analyzer is used extensively in laboratory experiments. (prereq: ET-210)

ET-240 Electric Machinery and Control 3 2 4

This course provides an introduction to the basic principles, analysis, and applications of transformers, DC and AC machines and their control. The laboratory work is designed to illustrate the concepts and characteristics of these devices including the use of programmable controllers. MATLAB is used to aid in the analysis of transformers and electrical machines. (prereq: CS-150 or CS-185, ET-104 or ET-108, PT-220)

ET-2550 Electronics 2 2 3

This course is a survey of semiconductor principles, discrete semiconductor devices, linear and digital integrated circuits, and transducers. These devices are applied to the concepts and properties of electronic circuits such as power supplies, linear amplifiers, active filters, oscillators, nonlinear circuits, digital circuits and interfacing circuits. The laboratory is used to illustrate electronic devices, applications, and measurement techniques. Note: this course is not intended for the electrical engineering technology major. (prereq: ET-1520, MA-128)

ET-295 Introduction to Microcontrollers 3 2 4

The microprocessor, microcontroller and microcontroller system are introduced in this course. In the laboratory, the student is required to design software for microcontroller applications and then download them to a microcontroller-based target system for execution. Topics covered include a review of number systems and digital system fundamentals, architecture and organization of a microprocessor and microcontroller, a programming model, the assembly language, addressing modes, an instruction set, looping, polling and handshaking techniques, stacks and stack operations, subroutines, parallel I/O, interrupts, design of interfacing circuits, memory interfacing and applications of microcontrollers. Debugger and simulation programs are also discussed. This course is the first of a two-course sequence in microcontrollers, ET-295 and ET-215. (prereq: CS-150 or CS-185, ET-190)

ET-3000 Linear Circuit Design 3 2 4

The analysis of electric circuits in both the time domain and the Laplace transform domain is covered in this course. The circuit responses to a variety of waveforms, including step, ramp, sinusoid, switched, exponential, and impulse functions, are analyzed. Time domain differential equations and Laplace transforms are emphasized as circuit analysis techniques. The student will also learn to design circuits and experiments that will illustrate the concepts introduced in this course. (prereq: ET-3051, MA-227; coreq: EN-333)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-3051 Signals, Circuits, and Systems I 3 2 4

The theory and circuit applications of periodic signals are covered in this course. The power in a circuit with multiple frequencies is investigated initially. This discussion leads to the determination of the rectangular, polar, and exponential forms of the Fourier series for periodic signals and the analysis of circuits with periodic signal inputs. Single- and double-sided spectra of periodic signals are constructed from the various forms of the Fourier series. Periodic signals are analyzed in circuits, filters and systems. Applications such as power spectra and harmonic disortion are covered. Laboratory experiments will reinforce the concepts presented. (prereq: full admission into the BS-EET program or permission of an EET program adviser; coreq: OR-307S)

ET-3060 Signals, Circuits and Systems II 4 0 4

Electronic signals and noise, especially in the frequency domain, and the corresponding circuit and system responses are examined in this course. Major topics include the Fourier transform, electronic noise, and circuit/system specifications and performance. This course concludes with an examination of digital signals, sampling, A/D and D/A converters, and an introduction to digital signal processing using the Z-transform. Practical applications are discussed throughout the course. (prereq: ET-3000)

ET-3100 Electronic Circuit Design 3 2 4

This course provides an introduction to electronic circuit design. The student applies fundamental electronic circuit concepts to laboratory design projects utilizing discrete semiconductor devices and analog integrated circuits. Design activity focuses on linear power supplies, switching mode power supplies, sinusoidal oscillators and active filters. Circuit simulation software is utilized as an integral part of the design process. (prereq: ET-3000)

ET-3201 Electromagnetic Field Concepts 4 0 4

The fundamental concepts of electrostatics and magnetostatics are presented in this course. Vector tools are developed and used to strengthen the understanding of the physical properties of static electric and magnetic fields. Vector algebra in rectangular, cylindrical and spherical coordinate systems is initially covered. Subsequently, electrostatic and magnetostatic field topics, such as Coulomb's Law, Gauss's Law, divergence, voltage, gradient, resistance, capacitance and dielectric materials, Laplace's Equation, Biot-Savart Law, Ampere's Circuital Law, curl, and inductance and magnetic materials, are examined and related to circuit concepts. (prereq: EG-122, MA-227)

ET-324 Data Communications 4 0 4

The concepts needed to understand the increasingly important field of data communications are presented in this course. The principles associated with data communication, transmission media, interfaces, error control, flow control, synchronization, circuit-switching, and packet-switching are investigated. LAN configurations such as CSMA/CD, Token Bus, and Token Ring are studied. WANs, TCP/IP, and ATM are examined. The student studies various options available in networks and systems. Commonly used protocols and interface standards are emphasized throughout the course. (prereq: ET-295 and ET-301 or ET-305)

ET-351 Survey of Communication Circuits 2 2 3

Data communications is very significant in today's world. It is used in most aspects of everyday life. Business, industry, education and homes all rely on the communication of information. This course is focused on fundamental concepts and practical applications, and prepares students to make intelligent decisions on the appropriate design, purchase, integration, and use of data communications equipment and systems. Required aspects of data communications are discussed, including relevant terminology, concepts, hardware, software, protocols, architectures, and current and future products. (prereq: higher level programming course)

ET-355 Electronics and Instrumentation 3 2 4

In this course, basic semiconductor devices, linear integrated circuits and transducers are studied. These devices are applied to power supplies, linear amplifiers, active filters, oscillators, nonlinear circuits, and digital interfacing. (prereq: ET-190 or ET-294; coreq: MA-226)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-3801 C++ Programming 3 2 4

The student develops a working knowledge of designing and implementing computer programs to solve problems encountered in engineering technology practice. Structured programming techniques and object-oriented programming techniques will be introduced in this course. Fundamental topics include program design life cycle, data types, assignment statements, I/O statements, I/O files, strings, control constructs, looping techniques, arrays, user-defined functions, library functions, and modules. Object-oriented programming topics include describing, declaring and developing user-defined classes and objects, function overloading, constructors and destructors, inheritance, polymorphism, encapsulation, operator overloading, pointers and dynamic memory. Standard Template Library (STL) with vectors, stacks, queues and linked lists data structures will also be discussed. Problems related to applications in engineering technology and numerical methods will be emphasized. Data visualization will be presented. Laboratory sessions will be used to enhance lecture topics. (prereq: full admission into the BS-EET program or permission of an EET program adviser.)

ET-3900 Design of Logic Systems 3 2 4

The design, analysis and typical applications of logic elements and systems are studied in this course. A brief review of combinational logic circuits is followed by a complete development of sequential logic systems. A variety of representations of digital systems are covered including state diagrams, algorithmic state machine (ASM) charts, and hardware description languages. The lectures present the theory of logic design and the labs provide projects for the student to apply the theory. Designs will be tested using simulation and implemented using Programmable Logic Devices (PLDs) or Field Programmable Gate Arrays (FPGAs). (prereq: EN-333, ET-3801)

ET-395 Machine Vision Systems 3 2 4

Vision systems are an integral part of modern manufacturing, being used for inspection, part recognition, sorting and robot guidance. Machine vision systems have found applications in electronics assembly, consumer products, automotive manufacturing, and food inspection. In this course, industrial applications as well as the basic principles of machine vision system operation are presented. Topics covered include image sensing, optics and lighting, and cameras and processes. Also included are image processing algorithms and interfaces to other manufacturing systems. Laboratory sessions using typical vision systems are included. (prereq: CS-150 or CS-185, PT-220)

ET-400 Senior Project 1 0 4

(1-4 credits, but 4 credits to count as a technical elective)

In this subject, the student is required to complete a senior design project. The senior project must conform to MSOE ET-400 guidelines. An oral report, a written report, and a working model are normally required. (prereq: EN-332, GE-300 courses appropriate to the selected project, senior standing, and consent of a senior project adviser, the EET program director, and the department chairman.)

ET-4001 Senior Project I 3 2 4

This is the first course in the two-course senior project sequence, ET-4001 and ET-4002, which is required for the BS-EET degree. Students form into teams and define a technological problem. Alternative approaches are analyzed and evaluated to determine the most feasible approach. A formal project plan is required of each team, culminating in a written report and an oral presentation. Each student is required to keep a project log in a bound engineering notebook. The lecture portion of the course provides background material appropriate to the senior project. (prereq: EN-333, ET-4601, GE-300, courses appropriate to the project area; coreq: MS-4801)

ET-4002 Senior Project II 3 2 4

This course is a continuation of the senior project proposed in ET-4001. The project plan is implemented and completely documented in this final course of the senior project sequence. Each student will be involved with demonstrating the completed project, with submitting a final formal written report, and with delivering a final oral presentation. The lecture is used to provide additional pertinent information in the project areas and for presentations. (prereq: ET-4001)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-412 Linear Integrated Circuits 3 2 4

The student investigates a variety of different special purpose integrated circuits and their applications. Progressing from operational amplifiers, a variety of circuit applications are examined, including level detectors, timers and timer circuitry, sinusoidal and nonsinusoidal waveform generators, counters and active filters. (prereq: EN-332, ET-310, GE-300)

ET-418 Electromagnetic Compatibility 3 2 4

In this course the student is introduced to the increasingly complex electronic environment that is created by spectrum crowding, proliferation of diverse electronic products, higher operating frequencies, increased component density and the resultant guidelines that are now mandatory for new equipment design. The nature of radiated and conducted emissions and immunity is discussed, with particular emphasis on testing procedures. Worldwide EMC standards are introduced. Other topics include such EMC problem areas as ESD, transient phenomena, shielding and grounding. Design techniques are introduced to minimize the adverse effects of EMC, especially in PCBs. Field trips to Open Area Test Sites are planned. (prereq: GE-300, EN-332; coreq: ET-424)

ET-419 Optical Electronics 3 2 4

The objective of this course is to equip the student with both theory and laboratory experience to apply optical electronic devices in areas such as communication and sensor systems. Topics include an introduction to the physical theory of optic fibers and optical components as well as applications and measurement techniques. A variety of devices are covered including LEDs, ILDs, photodetectors, connectors and couplers. Specific optical communication links and their performance evaluations are also covered. (prereq: EN-332, ET-310, ET-323, GE-300)

ET-420 Electromagnetic Field Concepts 3 0 3

This course introduces the basic analysis tools of electrostatics and uses those tools to develop a basic understanding of the physical properties of static electric fields. Vector algebra in rectangular, cylindrical, and spherical coordinate systems is initially covered. Subsequently, the electrostatic field topics of Coulomb's Law, Gauss's Law, divergence, voltage, gradient, resistance, capacitance, and Laplace's equation are presented. This course is the first of a two-course sequence, ET-420 and ET-424. (prereq: MA-226, PT-200)

ET-421 Communication Circuits and Systems 3 2 4

AM and FM communication systems and circuits are examined in this course. The major topics are the signal processing involved in AM and FM systems, the characteristics of those systems, and system performance in the presence of noise. (prereq: EN-332, ET-301 or ET-306, GE-300)

ET-422 Digital Communication Systems 3 2 4

In this course, the student examines various performance aspects of pulsed communication systems. The major portion of the course is concerned with the bandwidth requirements of digital communication systems and with the effects of noise in these systems. (prereq: ET-324, ET-421)

ET-423 Digital Signal Processing and Applications 3 2 4

In this course, students are introduced to the fundamental concept of digital signal processing with emphasis on application aspects of the technology. Topics include: the review of Fourier series, Fourier transforms, Laplace transforms and analog filter design; fundamentals of digital systems, the sampling theorem, and Z transforms; and discrete Fourier transforms, fast Fourier transforms, and the design of digital filters. Applications of digital signal processing in signal filtering, image processing, and speech synthesis are also discussed. Laboratory sessions enhance the materials discussed in lecture. (prereq: EN-332, ET-215, ET-301 or ET-306, GE-300)

ET-424 Electromagnetic Field Applications 2 2 3

This course is a continuation of ET-420 and completes the introduction of the fundamentals of electromagnetics and applies those concepts to common topics. The additional fundamentals are magnetostatic fields, time-dependent fields, and Maxwell's equations. The application topics covered include electromagnetic interference (EMI), antenna radiation, and aspects of magnetics. (prereq: ET-323, ET-420, PH-361)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-4250 Electromagnetic Field Applications 3 2 4

This course is a continuation of ET-3201 and ET-4261. Electrostatic and magnetostatic fields are extended to time-dependent electromagnetic fields and Maxwell's equations through the concepts of Faraday's Law and displacement current. Then several application topics are covered in both the lecture and laboratory, including magnetics, electromagnetic field simulation, electromagnetic interference (EMI), electrostatic discharge (ESD), grounding and shielding, antenna radiation, and standards. (prereq: ET-4261, PH-361)

ET-4261 Transmission Lines 3 2 4

The course begins with a study of step and pulse transients on a lossless transmission line to illustrate the position dependency, characteristic impedance, and reflection concepts of transmission lines. Transmission line theory and the Smith Chart are utilized for AC sinusoidal steady-state transmission line calculations. Scattering (s) parameters are introduced as high frequency two-port parameters and specifications. The course includes a brief examination of antenna fundamentals and basic link calculations. In the laboratory sessions, high-frequency measurement techniques and topics are covered. (prereq: ET-3000, ET-3201)

ET-427 Microwave Components 3 2 4

In this course, the theory behind microwave transmission structures is covered, and the basic circuit components utilized at microwave and millimeter wave frequencies are surveyed. TEM and quasi-TEM guiding structures (especially microstrip) are initially covered. The electromagnetic field solutions and patterns inside rectangular and circular waveguides are developed. The examination of microwave resonant cavities and microwave ferrite devices concludes the course. In the laboratory each student gains microwave component design experience in fulfilling selected project requirements. (prereq: EN-332, GE-300; coreq: ET-424)

ET-431 Sensors and Fiber Optic Technology 3 2 4

This course provides foundation concepts for the rapidly expanding fields of photonics and sensors used in both communications and manufacturing. Principles and laboratory experiments explore the use of photons (rather than electrons) and fiber optics, which combine extraordinary data rates - exceeding 1-10 gigabits per second - with freedom from external electromagnetic interference. Measurements include use of the Optical Time Domain Reflectometer. A wide variety of sensors and examples of their application to manufacturing processes are covered, including vibration, flow, pressure, strain, spectroscopy, solid state gyroscopes, thermistors and proximity. Active and passive, incremental and absolute sensors, and methods of enhancing their outputs are considered. (prereq: PT-220, ET-310, ET-323)

ET-432 Audio Systems 3 2 4

The physical principles behind audio systems and components are investigated in this course. Topics include the decibel system, the nature of sound, the Doppler effect, microphones and loudspeakers, amplifiers and computer sound, recording and reproduction of sound, sound processing and modification, noise reduction systems, digital sound processing, MIDI concepts, and contemporary audio applications. (prereq: EN-332, ET-301 or ET-306, GE-300, PT-220)

ET-441 Power Systems Analysis 3 2 4

This course provides a solid foundation in classical methods and modern techniques in power systems engineering. Methods of power systems analysis and design, particularly with the aid of a personal computer and MATLAB, are presented. Topics include the per-unit systems, transmission line performance and compensation, power flow analysis, three-phase faults, symmetrical components, and imbalanced faults. (prereq: EN-332, ET-240, ET-301 or ET-306, GE-300)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-442 Power Electronics 3 2 4

The objective of this course is to make the student conversant with the analysis and design of state-of-the-art energy conversion circuits and systems. Students select and evaluate the semiconductor devices required to satisfy the stringent demands imposed by operation at relatively high power levels and often at ultrasonic frequencies or under pulse conditions. Topics covered emphasize the use of thyristors in inverter, converter, motor drive and power conditioning circuits exclusive of conventional DC power supply circuits. (prereq: EN-332, ET-371, GE-300)

ET-4500 Electric Motors 2 2 3

The emphasis in this course is on the examination of different electric motors that are used in common industrial power systems. Students are introduced to terminology, principles of operation, characteristics, and performance curves of various types of AC and DC machines as well as their proper selection, connections and applications. Practical transformers and relays are also considered. The laboratory is used to illustrate and reinforce these electric motor topics and measurement techniques. (prereq: MA-126, MA-127, ET-1520, MT-3301)

ET-460 Quality in Electronic Systems 3 0 3

An understanding of the meaning of quality and the impact that understanding has on how tasks, engineering and otherwise, are performed is critical to all engineers. Through the entire gamut of activities resulting in industrial products, the engineer is a key factor of every process and has the responsibility of assuring that quality is implemented in an intentional, deliberate manner. This course seeks to instill the required understanding of quality via experiential activities, demonstrate its impact, and develop the needed statistical and organizational tools and techniques for quality analysis. (prereq: EN-332, ET-310, MS-221)

ET-4601 Quality in Electronic Systems 3 0 3

Critical to all engineers is an understanding of the meaning of quality and the impact that understanding has on how tasks, engineering and otherwise, are performed. Throughout the range of activities resulting in industrial products, the engineering technologist has responsibility in every process for assuring that quality is implemented in an intentional, deliberate manner. This course emphasizes the understanding of quality via experiential activities, demonstrates the impact of quality, and develops the statistical and organizational tools and techniques for quality analysis. Students will also independently investigate quality-related topics and deliver oral presentations. (prereq: ET-3100)

ET-4620 Data Communications 4 0 4

The concepts needed to understand the increasingly important field of data communications are presented in this course. The principles associated with data communication, transmission media, interfaces, error control, flow control, synchronization, circuit-switching and packet-switching are investigated. LAN configurations such as CSMA/CD, Token Bus, and Token Ring are studied. WANs, TCP/IP, and ATM are examined. The student examines the various options available in networks and systems. Commonly used protocols and interface standards are emphasized. (prereq: ET-3060)

ET-4710 Feedback Control Systems and Circuits 3 2 4

The student is introduced to the analysis, design and applications of feedback control systems in this course. The topics include the concepts of open- and closed-loop systems, transient and steady-state responses, system speed and error performance, techniques used to determine closed-loop system stability, and design of basic controllers. Modeling and simulation of control systems will be covered using commercially available simulation languages. Typical applications of feedback control systems and circuits will be investigated in the laboratory sessions. (prereq: ET-3000)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-472 Applied Analog and Digital Control Systems 3 2 4

The study of feedback control systems is continued in this course. It includes both analog and digital systems. Bode plots, frequency response and Nyquist analog methods are investigated. State variable systems are introduced and solved. Digital feedback studies include discrete-time signals and implementation of discrete-time systems. A major portion of the course is student projects associated with developing analog and digital systems. (prereq: EN-332, ET-371, GE-300)

ET-476 Control of Automation Systems 3 2 4

The electronic devices used in factory automation are introduced in this course. The devices examined include programmable controllers, cell controllers, and bar code readers. Students develop an understanding of programmable controllers by using ladder logic programming in laboratory exercises. Communications and networking of devices in an industrial environment are also discussed. (prereq: ET-240, ET-295)

ET-481 Numerical Methods for Technology 3 2 4

In this course, numerical methods to solve problems in technology are examined. Attention is focused on developing algorithms and all on sources that contribute to errors. Topics covered will include the following: roots of algebraic and transcendental equations, roots of simultaneous equations, Eigenvalue problems, ordinary differential equations, numerical interpolation and curve fitting, numerical differentiation and integration. (prereq: EN-332, ET-380 or CS-250, GE-300, MA-227)

ET-484 The UNIX Operating System 3 2 4

The UNIX operating system was developed for in-house use by AT&T. It delivers the performance and the user tools that provide for the maximum utilization of today's computer systems. UNIX and its variants are used by all modern workstations platforms such as SUN, HP, DEC., etc. The POSIX standard developed from UNIX is the recommended operating system standard for the new generation of computers because it offers multi-tasking, multi-user, and an interactive computer environment that users can mold to their way of operation. This provides an industrial work, communication and programming platform that manages, controls and uses hardware and software resources. The student will learn to fully understand and utilize these resources through the UNIX operating system. (prereq: EN-332, ET-380 or CS-250, GE-300)

ET-488 Artificial Intelligence and Applications 3 2 4

The objective of this course is to provide the student with an overview of topics in the field of artificial intelligence (AI). The student develops a working knowledge of designing expert systems, neural network systems, and fuzzy logic systems. The historical background, knowledge acquisition, knowledge representation including semantic networks and production rules, and searching techniques are briefly covered. Applications of AI in engineering system design and analysis are stressed throughout. Case studies are discussed using commercially available AI software. Students are encouraged to design AI systems for their own engineering applications. (prereq: EN-332, ET-371, GE-300)

ET-489 Advanced C Language 3 2 4

In this course, the application of the C language to industrial and commercial programming requirements is covered. Typically, the problems of interfacing to hardware, input and output, and working with specific types of computers are examined. The development of C language tools that use and work with standard algorithms, assembly language and the operating systems that provide the background environment are also covered. (prereq: EN-332, ET-215, ET-380 or CS-250, GE-300)

ET-493 Design of Logic Systems 3 2 4

In this course, the design, analysis and typical applications of digital logic elements and systems are studied. A brief review of combinational logic circuits is followed by a complete development of sequential logic systems. The classifications of sequential logic circuits covered are synchronous, pulse-mode, and level-mode circuits. Design applications of each type of circuit are incorporated in the laboratory, where the students implement their own designs. Extensive emphasis is placed on the use of programmable logic devices. (prereq: EN-332, ET-215)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ET-499 Independent Study 1 0 4

Independent investigation into a topic is encouraged under the direction of an MSOE faculty member. The independent study must conform to MSOE ET-499 guidelines. (1-4 credits, but 4 credits to count as a technical elective). (prereq: EN-332, GE-300, courses appropriate to the selected topic, senior standing, consent of an independent study adviser, the EET program director, and the department chairman)

FP-2701 Basic Fluid Power 3 0 3

This course presents basic concepts of fluid power and its applications and limitations. Various components are covered, including pumps, motors, actuators and valves. The design and optimization of hydraulic circuits to meet specific purposes are introduced. (prereq: none)

FP-4701 Advanced Fluid Power 3 2 4

The study of fluid power and its applications is continued in this course, with an emphasis on the design of fluid power circuits. Also included is an introduction to industrial pneumatics. Laboratory exercises include the construction and analysis of fluid power circuits. (prereq: MT-3101, FP-2701)

FP-472 Modeling & Simulation in Design of Hydraulic Components & Systems 3 0 3

This course focuses on the continued development of analytical methods as applied to hydraulic components and circuits. Steady-state and limited transient performance of pumps, valves, accumulators, motor and cylinders as components and systems are addressed. An introduction to the construction of mathematical modeling for components used in hydraulic systems is provided. System/component modeling using computer methods is applied to establish input/output performance at different modeling levels (I.e. functional, steady-state and dynamic). (prereq: FP-272 or ME-471)

FP-473 Electrohydraulic Components/Systems 3 2 4

This course covers the construction, performance, and mathematical modeling of components used in electrohydraulic systems for precise motion control and power transmission. The components include proportional and servo valves, fixed and variable displacement pumps and motors, cylinders and the electronic devices and transducers used to control these systems. Open- and closed-loop control systems used for velocity and position control are constructed using analog and digital circuits. A microcomputer is employed to analyze the performance of these systems. (prereq: FP-272, ME-431 or ME-432 or MT-433)

FP-475 Fluid Power Design Projects 2 2 3

A specific design project, having a substantial hydraulics content is undertaken. A set of specifications is developed, and a team or teams are formed to address all issues of the design. Issues include component sizing, systems/sub-systems design, and interfacing with electronic, pneumatic, and mechanical systems and components. Hardware fabrication and testing are completed if the project scope, timing, and personnel levels allow. The open-ended projects are evaluated based on originality, functionality, performance, satisfaction of good engineering practice, safety, and presentation of results. A written report and oral presentation of the results of the project are required. (prereq: FP-373, FP-374, FP-375, FP-473)

GE-110 Introduction to Engineering Concepts 2 2 3

This course provides students with an overview of computer and software engineering, as well as strategies for being successful at MSOE. Student teams build working embedded computer systems using an engineering process that includes system requirements, design, implementation and verification.

GE-205 Professional Growth 1 0 0

This series of courses (GE-205, GE-305, GE-405) is directed towards the overall growth of the student. The AE and CM B.S. student is required to attain 20 hours of combined professional and community outreach from sophomore through senior year.

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

GE-300 Career and Professional Guidance 0 2 1

This course is designed to provide professional guidance to students in electrical engineering and electrical engineering technology for their senior year and for their professional career immediately following graduation. Guest speakers from several major areas of electronic and electrical technology help provide insight into industrial careers. The instructors also advise students on selecting their senior technical electives. Students also learn about graduate school opportunities and the mechanics for applying to graduate school. Part of the course is devoted to developing and discussing team concepts, and the advantages and pitfalls of team engineering efforts. Placement office personnel discuss how to prepare a good resume, placement office procedures, interviewing skills and use of the Internet to find employment opportunities. Students prepare a resume, do research on a company in which they are interested and submit their resume with an appropriate cover letter seeking employment. Finally, the process of professional engineering registration is presented. (prereq: EE- junior standing, EET- ET-3051)

GE-305 Professional Growth 1 0 0

This series of courses (GE-205, GE-305, GE-405) is directed towards the overall growth of the student. The AE and CM B.S. student is required to attain 20 hours of combined professional and community outreach from sophomore through senior year.

GE-3601 Solid Modeling and Design 2 2 3

This course introduces the student to the parametric solid modeling software, Pro/ENGINEER. The purpose is to teach the student all the basic modeling skills for creating parts, assemblies and detailed drawings. In addition to the features learned to create solid models and production quality drawings, students learn to use the analysis area of the software to obtain: mass properties, draft check to verify if parts have enough draft to be released from an injection mold, clearance/interference check of assembled parts. (prereq: EG-124 or equivalent)

GE-3602 Solid Modeling and Design II 2 2 3

This course teaches advanced part modeling features such as sweeps, blends, surfacing and family tables, within the parametric solid modeling software, Pro/ENGINEER. Students model sheet metal parts such that a view is created of the unbended part to determine the stock size needed to manufacture it. Mechanisms are modeled with animated movements, while collecting position, velocity and acceleration data. (prereq: GE-3601 or consent of instructor).

GE-405 Professional Growth 1 0 0

This series of courses (GE-205, GE-305, GE-405) is directed towards the overall growth of the student. The AE and CM B.S. student is required to attain 20 hours of combined professional and community outreach from sophomore through senior year.

GT/NG-402 Basic Geometric Dimensioning and Tolerancing 2 0 2 **or 2.2 CEUs**

This course examines the essential criteria needed for manufacturers to master the skills needed to design and produce goods that satisfy customers' needs efficiently, consistently and without waste. Topical coverage focuses on the method of functional concepts which clearly defines the required manufacturing and measuring techniques. (prereq: none)

GT/NG-403 Advanced Geometric Dimensioning and Tolerancing 2 0 2 **or 2.2 CEUs**

This course covers the life cycle of component geometry validation, including design specification, production and inspection. Topics include necessary relationships between design, manufacturing and quality assurance functions; selection of design tolerances: standards, functional analysis and constraints; process definition, measurement and capability studies; use of control charts: run charts, chart variations and histograms; problem analysis tools: check sheets, Parato diagrams and others; inspection equipment selection and evaluation; and applications and case studies. (prereq: GT/NG-402)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HU-100 Contemporary Issues in the Humanities 3 0 3

This course introduces students to selected contemporary issues in the humanities. At the same time, this course introduces students to approaches for interpreting and synthesizing the contexts surrounding these issues and for making personal connections between the issues and their own personal experiences, beliefs and values. Students will be acquainted with contemporary issues through a variety of media, including film, slides, reading and participation in a fine arts experience. (prereq: none)

HU-332 Bioethics 3 0 3

Bioethics is a broad interdisciplinary field encompassing consideration of the ethical significance of the practice and results of the biological sciences as well as the ethics of the practice of the various health care professions. This course emphasizes the ethical issues arising in health care delivery and its institutions. Topics include: the nature of professional ethics; truth telling, informed consent and confidentiality; children, well-being and competence; decision-making with respect to the end of life; the ethics of reproductive technologies; and justice and access to health care. The polarity of the values of autonomy and community is a recurring theme of the course. (prereq: none)

HU-410 Foreign Language I 2 2 3

This course aims at providing the student with an understanding of the basic sounds and morphology of the language studied, and, to a smaller extent, the customs and civilization of that culture. Through exercises and dictation, students are exposed to the reading, understanding and writing of the language. The intention is to perform all these activities concurrently. A large part of the time is devoted to class exercises. (prereq: none)

HU-411 Foreign Language II 2 2 3

This course is a continuation of HU-410. (prereq: HU-410 or two years of high school foreign language)

HU-412 Foreign Language III 2 2 3

This course is a continuation of HU-411. (prereq: HU-411 or three years of high school foreign language)

HU-413 Foreign Language IV 3 0 3

This course is a continuation of HU-412. Grammar is reviewed as needed, especially in more difficult points. The course stresses vocabulary expansion. Students do extensive reading from original texts, and discuss related cultural issues. (prereq: HU-412 or four years of high school foreign language)

HU-414 Foreign Language V 3 0 3

This course is a continuation of HU-413. (prereq: HU-413 or five years of high school foreign language)

HU-420 Classical Derivatives 3 0 3

This course aims to help the student better appreciate the classical heritage of the English language. It is a comprehensive study of the basic Greek and Latin word elements – roots, prefixes and suffixes – that underlie modern English usage. The purpose of the course is to provide the student with a systematic method for increasing his/her vocabulary. Exercises illustrate practical applications. (prereq: none)

HU-421 Literary Genres 3 0 3

The purpose of the course is to acquaint students with the conventions of the short story, poetry and drama, and to provide them with the tools they need in order to interpret, evaluate and appreciate quality literature. By providing students with a richly diverse menu of selections, which balances the classic with the contemporary, it is hoped that they will develop a habit of reading quality literature because it holds their interest, helps them reflect on and understand the human condition better, and affords them much pleasure. The course focuses on class discussions involving the analysis and interpretation of many selections in each genre, but it also considers, at times, historical, political and social forces that may have an impact on a writer's vision. The course also considers major approaches to literary criticism. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HU-422 British Literature 3 0 3

This course will acquaint students with a significant range of British literature so that they can appreciate British culture, the beauty of the English language and the infinite variety of literature. The course covers major periods of British literature, beginning with the Middle Ages and continuing through the 20th century, so that students can learn significant characteristics of each period and then observe how writers of subsequent periods react against or conform to preceding periods. The social, historical, political, religious and economic factors which had an impact on the writers from each period are read so that students become aware of the themes which seem to prevail during the time. Students read poetry, essays, short stories, a novel and a drama in order to learn how language varies from genre to genre and from period to period. Students are expected to participate in discussions during class about the works which they read, write one or more papers, take tests during the quarter and take a final exam. (prereq: none)

HU-423 American Literature 3 0 3

The objective of this course is to acquaint students with representative selections from the main periods in American literature, beginning with the Native American oral tradition (precolonization) and continuing through the 20th century. The various movements in American literature are explained and discussed as are the various social, political, religious, historical, and economic conditions which helped to produce them. Students read the works of a variety of different writers in each period, and they read essays, poetry and short stories, as well as a novel and a drama. It is hoped that, as a result of their reading, they will come to appreciate how American literature has evolved to its present, world-class status. Students are expected to keep a journal of their reactions to what they read, participate actively in classroom discussions, write one or more papers, take tests during the quarter and take a final examination. (prereq: none)

HU-425 Contemporary Literature 3 0 3

This course focuses on the best of literature published within the past 10 years in order to enhance students' understanding and appreciation of modern literary forms as well as to explore important human concerns in contemporary life. Readings may be drawn from contemporary poetry, novels, plays, short stories and essays. Films may also be used to give students visual reference to what has been studied. (prereq: none)

HU-426 Survey of Third World Literature 3 0 3

This course acquaints students with a variety of modern works by authors from Third World countries. As a result, students learn about the literature as well as the social, philosophical and religious themes which concern writers in developing nations. Films may be used to give students visual reference to what has been studied. (prereq: none)

HU-427 Oriental Literature 3 0 3

This course acquaints students with classic literature of China, India, Japan, Korea and the Middle East. Students will read and learn about some of the literary masterpieces of the Eastern world. Films may be used to give students visual reference to what has been studied. (prereq: none)

HU-428 Classics in Literature 3 0 3

This class will examine the development of major periods in literature beginning with the first writings that evolved out of the ancient oral tradition and continuing into the Renaissance. The course will concentrate on well-known writings that represent the early social and literary evolution of the Mediterranean Basin and western civilization. The course will be divided into three major divisions: Ancient Literature (Gilgamesh, Homer, Sophocles, Euripides, Aristophanes, Plato, Virgil, etc.); Middles Ages Literature (Beowulf, Dante, Chaucer, etc.); and Renaissance Literature (Petrarch, Erasmus, Machiavelli, Cervantes, Shakespeare, Milton, etc.). In addition to the reading done as a group, students are required to conduct an individual research project. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HU-429 Literature of American Minorities 3 0 3

This course acquaints students with a broad range of literature, historical and contemporary, by American writers from minority ethnic backgrounds The works read are placed into historical and cultural perspectives, and films may be used to give students visual reference to what has been studied. (prereq: none)

HU-430 Epistemology 3 0 3

Epistemology – also known as the theory of knowledge – together with metaphysics, constitutes the traditional core of philosophy. What is knowledge, and how does it differ from mere belief? How do I know that I know anything? Is certainty even a reasonable objective? Among the topics within epistemology's ambit are the challenge of skepticism, the justification of belief, belief in an external world, the nature of perceptual knowledge, memory, the justification for belief in other minds, the difference between "knowledge that" and "knowledge how," theories of truth and the ethics of belief. Both historical and contemporary texts will be used. (prereq: none)

HU-431A Formal Logic 3 0 3

Logic is the study of argument. Formal logic is principally the study of the formal or symbolic systems by which arguments are expressed, and is fundamental to such disciplines as computer science, artificial intelligence, linguistics and mathematics. The course begins with an examination of the concepts of argument, validity and soundness. The relation of the notions of semantics and syntax is stressed as elements of formal systems for sentential and quantificational deduction are introduced. Activities emphasize acquiring skill in the translation of English expressions into symbolic notation and proof construction. (prereq: none)

HU-431B Informal Logic 3 0 3

The study of logic emphasizes critical analysis, clarity of language, formulation and evaluation of arguments, and the recognition of fallacies or mistakes in reasoning. The first part of the course covers the relationship between philosophy and logic, the history of logic, and recognizing and evaluating arguments. The second part of the course covers recognition of fallacies, and the role and importance of language used in the media, science, business and other areas of contemporary concern. (prereq: none)

HU-432 Ethics for Professional Managers and Engineers 3 0 3

This course examines and evaluates the meaning of ethics and professional conduct. A guiding theme is the human search or quest for values and ethical direction in terms of professional conduct and daily relationships with others. Students are expected to articulate and evaluate their own ethical principles and values and their foundations. The first part of this course covers the nature of ethics, ethical development and basic ethical directions such as utilitarianism, Kantian ethics and rights, and various views of justice. The second part of the course covers specific business and engineering ethical issues such as the company's and engineers' ethical obligations to the public, whistle-blowing, discrimination and affirmative action. Also, emphasis is given to environmental ethics including such topics as pollution control, the conservation of natural resources, various ethical positions on the environment, treatment of animals and the ethical assessment of new technologies. (prereq: junior standing)

HU-433 Philosophy 3 0 3

This course introduces students to the nature of philosophy and the philosophical enterprise in both a historical and thematic way. The Socratic idea of the value of the examined life and its role in our search for better understanding of who we are and what genuinely matters is a guiding theme in the course. Some topics discussed are the nature of human being, knowledge, free-choice, friendship/love, questions of meaning and value of life, and the human search for a sense of belonging and home in the world. As these topics are discussed, students are encouraged to develop their own philosophical positions regarding these questions. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HU-434 Existentialism 3 0 3

Existentialism may be viewed more as a collection of diverse philosophical attitudes toward life and the human condition than a specific school of philosophical thought. As such, in this course students will study and critically evaluate the positions of selected writers and philosophers that are often called "existentialists." Some topics that will be explored are: questions of meaning and value in life; freedom and responsibility; issues of an "authentic existence"; and similar existential themes in dramatic literature and philosophy. Students will be encouraged to explore and develop their own personal and philosophical positions. (prereq: none)

HU-435 Philosophy of Religion 3 0 3

The objectives of this course are to explore and reflect upon the human search for meaning, purpose and value in life. The first part of the course covers the nature of philosophy and religion, and various views concerning the origin of religion, world religions, and arguments and questions concerning the existence of God. The second part of the course covers the problem of evil and suffering, death and immortality, and issues connected with the nature of faith and the search for ultimate meaning. (prereq: none)

HU-436 Metaphysics 3 0 3

Metaphysics is the philosophical study of basic problems of existence. It considers such issues as why there is something rather than nothing, what kinds of things exist and how they are related. Metaphysical thought attempts to clarify the use of the concepts of existence, identity, property, external world, universal and particular, mind and body, and causality, among others. The course emphasizes topics of particular importance to an understanding of what we are and what we do. Topics considered include time, the mind/body problem, personal identity, and freedom and determinism. Both historical and contemporary sources are used. (prereq: none)

HU-437 Praxiology 3 0 3

Praxiology is the normative study of effective action. This course takes a philosophical perspective on the field and aims at an increased understanding of concepts used in reflection upon our practical interaction with the world. Description of action is stressed, and the transparency of habitual action is considered as the main methodological obstacle. Topics considered include: the central importance of the hand, G.H. Mead's theory of action, the Alexander Technique and the Lakoff-Johnson theory of metaphor. (prereq: none)

HU-438 Aesthetics 3 0 3

Aesthetics is often identified with its major component – the philosophy of art. And while beauty is the aesthetic property most often associated with thinking in aesthetics, our experience of awe, humor, horror and disgust are also of considerable interest. The course begins with an examination of the notion of aesthetic experience in its relation to nature and art. Other topics include: imagination and creation; aesthetic evaluation and criticism; copies, forgeries and imitations; objects and performances; the presentation of art to the public; and aesthetics, morality and censorship. (prereq: none)

HU-439 Philosophy of Technology 3 0 3

This course will examine the nature, history and impact of modern technology on ourselves, our lives and the world we share with other living beings both human and non-human. Students will study and evaluate various views toward technology and from this basis develop their own philosophical and ethical positions regarding the impact, purpose and direction of technology. One of the aims of this class is to question, explore and evaluate much of what we may take for granted about modern technology. (prereq: none)

HU-440 Global History I (The World to 1500) 3 0 3

This course aims to analyze the essential characteristics and experiences of the major world regions and to consider those forces that had a worldwide impact. Topics considered include the ancient, classical and medieval civilization of Eurasia; the Confucian, Moslem and non-European worlds on the eve of Europe's expansion; and roots of European expansion. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HU-441 Global History II (The World Since 1500) **3** **0** **3**

This course aims to analyze the essential characteristics and experiences of the major world regions and to consider those forces that had a worldwide impact. Topics considered include the stages – Portuguese, Spanish, Dutch, French, British and Russian – of European expansion; European domination of the globe; and the non-Western world's reaction against Europe's hegemony. (prereq: none; Global History I is not a prerequisite)

HU-442 Modern European History **3** **0** **3**

This course covers the political, economic and social history of Europe since the Congress of Vienna, 1815. It deals with the history of Europe and European civilization as a unit, and, in the 20th century, attempts to tell the story of an integrated, or at least interconnected, world. Emphasis falls on those situations and movements – nationalism, socialism, liberalism, imperialism and militarism – that are international in scope and that have confronted and occupied Europeans and their descendants in common. The course concludes with a consideration of Europe's apparent resurgence as the world enters a new millennium. (prereq: none)

HU-443 Russian History **3** **0** **3**

This course introduces the student to the Soviet Union through both a geographic and an ethnic analysis of the country. The course covers the 1917 Revolution and its causes, the establishment of the Communist dictatorship, the formation of the Soviet Union, the Stalinist years and the aftermath of Stalin. The last part of the course deals with Russian foreign policy and international communism, with particular emphasis on the Sino-Soviet conflict and its implications. (prereq: none)

HU-444 United States History **3** **0** **3**

This course presents a synopsis of American history highlighting the significant events that have shaped American heritage. Special detail is paid to the U.S. Civil War as a major event in the development of the country. Successive historical periods are covered with special emphasis on concurrent developments in the fields of politics, culture and economics. (prereq: none)

HU-485 Fine Arts **3** **0** **3**

This course allows students to study the fine arts – music, dance, theater and visual expression – by actually experiencing these arts. Attendance at a concert, play and art film, and a visit to an art museum are essential parts of the course. Slides, films, recordings and lectures are used to supplement these activities. Since the course is essentially practical, it emphasizes how to listen to music, how to interpret dance, how to watch a play or movie and how to look at an art object. Analytical written reports are required. (prereq: none)

HU-486 Theater Arts **3** **0** **3**

Enjoyment of theater is increased by experiencing it, by understanding the range of its forms and its history. The elements of theater, both live and filmed, are studied. Acting techniques are practiced in class. Current community offerings determine viewing assignments as well as the arrangement of instructional material. Backstage tours of local theaters are featured. (prereq: none)

HU-487 Visual Arts **3** **0** **3**

What pleases the eye? Why? This course explores the elements of visual beauty – color, form, line, proportion and texture; their expression in various media – painting, sculpture, drawing, architecture, film, landscaping, costume and others; the distinction between "fine" and "applied" arts; and the role of these arts in everyday life. Community resources are used as learning material. (prereq: none)

HU-494 Creative Thinking **3** **0** **3**

This course seeks a deeper understanding of the creative process by examining the nature of creativity, and various competing and complimentary theories that seek to explain the nature of creativity and its origins. The course provides instruction beyond the scientific method and traditional problem solving, aiming for greater fluency in generating ideas, increased sensitivity to problems, greater intellectual flexibility, and the gaining of a broader range of new insights through an enhanced "openness to experience." (prereq: none)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
HU-495	**Humanities Selected Studies**	**3**	**0**	**3**

This course covers timely topics in the humanities or specialized subjects that reflect the expertise/interest of current General Studies Department faculty. This class is limited to 15 students. (prereq: consent of the instructor)

IE-100	**Introduction to Industrial Engineering Profession**	**2**	**2**	**3**

This course is an introduction to the field of Industrial Engineering. The course introduces the student to a number of career paths in industry such as management engineering, quality, logistics, process improvement manager, etc., using guest speakers to provide first-hand experience. This course will also introduct students to the common terminology used in Industrial Engineering as well as examine current trends in Industrial Engineering.

IE-191	**Computer Applications in Industrial Engineering**	**2**	**2**	**3**

This course provides basic familiarization, instruction, and competence with common computer applications used in the field of Industrial Engineering. The purpose of the course is to provide a student with expertise in using computational tools. These tools will be used in multiple subsequent courses and throughout the student's career. The course will provide instruction in the use of these tools and laboratory time to practice their use while deepening understanding and expertise.

IE-201	**Introduction to Industrial Engineering**	**2**	**0**	**2**

This course is an introduction to the field of Industrial Engineering. It introduces the student to a number of career paths in industry, such as facilities design, quality, manufacturing, simulation and methods development. It also provides an introduction to systems design and introduces the student to the use of various mathematical tools, such as statistical process control, probability and decision making, and linear programming and allocation of resources, in solving industrial problems. (coreq: MA-262)

IE-202	**Application of Statistics in Industrial Engineering**	**2**	**0**	**2**

This course emphasizes the importance and relevance of statistics in the field of Industrial Engineering. The purpose of the course is to further the student's understanding of the applications of statistics in engineering. The course will concentrate on data collection, analysis and inference using statistical methods. A state-of-the-art statistics package will be used so that meaningful problems can be addressed. (prereq: MA-262)

IE-331	**Production Planning and Inventory Control**	**3**	**0**	**3**

As manufacturing becomes increasingly automated and faces additional competition, the need for an integrated, efficient production control system becomes critical. This course provides a quantitative basis for analyzing production. Topics covered include production information processing and flow, forecasting, material requirements planning, inventory control and scheduling. Computer based algorithms are also examined. (prereq: MA-136 or equivalent)

IE-336	**Contemporary Integrated Manufacturing Systems**	**2**	**2**	**3**

Contemporary manufacturing is viewed as an integrated system designed for maximum flexibility and rapid responsiveness. This course introduces the student to the systematic design and operation of manufacturing processes, based upon a strong theoretical foundation. Laboratory exercises are included to enable the students to both configure various manufacturing systems and to experience the impact of changes upon overall manufacturing system effectiveness. (prereq: junior standing, MA-262)

IE-340	**Project Management**	**3**	**0**	**3**

This course will enable the student to gain an understanding of the mechanics of guiding a project from the initiation phase through project implementation and, finally, termination. Topics such as project planning, budgeting, scheduling, evaluation and resource allocation are discussed as well as the individual roles of the project manager and team members. (prereq: MA-262 or equivalent)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

IE-345 Work Planning and Methods Development 2 2 3

One of the objectives of industrial engineering is the effective use of the space, equipment and human resources. This course emphasizes the techniques and procedures for planning the effective use of these integrated resources in both the manufacturing and nonmanufacturing environments, and developing better methods for accomplishing necessary tasks. (prereq: MA-262 or equivalent)

IE-347 Facilities Design 3 2 4

With the increasing emphasis on the integrated systems approach to equipment use and control, physical facilities planning must be included in the design. The subjects presented here move from traditional plant layout and facilities planning to comprehensive design requirements of modern integrated, computer assisted manufacturing, storage and material handling. (prereq: junior standing)

IE-348 Quality Assurance (SPC) 3 0 3

Improved quality has been identified as one of the most critical issues facing business today, essential to assuring competitiveness in a global economy. While emphasis is placed upon the techniques of statistical process control and acceptance sampling, the course also details all other graphical tools of quality analysis, explicitly connecting quality to productivity and costs. The course is intended to present quality concepts, tools and techniques in sufficient breadth so as to be applicable to both manufacturing and the service sector. (prereq: MA-262, IE-202)

IE-362 Ergonomics and Methods Development 3 2 4

This course combines the aspects of ergonomics and methods development to provide students with the tools necessary to design work stations which are efficient and effective while improving worker safety and well being. (prereq: IE-202 or equivalent)

IE-370 CNC Machine Tools 3 2 4

Modern machine tools are predominantly program controlled. Industrial engineers, in their quest for more effective use of these tools, must understand the principles of NC, CNC and DNC as they relate to various machines and programming systems. (prereq: EG-130 or EG-221, IE-426)

IE-377 Safety in Engineering 3 0 3

This course deals with the major interfaces of safety and engineering. Part of the course is devoted to workplace safety and the techniques for evaluating, controlling and improving safety. The other part of the course covers product safety and product liability along with their impact on design. (prereq: junior standing)

IE-379 Ergonomics 3 2 4

Ergonomics is the study of the relation between the worker, the work to be performed, tools used and the working environment. This course provides the student with the principles and techniques necessary to solve problems related to worker efficiency, increased productivity, and the promotion of health and safety in the industrial environment. (Students enrolling in this class may not enroll in HS-464.) (prereq: junior standing, consent of instructor)

IE-381 Deterministic Modeling and Optimization 3 0 3

Modeling requires building a logical or mathematical representation of a system and using the model to assist the decision making process. This course examines modeling techniques for systems in which the variables influencing performance are deterministic (non-random). These techniques include linear programming, transportation and assignment algorithms, inventory models and network analysis. Case studies and computer algorithms are utilized. (prereq: MA-127)

IE-382 Stochastic Processes 3 0 3

This course continues the modeling approach to problem solving by presenting techniques used to analyze and design systems affected by random variables. Queuing theory, Markov processes, dynamic programming and decision theory are examined. Case studies and computer algorithms are utilized. (prereq: MA-262)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

IE-383 Simulation 3 2 4

Focusing on discrete-event systems, this course uses FORTRAN and/or C++, Excel and AweSim simulation language to model, analyze, design, and improve production and service systems. The simulation process and statistical analysis of results are addressed. A strong emphasis is placed on decision making and design. (prereq: IE-382, CS-150)

IE-390 Industrial Engineering Junior Project 0 2 1

This course, entirely projects based, is intended to serve as an opportunity for third year students to apply subjects they have learned thus far to a real engineering problem which requires some choices as to the specific engineering tools that will be used. Students work in teams of typically three members on a client-based project from business/industry. This course is intended to serve as a precursor to the Capstone Engineering Design project courses (IE 4901-4903) scheduled in the senior year. (prereq: IE-362, IE-348, IE-381; coreq: IE-423)

IE-411 Compensation System Design 3 0 3

This course examines various aspects of compensation involving the design and evaluation of jobs; the measurement and recognition of individual and/or group performance; designs to attract, maintain and motivate good people; as well as to protect, reward, and enhance work life and organizational results. (prereq: senior standing)

IE-423 Engineering Economy 3 0 3

This subject is intended to provide the fundamental techniques for quantifying engineering and business decisions, especially those in which the time value of money is significant. It deals with cost, value, and work concepts and emphasizes the applications of funds invested in capital assets and facilities and the returns on such investments. Special emphasis is placed on the application of economic analysis to senior design projects. (prereq: junior standing)

IE-425 Advanced Engineering Economy 3 0 3

This second course in engineering economy presents a number of important and useful concepts and techniques built upon traditional engineering economic principles. It deals with accounting costs systems and capital budgeting; depreciation, depletion and after-tax evaluation; how to involve inflation, uncertainty, risk and capital allocation and constraints; and special applications in capital financing, replacement analysis and public project evaluation. (prereq: IE-423)

IE-426 Materials and Manufacturing Processes 3 2 4

This covers the properties of materials in relation to varied manufacturing processes. Manufacturing processes studied include bulk deformation, molding and casting, materials removal and joining processes, assembly, and an introduction to rapid prototyping concepts and techniques. The course also investigates the economic impact of processing selections on manufacturing costs. (prereq: ME-257, IE-362)

IE-440 Team Leadership/Facilitation 2 2 3

This course examines the role of the Industrial Engineer as a team leader and facilitator. Identification of personal strengths and weakness with respect to leadership will be addressed. The students will develop skill through leadership and facilitation opportunities as presented in class and during class projects. (prereq: junior standing)

IE-449 Quality Management 3 0 3

This course addresses the strategic role of quality in business and industry. It focuses on management's role in achieving quality excellence, the structures and systems needed to support a total quality strategy, and the main statistical and analytical tools for achieving quality improvement and control. The focus of this course is global and includes applications and examples ranging from high-tech companies to service industries such as health care, insurance, and distribution. (prereq: IE-348)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

IE-460 Design for Quality 3 0 3

Consistent conformance to requirements is most effectively addressed in product design rather than in manufacturing or through an inspect/sort function. Furthermore, the critical quality issue today is not conformance to tolerance specifications, but rather minimization of variability. This course covers the basic approaches to statistically designed experiments including hypothesis testing by the use of ANOVA, Analysis of Means, Student t, F, Chi-square and Z tests, and decision making by use of statistics, factorial and Taguchi methods. (prereq: MA-262)

IE-461 Quality Audits and ISO-9000 3 0 3

This course covers an introduction to ISO-9000 and its potential impact on business. It also discusses quality auditing, which is a foundation for working under ISO-9000. This coverage includes items such as the benefits from self-audit programs and various aspects of second and third party auditing. (prereq: MA-262, IE-348)

IE-470 Topics in Industrial Engineering 3 0 3

This course considers subject matter in several of the newer, emerging areas of industrial engineering and management theory and practice. Thus the content changes regularly. (prereq: senior standing and instructor consent)

IE-476 Robotics Systems and Automation 3 2 4

An industrial engineer of today must have a knowledge of state-of-the-art robotics. This course gives an overview of industrial robots and their relationship to computers and microprocessors. Coverage of robot engineering includes servo-controlled systems, actuators, sensing devices, programming and applications. Robots, as an integral part of computerized systems, are emphasized. (prereq: senior standing)

IE-477 Computer-Integrated Manufacturing 3 0 3

The planning, use, expansion and updating of computerized manufacturing systems to meet the needs of industry,are important facets of modern industrial engineering. This course deals with factors and principles involved with the design, implementation, maintenance and control of computer assisted manufacturing systems. Also covered are the transition steps in going from traditional hard automation to flexible manufacturing. (prereq: IE-370)

IE-4771 Automation I 2 2 3

This course gives an overview of modern automation tools. In particular CNC machine tools and industrial robots and their integration. It covers: 1. Principles of CNC machine tools (milling and turning) and their programming manually and with the use of CAD/CAM. 2. Principles of Robotics, various configurations, actuators, and controls. Program an industrial robot using robot controller. (prereq: IE-3770, AE-1311)

IE-4772 Automation II 3 2 4

This course gives an in-depth view of modern automation tools. In particular, CNC machine tools, industrial robots, vision systems and their integration. Topics covered: Advanced CNC features and multi axis programming. Off-line programming of robots and cell design.

IT/NM-126 Heating, Ventilating and Air Conditioning Systems I 2 2 3 **or 4.4 CEUs**

This course provides basic principles of energy concepts, heat transfer and fluid flow, and an introduction to heating, ventilating and air conditioning systems. Topical coverage includes comfort conditions, heat transmission, codes, infiltration, ventilation, exhaust, internal loads, and load calculations. Design problems provide for the application of theory. (prereq: none)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
IT/NM-127	**Heating, Ventilating and Air Conditioning Systems II**	**2**	**2**	**3 or 4.4 CEUs**

A continuation of IT/NM-126, this course adds piping, pumps, fans, air distribution, duct design, psychrometrics, heat recovery and solar concepts. Hands-on experience is gained through carefully constructed laboratory sessions. (prereq: IT/NM-126)

IT/NM-128	**Heating, Ventilating and Air Conditioning Control Systems**	**2**	**2**	**3 or 4.4 CEUs**

This course provides a study of electric, pneumatic, electronic and microprocessor based control systems and components as they apply to heating, ventilating and air conditioning control systems. Emphasis is on general types and operational characteristics. Laboratory sessions provide the student with the opportunity to operate and analyze various control units. (prereq: IT/NM-127)

IT/NM-171	**Fluid Power and Hydraulic Components**	**2**	**2**	**3 or 4.4 CEUs**

This course introduces the student to basic fluid mechanics and fluid power physics. It then covers the design, construction and operation of the following fluid power components: pumps, motors, cylinders, valves and conductors. Laboratory experiments, including disassembly and inspection of hydraulic components, reinforce the lecture material. (prereq: college algebra)

IT/NM-172	**Analyzing Hydraulic Circuits and Control Systems**	**2**	**2**	**3 or 4.4 CEUs**

Course coverage emphasizes the interrelationship of hydraulic components when they are assembled into a complete system. Applications with both resistive and overrunning loads are included. Calculations are performed to size every component in the system and to determine overall efficiency and heat generation. Various types of control systems that are applicable to fluid power systems are also studied, including electrical relay and programmable controller logic, hydraulic and pneumatic pilots and minicomputers. Laboratory sessions strengthen the material from lecture and include examination of several types of hydraulic circuits and electrical control systems. (prereq: IT/NM-171)

IT/NM-173	**Industrial Pneumatics**	**2**	**2**	**3 or 4.4 CEUs**

This course covers basic pneumatic principles, components, systems and circuitry used on modern, high-technology machinery. The design, function and application of compressors, valves, actuators, plant-layout schemes, and related air-treatment components are described. The lectures are augmented by laboratory exercises. (prereq: college algebra)

IT/NM-271	**Electrohydraulic Components**	**2**	**2**	**3 or 4.4 CEUs**

This course covers construction and performance of components that are used in electrohydraulic systems for precise control of power transmission. The components include fixed-displacement and variable-displacement pumps and motors, proportional and servo valves, and the electronic devices used to drive and control these systems. Laboratory sessions and demonstrations reinforce the lecture material. (prereq: Basic Fluid Power Technology Certificate or equivalent; college algebra or equivalent is extremely important.)

IT/NM-272	**Electrohydraulic Systems and Control**	**2**	**2**	**3 or 4.4 CEUs**

This course starts by introducing basic control theory as it relates to electrohydraulic systems. Then, with the assistance of electronics, analog and digital feedback control systems are studied and constructed. A microcomputer is employed in the performance analysis of velocity and positional control systems. The classroom work is closely supported by laboratory experiments. (prereq: IT/NM-271)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
IT/NM-273 Fluid Power Maintenance and Troubleshooting	**2**	**2**	**3 or 4.4 CEUs**

Proper maintenance and troubleshooting of hydraulic systems are covered in this course. Causes of failures and methods of reducing and preventing failures are discussed. A systematic approach to troubleshooting hydraulic systems using available diagnostic equipment is also presented. Laboratory sessions include examination of failed components to determine causes of failure and recommendations to prevent future failures, hydraulic system troubleshooting and control systems. (prereq: Basic Fluid Power Technology Certificate or equivalent)

MA-125 College Algebra I **4** **0** **4**

Topics covered include the four fundamental operations with signed numbers and polynomials, an introduction to exponents and radicals, simple equations and formulas, simultaneous linear equations, an introduction to determinants, special products and factoring, fractions and fractional equations, and quadratic equations. (prereq: none)

MA-126 Trigonometry **4** **0** **4**

Topics include trigonometric functions, special angles, solution of triangles, radian measure, graphs of sinusoidal functions, inverse trigonometric functions, solution of trigonometric equations and use of tables and calculators. Special emphasis is given to the basic identities and to the sum, difference, double-angle and half-angle formulas. (prereq: MA-125 or equivalent)

MA-127 College Algebra II **4** **0** **4**

Topics covered include exponents and radicals, complex numbers, systems of quadratic equations, quadratic forms, equations with radicals, polynomial equations, determinants, matrices, binomial theorem and an introduction to analytic geometry. (prereq: MA-125 or equivalent)

MA-128 Analytic Geometry and Calculus I **4** **0** **4**

This course is an introduction to differential and integral calculus with analytic geometry. The following topics are covered: techniques of curve sketching, conic sections and the general second degree equation; the derivatives of algebraic functions and use of derivatives in curve sketching; applied maxima and minima; related rates; the integrals of algebraic functions; and definite integrals and areas. (prereq: MA-126 and MA-127, or equivalent)

MA-129 Introduction to Differential and Integral Calculus

This course covers functions, the derivative with applications, techniques of differentiation, the exponential and logarithmic functions with applications, and an introduction to the definite integral. (prereq: MA-126 and MA-127, or equivalent)

MA-136 Calculus for Engineers I **4** **0** **4**

This course begins with plane analytic geometry and introduces the student to differential calculus. The topics include conic sections and lines in the plane, limits, continuity, differentiation of algebraic and trigonometric functions, and applications of the derivative to maximum, minimum and time rate problems. (prereq: MA-126 and MA-127, or equivalent)

MA-137 Calculus for Engineers II **4** **0** **4**

This course is a continuation of MA-136 and an introduction to integral calculus. The topics include vector algebra; dot and cross products; lines and planes in space; differentials; Newton's method; and integration of algebraic, trigonometric, exponential, logarithmic and inverse trigonometric functions, along with areas and volumes of revolution. (prereq: MA-136)

MA-225 Calculus II for Technologists **4** **0** **4**

This course is a continuation of MA-128. The topics covered include applications of indefinite integrals, areas between curves, numerical integration, volumes of revolution, centroids and moments of inertia, work and fluid pressure, differentiation and integration of transcendental functions, L'Hospital's rule, special integration techniques and applications. (prereq: MA-128 or MA-129)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MA-226 Calculus III for Technologists 4 0 4

This subject is a continuation of MA-225. The topics covered include parametric equations, curvilinear motion, arc length, curves and areas in polar coordinates, surfaces in three dimensions, partial derivatives and multiple integrals. Also included are infinite series, tests for convergence, Taylor and Maclaurin series, operations with series and introduction to Fourier series. (prereq: MA-225)

MA-227 Differential Equations for Technologists 3 0 3

This course is an introduction to applied differential equations. The topics covered include the solution of first-order differential equations, the solution of higher-order linear equations with constant coefficients, and the solution of linear equations by Laplace transforms. (prereq: MA-226)

MA-230 Discrete Mathematics 4 0 4

This course provides an introduction to several topics fundamental to computer science. Topics discussed include set algebra, logic, relations and functions, recursion, matrices, graph theory, and methods of proof. Emphasis is on an algorithmic approach. (prereq: MA-127 or equivalent)

MA-231 Calculus for Engineers III 4 0 4

This course is a continuation of MA-137 and an introduction to the calculus of functions of several variables. The topics include integration by trigonometric substitution and by the use of partial fractions; integration by parts; the trapezoidal rule; improper integrals; L'Hospital's rule; applications of integration to centroids, work, fluid pressure, and arc length; partial derivatives with applications; and parametric equations. (prereq: MA-137)

MA-232 Calculus for Engineers IV 3 0 3

This course is a continuation of MA-231. The topics include calculus applications of polar coordinates, as well as multiple integration and its application to areas, volumes and moments. Also covered are infinite series, including tests for convergence, power series, Taylor and Maclaurin series, and operations with series. (prereq: MA-231)

MA-235 Differential Equations for Engineers 4 0 4

This course covers the solution of first-order differential equations; the solution of higher-order linear differential equations with constant coefficients, applications of differential equations; and an introduction to the method of Laplace transforms. (prereq: MA-231)

MA-262 Probability and Statistics 3 0 3

This course gives an introduction to the basic laws of probability needed in statistical work. This includes the development of probability distributions, moments, the central limit theorem and the law of large numbers. The statistics covers sampling procedures, confidence intervals and tests of hypotheses. (prereq: MA-137 or MA-225)

MA-315 Introduction to Applied Statistics 3 0 3

This course introduces the laws of probability with applications to statistical analysis of data, including medical data. Topics include estimation of population parameters, tests of hypotheses and tests for goodness of fit. This course is not open to students who have credit for MA-262 or MA-340. (prereq: MA-125 or equivalent)

MA-330 Vector Analysis 3 0 3

This subject provides a brief study of vector algebra, followed by vector calculus, including velocity and acceleration; space curves; gradient; divergence and curl using the del operator; line, surface and volume integrals; conservative fields; curvilinear coordinates; Green's lemma; the divergence theorem; and Stokes' theorem. (prereq: MA-232 and MA-235, or MA-227)

MA-340 Business Statistics 4 0 4

Almost all managerial decisions involve some amount of uncertainty. This course is designed to acquaint the student with some of the statistical methods that can be used to help make these decisions. Topics covered are probability, probability models, estimation, tests of hypotheses, and regression and analysis of variance. This course is not open to students who have credit for MA-262 or MA-315. (prereq: MA-127 or equivalent)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MA-343 Matrix Methods and Linear Programming 3 0 3

This course is an introduction to matrix methods and linear programming, including matrix algebra; matrix inversion; simultaneous linear equations; and convex sets. Study of linear programming includes the simplex method, and the simultaneous solution of primal and dual problems. (prereq: MA-231)

MA-380 Advanced Differential Equations 3 0 3

This course gives the student more powerful methods of solving differential equations. Topics include systems of linear differential equations, series solutions of linear differential equations with variable coefficients, and a solution of Bessel's equation. (prereq: MA-232 and MA-235)

MA-381 Complex Variables 3 0 3

This course provides a brief study of the algebra and calculus of complex variables including the following topics: analytic functions; the elementary functions; infinite series in the complex plane; differentiation, and integration and mapping of the elementary functions; and the theory of residues. (prereq: MA-232 and MA-235, or MA-227)

MA-382 Laplace Transforms 3 0 3

This course introduces the theoretical concepts and uses of the Laplace transform. Topics covered include transforms of special functions, properties, operations, and ordinary and partial differential equations with special emphasis on periodic phenomena, the unit step function and the Dirac delta-function. (prereq: MA-232 and MA-235, or MA-227)

MA-383 Linear Algebra 3 0 3

This course illustrates the nature of mathematics as a blend of technique, theory and applications. The important problem of solving systems of linear equations leads to the algebra of matrices, determinants, vector spaces, bases and dimensions, linear transformations and eigenvalues. Numerical methods of solution are introduced. MATLAB integrates the communication of mathematics with mathematical (and computer) techniques, visualizations and applications. (prereq: MA-231 or MA-226)

ME-160 Introduction to Mechanical Engineering and Design 2 2 3

This course is intended to provide the student with an overview of the mechanical engineering profession, the process of mechanical engineering design and the tools associated with the mechanical design process. Lecture topics will include an overview of the engineering profession, career paths within mechanical engineering, and the relationship of the educational curriculum to the personal and professional growth of the student. Laboratory exercises will focus on the mechanical engineering design process, and the application of solid modeling tools and techniques in mechanical design. (prereq: none)

ME-190 Computer Applications in Engineering I 2 2 3

This course will familiarize students with the modern computer tools required for engineering practice, and teach them how to apply these tools to solve practical engineering problems. Topics include problem formulation, model development, algorithm development and the use of numerical methods and computer graphics in the solution of engineering problems. Laboratory exercises involve the use of various numerical and graphic software packages. (prereq: MA-127 or equivalent)

ME-191 Computer Applications in Engineering II 1 2 2

The purpose of this course is to apply the model and algorithm development methods from ME-190 to hands-on "hardware-in-the-loop" applications. Applications in data acquisition, robotics and mechatronics will be emphasized. (prereq: ME-190 or equivalent)

ME-205 Engineering Statics 4 0 4

This is a study of force systems acting on bodies that are not in motion. The course includes analysis of forces in trusses, frames and machine components; additional topics are friction, location of centroids, and evaluation of area and mass moments of inertia. (prereq: MA-137, PH-110)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-206 Engineering Dynamics 4 0 4

This is a study of motion and the forces that affect the motion. Topics include rectilinear motion, curvilinear motion, plane motion, dynamic force analysis, work and energy, and impulse and momentum. (prereq: MA-137, ME-205)

ME-207 Mechanics of Materials 3 2 4

This is an introductory course in mechanics of deformable bodies. Topics include stresses and strains produced by axial loading, torsion, and bending; elastic deflections of beams; effects of combined loading; and buckling of slender columns. Laboratory topics will reinforce lecture material. (prereq: ME-205, MA-231)

ME-230 Dynamics of Systems 4 0 4

This course is an exploration into the use of mathematical techniques to model the behavior of mechanical and electrical systems. Topics will include modeling of mechanical and electrical components, generation of system models, time domain analysis and frequency domain analysis. Both analytical and numerical solution techniques will be emphasized. (prereq: ME-190, ME-205, MA-235)

ME-255 Engineering Statics for Nonmechanical Engineers 3 0 3

This is a study of force systems acting on bodies that are not in motion. The course includes analysis of forces, location of centroids and evaluation of moments of inertia. This course may not be taken for credit by mechanical engineering students for whom ME-205 is required. (prereq: MA-137, PH-110)

ME-256 Engineering Dynamics for Nonmechanical Engineers 3 0 3

This is a study of motion and the forces that affect motion. Topics include rectilinear, curvilinear and plane motion; particle force analysis; work and energy; and impulse and momentum. This course may not be taken for credit by mechanical engineering students for whom ME-206 is required. (prereq: MA-137, ME-255)

ME-257 Strength of Materials 3 2 4

This course is for nonmechanical engineering students. The course provides non-MEs with a background in the area of strength of materials including what is required in the selection of materials to meet actual application requirements. Subjects include the stress-strain relationship, elasticity, as well as axial, torsional and shear stresses and deformations. Interrelated laboratory experiments reinforce the concepts presented in the lecture/analysis sessions. (prereq: ME-255)

ME-300 Modeling and Numerical Analysis 3 2 4

This course is a study of mathematical techniques used to model engineering systems. It involves the development of mathematical models and the application of the computer to solve engineering problems using the following computational techniques: Taylor Series approximation, numerical differentiation, root finding using bracketing and open methods, linear and polynomial curve fitting, numerical integration, and the solution of differential equations. Laboratory sessions involve the application of numerical analysis to physical systems involving fluid dynamics, heat transfer, electrical circuits and vibratory systems. (prereq: ME-230)

ME-301 Computer-Aided Engineering 2 2 3

This course is a continuation of ME-300. Numerical methods and the computer are applied to various design problems in engineering. (prereq: ME-300)

ME-309 Intermediate Mechanics of Materials 2 2 3

This course continues the study of the mechanics of deformable bodies. Topics include statically indeterminate structures, failure theories, stresses in miscellaneous structures (shear in thin members, torsion in noncircular members, pressure vessels, etc.), design of compression members and energy methods. Laboratory exercises and design projects will reinforce lecture material. (prereq: ME-207)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-311 Principles of Thermodynamics I 3 0 3

This first course in engineering thermodynamics for mechanical engineering students uses the classical approach. The subject material serves as a building block for all thermodynamicoriented courses to follow. Specific topics include definitions, first law, heat and work transport and the steady flow energy equation. Water, as both steam and compressed liquid, and ideal gases are the principal substances considered. (prereq: MA-231, PH-220)

ME-314 Principles of Thermodynamics II 4 0 4

This is a continuation of basic thermodynamic concepts for mechanical engineering students. Unsteady processes, second law, irreversibility and availability(energy) are covered. The thermodynamic principles are applied in the study of power cycles and combustion processes. (prereq: ME-311)

ME-316 Thermodynamics Applications 3 3 4

This course is a continuation of the thermodynamic sequence, with emphasis on applications of thermodynamic principles to typical systems. New topics include combustion, internal combustion engines, compressible flow theory and psychrometrics. Design projects and laboratory experiments are used to illustrate the application of First and second law analysis to devices such as pumps and fans, steam power or refrigeration cycles, and psychrometric processes. (prereq: ME-314, CH-200)

ME-317 Fluid Mechanics 3 2 4

This course begins with fluid properties, fluid statics, and pressure gauges. The study of fluid dynamics starts with the mathematics of the velocity field and proceeds to a control volume formulation for conservation of mass, momentum and energy. The Bernoulli equation is derived and extended to include pipe friction and minor losses. The student is introduced to boundary layers, and drag. The lab stresses instrumentation, error analysis, and independent thought. (prereq: ME-206, MA-232)

ME-318 Heat Transfer 4 0 4

The purpose of this course is a study of the principles of heat transfer by conduction, radiation and convection. Application of both analytical and numerical solution techniques will be emphasized. (prereq: ME-300, ME-317)

ME-321 Materials Science 3 0 3

Atomic, crystal and defect structure fundamentals are studied to lay the foundation for understanding the structure-property-processing relationship. (prereq: CH-201, ME-207)

ME-322 Engineering Materials 3 2 4

The structure-property-processing relationship for materials is studied. Several strengthening mechanisms and the required heat treatment or processing procedures are considered. Material selection in terms of mechanical strength, service stability, cost and environmental impact are discussed in detail. (prereq: ME-321)

ME-323 Manufacturing Processes 3 2 4

Physical principles underlying the processing of metal, polymer, ceramic and composite are studied. Numerous processing techniques in the areas of casting, bulk deformation, joining, sheet metal working and particle processing are treated. Laboratory experiments include welding, casting and statistical process control techniques. (prereq: ME-322)

ME-354 Thermodynamics and Heat Transfer 3 0 3

For electrical engineering and industrial engineering students: a study of the fundamental concepts and laws of heat transfer, with supporting foundation in thermodynamics. Application of principles of heat transfer to problems encountered in electrical and other systems. (prereq: MA-231, PH-220)

ME-361 Dynamics of Machinery 2 2 3

This course is an application of the principles of dynamics to mechanisms and machine elements. Topics will include kinematic and dynamic analysis of linkages and cam mechanisms. (prereq: ME-206)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-362 Design of Machinery 3 0 3

This course is an application of principles of machine dynamics to the design of machinery. Topics will include synthesis of mechanisms, machine balancing, design of flywheels, actuator selection, and computer-aided design of mechanisms. (prereq: ME-361)

ME-363 Design of Machine Components 4 0 4

This course applies mechanics of materials concepts to the design of machine components. Static and fatigue failure criteria are introduced and applied to shafts, bearings, gears, threaded fasteners and helical springs. (prereq: ME-309, ME-361)

ME-401 Vibration Control 3 0 3

This is an introduction to mechanical vibrations, to free and forced vibrations of freedom systems, and to two-degree of freedom systems. Various types of forcing functions are considered for both damped and undamped systems. (prereq: MA-232, ME-230)

ME-402 Vehicle Dynamics 3 0 3

This course covers the application of engineering mechanics to the design of road vehicles. Topics include pneumatic tires, load transfer, performance limits, suspension and steering, and handling and response. (prereq: ME-230)

ME-411 Advanced Topics in Fluid Mechanics 3 0 3

This course involves the application of fluid mechanics principles to various engineering design problems. Typical topics included are pipe flow, orifices, flow measurement, scale modeling, and hydrodynamic machinery. (prereq: ME-317)

ME-413 Heat Transfer 3 2 4

This is a study of the principles of heat transfer by conduction, radiation and convection. Numerical methods, utilizing a computer for steady-state and transient design problems, are covered in the laboratory sessions. (prereq: ME-300, ME-317)

ME-416 Thermodynamics Applications 3 2 4

This course begins by applying thermodynamic principles to the study of refrigeration cycles, psychrometrics and compressible flow. Design projects are then assigned to examine the integration of fluid dynamics, thermodynamics and heat transfer in a design setting. An energy laboratory experience provides a further opportunity to integrate the three disciplines. (prereq: ME-314, CH-200, ME-318)

ME-419 Internal Combustion Engines 2 2 3

This course covers the basic theory of internal combustion engines, engine testing, carburetion, combustion, ideal cycles, and internal combustion engine fuels including knock ratings and injection. Spark ignition and compression ignition engines are considered separately in detail. (prereq: ME-311, ME-354 or equivalent)

ME-423 Materials Selection 3 0 3

This course provides the students with an understanding of materials as grouped systems as well as familiarization with enough specific engineering materials to allow their effective use in daily assignments. Also illustrated are the guidelines for screening candidate materials and arriving at reasonable choices. (prereq: ME-323 or equivalent)

ME-424 Engineering with Plastics 3 0 3

This course provides the student with a knowledge of the various classes of polymers and composites that are commonly used. Molecular structures and how they affect the material's behavior under various conditions are discussed along with the effect of processing. Selection guidelines based on mechanical and physical properties, as well as information on how to use properties in a design, are provided through examples. (prereq: ME-321 or equivalent)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-429 Composite Materials 2 2 3

This course introduces the student to the mechanical behavior of fiber-reinforced composite materials. Topics to be covered include anisotropic stress-strain relationships, failure theories, and stress analysis of plates and shells. Different manufacturing methods and applications will be presented. Laboratory exercises include computer modeling of composite laminate performance and mechanical property testing of laminates. (prereq: ME-207)

ME-431 Automatic Control Systems 3 2 4

This course provides an introduction to automatic controls used in mechanical engineering applications, including fluid power. Differential equations are used to model and analyze basic feedback control systems. Laboratory experiments are done using fluid power and electronic equipment. (prereq: ME-300)

ME-432 Automatic Control Systems II 3 2 4

This course extends preceding course work on feedback control systems in mechanical engineering applications to include frequency response, system analysis, and compensation, including fluid power applications. System analysis techniques include logarithmic plots. Feedback control systems involving servo valves, proportional valves and speed control are included in related laboratory experiments. (prereq: ME-431)

ME-433 Electromechanical Systems 3 2 4

This course extends the concepts of feedback control to the design and realization of electromechanical systems. Topics will include modeling, simulation, and selection of actuators and digital implementations of control algorithms. The course will include an electromechanical systems design project. (prereq: ME-363, ME-431)

ME-435 Robotics and Mechatronics 3 0 3

This course is an introduction to the mechanics, design and control of robotic systems. Topics will include kinematics and dynamics of robotic systems, control and sensing hardware, robot programming and electromechanical system integration. A project involving the design of a robotic system will be undertaken. (prereq: ME-361, ME-431)

ME-460 Finite Element Methods 3 2 4

This course serves as an introduction to finite element analysis (FEA) for structural problems. In the lecture portion of the course, finite element equations are developed for several element types from equilibrium and energy approaches and used to solve simple problems. In the laboratory portion, students use a commercial, general-purpose finite element computer program to solve more complex problems. A project introduces the use of FEA in the iterative design process. (prereq: ME-309)

ME-462 Vehicle Design Project 2 2 3

This course involves the extension of vehicle dynamic fundamentals to the analysis and design of advanced vehicle systems. (prereq: ME-402)

ME-463 Design of Machine Components 2 2 3

This course applies mechanics of materials concepts to the design of machine components. Static and fatigue failure criteria are introduced and applied to shafts, bearings, gears, threaded fasteners, and helical springs. (prereq: ME-309, ME-361)

ME-464 Mechanical System Design 3 0 3

This course provides students with the opportunity to design mechanical systems in simulated, real-life situations. Student project teams interpret specifications, develop alternate designs, conduct basic research and complete a design solution, using knowledge gained in prior courses. Creativity is encouraged. Oral and written reports are required. (prereq: ME-363)

ME-466 Aerodesign Project 2 2 3

This course involves the application of the principles of aerodynamics, fluid mechanics and strength of materials to an aerodesign project. Students are required to form project teams which carry the design from project statement and specifications to a final written design report and oral presentation. (prereq: ME-481 or consent of instructor)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
ME-471	**Fluid Power Circuits**	**3**	**0**	**3**

This course considers the operating principles and performance of standard fluid power components such as pumps, motors, valves, cylinders, etc. Using standard components, appropriate circuits are designed and calculations made to match components with operating conditions in typical industrial applications. Hydrostatic transmissions, cavitation, accumulators, pump controls for energy conservation, hydraulic fluids and filtration are also covered. (prereq: ME-317)

ME-472	**Modeling and Simulation in the Design of Hydraulic Components**	**2**	**2**	**3**

This course focuses on the continued development of analytical methods as applied to hydraulic components and circuits. Steady-state and limited transient performance of pumps, valves, accumulators, motors and cylinders as components and systems are addressed (i.e. functional, steady-state and dynamic). Linear and nonlinear models for pumps, motors and valves are also developed and applied to system analysis. Laboratory sessions are included to relate model predictions to actual component performance. (prereq: ME-471)

ME-475	**Design of Fluid Power Circuits**	**3**	**0**	**3**

A specific type of machine is designed to meet a developed set of specifications. The machine will have a substantial hydraulics content along with electronic interfaces that provide control and sensing. The project usually includes hardware fabrication to provide the student with problems associated with this activity. Tasks include component sizing and selection, systems design, integration with mechanical and electrical systems, and human factors considerations. The open-ended designs are evaluated based on originality, accuracy, safety, and written/oral presentations. (prereq: ME-471 or consent of the instructor)

ME-480	**HVAC System Design**	**2**	**2**	**3**

This course explores major elements in the design of heating, ventilating and air conditioning systems. Topics include psychrometric analysis, load estimation, duct/piping design, equipment selection and energy consumption estimating. Students are required to design elements of HVAC systems, resulting in an understanding of the entire process. (prereq: ME-416)

ME-481	**Aerodynamics**	**3**	**0**	**3**

This course reviews nondimensional numbers and boundary layer concepts. It also includes a physical description and understanding of fluid flow over bluff and streamlined bodies; experimental and theoretical lift and drag results for both two-dimensional and finite airfoils; aircraft stability and control; propeller design; and automobile aerodynamics, including airfoil, spoilers and airdams. (prereq: ME-317)

ME-485	**Energy System Design Project**	**3**	**0**	**3**

This course involves the application of energy principles to various engineering design problems. (prereq: ME-416)

ME-490	**Senior Design I**	**1**	**0**	**3**

This course functions as the proposal-writing phase for the major design experience in the mechanical engineering program. Student design teams are organized, and paired with a faculty adviser. A detailed design proposal is prepared. Topics covered in lectures and addressed in the design proposal include the design process, engineering specifications, patents and intellectual property, library research techniques, reliability and safety, design for manufacturability and project management. (prereq: senior standing)

ME-491	**Senior Design II**	**1**	**0**	**3**

This course is a continuation of ME-490. Students are required to complete or show sufficient progress on an engineering design project proposed in ME-490. Design work is performed by design teams under the supervision of a faculty adviser. A final or interim design report is prepared and orally defended. Lecture meetings are used for discussion of topics related to professionalism and engineering careers. (prereq: ME-490)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-492 Senior Design III 1 0 3

This course is a continuation of ME-491. Students are to create a prototype of the engineering design project proposed in ME-490 and initiated in ME-491. Design work is performed by design teams under the supervision of a faculty adviser. A final design report is prepared and orally defended. (prereq: ME-491, consent of project faculty adviser and ME-492 instructor)

ME-498 Topics in Mechanical Engineering 3 0 3

This course allows for study of emerging topics in mechanical engineering that are not present in the curriculum. Topics of mutual interest to faculty and students will be explored. (prereq: senior standing and consent of the instructor)

ME-499 Independent Study 0 0 3

This selection allows the student, with faculty guidance, to concentrate on an approved subject of special interest not covered in regularly scheduled courses. This may take the form of individual or small group supervised study, literature survey, analysis, design or laboratory study. (prereq: senior standing and approval of a faculty adviser and the program director)

MS-183 Introduction to Computer Methods and Applications 3 0 3

This course introduces the student to the fundamental concepts of popular application software including operating systems (Windows), word processing (Word), spreadsheets (Excel) and presentation packages (PowerPoint). The course also explores communication technologies, including e-mail and the Internet. This is a hands-on, skill-building course that prepares students to use these tools in various other courses. Based on previous experience, students can test out of all, or portions, of this course. This course is designed for students who are not pursuing a business degree.

MS-184 Introduction to Computer Methods and Applications 3 0 3

This course introduces the student to the fundamental concepts of popular application software including operating systems (Windows), word processing (Word), spreadsheets (Excel), presentation packages (PowerPoint) and databases (Access). This course also explores communication technologies, including e-mail and the Internet. This is a hands-on, skill-building course that prepares students to use these tools in various other courses. Based on previous experience, students can test out of all, or portions, of this course.

MS-221 Microeconomics 3 0 3

This course provides an introduction to the central concepts of microeconomic analysis and decision-making, such as demand and supply, as well as marginalism. The concepts are then used to explain and analyze market structures, including perfect competition and monopoly. Other topics may include analysis of labor markets, property rights and international economics.

MS-273 Web Design 3 0 3

This hands-on course is designed for beginners in Web site design. The course will cover how to use XHTML to create Web pages, as well as how to incorporate Cascading Style Sheets (CSS) and JavaScript. Students will complete a Web site from start to publishing it on the Internet.

MS-275 Advanced Web Site Development 3 0 3

This hands-on course is designed for experienced Web site designers. The course will cover Web site design beyond the basics as well as how to create graphics, animation and JavaScript form validation into an already created Web site. The student will enhance a pre-existing Web site with graphics and JavaScript while using the advanced Web site design techniques. Upon completion of this course, it is expected that students will be able to understand in-depth knowledge of Web site development; select approaches, strategies and techniques for integrating Internet technologies into the design and development of Web sites; and incorporate form validation with JavaScript, animated graphics, and advanced Web design techniques into their Web sites. (prereq: MS-273)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-277 Multimedia for Web Sites 3 0 3

This hands-on course is designed for experienced Web site designers interested in including multimedia on their sites. The course will cover all aspects of creating and including multimedia on a site specifically using Adobe Illustrator and Macromedia Flash. Students will create a multimedia project using the techniques discussed in class. Upon completion of this course, students will be able to understand multimedia and the issues surrounding its inclusion on Web sites; select approaches, strategies and techniques for integrating multimedia technologies into the design and development of Web sites; and incorporate Flash technologies into their Web sites. (prereq: MS-275)

MS-2771 Object-Oriented Programming for the Web 3 0 3

This course introduces the concepts of object-oriented programming to beginners. Upon completion of this course the student should have a basic understanding of the software development lifecycle issues, the design process, the reuse of existing software components, and the thought processes involved in object-oriented programming for the Web. (prereq: MS-2775)

MS-2773 Java for Web Design 3 0 3

This hands-on course is designed for experienced programmers that want to learn Java. Upon completion of this course, students will be able to: learn the basics of creating Java applets and applications; create object-oriented programs using Java; incorporate graphics, sound and event handling; use multiple threads to create animations; and understand and use inheritance and polymorphism properly. (prereq: MS-2771)

MS-2775 Servlet for the Web 3 0 3

This hands-on course is designed for experienced programmers that want to learn the basics of server-side Java programming. Upon completion of this course, students will be able to: create servlets that provide dynamic Web content to users; incorporate graphics and multimedia responses to client requests; use multiple threads to create animations; require users to authenticate themselves in order to protect Web content; and understand the basics of Java ServerPages. (prereq: MS-2773)

MS-2777 Web Java Server Pages 0 0 0

This hands-on course is designed for experienced programmers that want to learn the basics of server-side Java programming. Upon completion of this course, students will be able to: create JSP pages that provide dynamic Web content to users; incorporate graphics and multimedia responses to client requests; understand how multiple threads affect JSP coding; allow users to authenticate themselves in order to protect Web content; and understand the basics of XML processing. (prereq: MS-2775)

MS-280 Introduction to Management Information Systems 3 0 3

This course provides the technical foundation for understanding information systems by describing hardware, software, data storage and telecommunications technology that comprise an organization's information technology infrastructure. The role of information systems is explored with emphasis on business processes, distribution of organizational knowledge to enhance management decision-making, and the implications of ethical and social issues. An examination of electronic commerce and global business is included. (prereq: MS-184 or equivalent)

MS-300 Principles of Operating Systems 3 0 3

This is an introductory course that covers the principles of operating systems from the user's point of view. The four major components (scheduling, memory management, I/O management and file systems) are examined in detail along with how various hardware components of a computer system work together. (prereq: MS-3811)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-322 Macroeconomics 3 0 3

This course outlines and analyzes the application of the principles of economics to modern business and the economic environment. Topics include measuring and understanding GDP, unemployment and business cycles, national debt and the role of government as expressed in macroeconomic theory from the classical to the supply side. Monetary and fiscal policy efforts to promote employment, price stability and economic growth are reviewed.

MS-327 International Business 3 0 3

This course is designed to develop an understanding of the expanding need for businesses to think and react with an international focus. An initial focus is recognizing the forces of globalization, the factors to consider when moving into new markets, and the methods by which firms decide to compete in these foreign markets. Emphasis is given to developing an analysis and appreciation of at least one country/region of the world in regard to its geography, people, history and the associated business risks within this environment. Secondary goals in the course include expanding on the sensitivity to other cultures, and encouraging students to think of their career in the context of a global path. (prereq: MS-221)

MS-331 Business Law 3 0 3

This subject acquaints the student with legal concepts and their application to business and personal situations. Attention is paid to problems arising under the following topical headings: basic nature of the legal system; tort law; contract law, including both common law principles and the provisions of the Uniform Commercial Code; products liability law; debtor/creditor relations; bankruptcy law; and agency law.

MS-340 Production Management 3 0 3

This course introduces the student to the concepts and methods for designing and managing operations in both manufacturing and service industries. Operations are processes that transform input into output of goods and services. Operations management addresses the application of resources needed to achieve transformation with regard to cost, quality and customer satisfaction. (prereq: MS-221)

MS-3405 Advanced Operations Management 3 0 3

This course describes the value of and an approach to develop a manufacturing operations strategy. Also addressed is the need to align manufacturing with overall organizational strategic plans and objectives. Manufacturing's early involvement in the planning process is critical. Typically manufacturing's active involvement takes place late in the planning cycle. This course will address why the late involvement exists and the need for early involvement. Late involvement often leads to a flawed strategy and or strategies difficult for manufacturing to successfully support. A factor in the flawed approach is often due to manufacturing's excessive attention to day-to day issues. The day-to-day necessity may also be symptomatic of a flawed manufacturing process. Late involvement provides little time to assess and acknowledge current system flaws. Building a strategy from a flawed system or process is a potentially devastating situation.

MS-3411 Leading Project Teams 3 0 3

Techniques of studying, analyzing, improving, managing and leading the growth, productivity and development of individual and group competencies to enhance project performance are explained and practiced in this course. The course includes the processes required to make the most effective use of the people involved with the project. The importance of involving team members in the linking and overlapping of process groups in various project phases is emphasized. This course helps managers deal with value dilemmas, conflict, resistance to change and project team-building skills. (prereq: junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MS-3411S* Leading Project Teams Suite	**3**	**0**	**3**

Techniques of studying, analyzing, improving, managing and leading the growth, productivity and development of individual and group competencies to enhance project performance are explained and practiced in this course. The course includes the processes required to make the most effective use of the people involved with the project. The importance of involving team members in the linking and overlapping of process groups in various project phases is emphasized. This course helps managers deal with value dilemmas, conflict, resistance to change and project team-building skills. *S represents one class of a suite of courses that must be taken together. (prereq: junior standing)

MS-342 Management Principles	**3**	**0**	**3**

This is a survey course on the management processes of planning, organizing, leading and controlling in organizations. The course begins with a comparison of the current spectrum of management philosophies to those of the last century. Various aspects relating to the challenges of social responsibility and ethical decision-making are normally covered through case studies, while the emerging interest in international and cross-cultural managing is interwoven throughout the course. Traditional functions of management such as strategic planning and organizational design are given special emphasis to stimulate discussion on how organizations adapt to global conditions.

MS-3421 Management Principles	**3**	**0**	**3**

The course content is a concise, comprehensive presentation of the management process. It reviews the current schools of management thought, the traditional functions of management, and the theory of organization – its structure, design and techniques for managing organizational change. Interfunctional relationships among departments, decentralization and delegation are closely viewed. Problem-solving, performance appraisal and leadership concepts are considered as techniques of the management process. The new international management environment and the social responsibilities to society conclude the study. (prereq: MS-221,MS-331)

MS-344 Organizational Behavior and Leadership Development	**3**	**0**	**3**

The course examines organizations and the interactions among individuals and groups. Students will explore the challenges of managing people in organizations in terms of the interaction between human beings and the organizational contexts within which they work. Further, individual differences of human behavior will be compared and contrasted to differences in organizations. The course has three areas of focus. First, fundamental concepts of organizations are introduced, including form, structure and culture. Second, individual characteristics and behaviors are examined, including perspectives, attitudes, personality and judgment. Third, the principles of groups and group dynamics are presented, including formation, development, processes and leadership. The goal of the course is to prepare students to effectively manage resources, both human and technical. (prereq: junior standing)

MS-344I Organizational Behavior and Leadership Development	**3**	**0**	**3**

The course examines organizations and the interactions among individuals and groups. Students will explore the challenges of managing people in organizations in terms of the interaction between human beings and the organizational contexts within which they work. Further, individual differences of human behavior will be compared and contrasted to differences in organizations. The course has three areas of focus. First, fundamental concepts of organizations are introduced, including form, structure and culture. Second, individual characteristics and behaviors are examined, including perspectives, attitudes, personality and judgment. Third, the principles of groups and group dynamics are presented, including formation, development, processes and leadership. The goal of the course is to prepare students to effectively manage resources, both human and technical. (prereq: junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-346 Project Management 3 0 3

This course will present a practical understanding of the project management process with emphasis on implementation. The course will combine a classroom and hands-on approach to provide students with the knowledge of defining and managing the scope of a project, preparing and managing a project plan, preparing and managing a project budget, evaluating and managing project risks, managing project issues, and closing and transitioning off the project. This course will provide students with the tools and knowledge to carry out a project in any industry.

MS-346S* Project Management Suite 3 0 3

This course will present a practical understanding of the project management process with emphasis on implementation. The course will combine a classroom and hands-on approach to provide students with the knowledge of defining and managing the scope of a project, preparing and managing a project plan, preparing and managing a project budget, evaluating and managing project risks, managing project issues, and closing and transitioning off the project. This course will provide students with the tools and knowledge to carry out a project in any industry. *S represents one class of a suite of courses that must be taken together.

MS-354 Principles of Accounting 3 0 3

This course focuses on the preparation and understanding of the four basic financial statements - income statement, statement of retained earnings, balance sheet and statement of cash flow. Specific topics include basic double entry accrual accounting and the special requirements in accounting for managing cash, receivables, investments, inventory, fixed assets, liabilities and equity. The Great Plains computer software program is used to illustrate how computers facilitate the accounting process. Students are required to complete a transaction-based term project using both manual and computer techniques. (prereq: MS-221)

MS-356 Business Finance 3 0 3

This course introduces students to various aspects of financial management. Topics covered include a review of accounting, financial analysis and forecasting, operating and financial leverage, working capital and financing decisions, current asset management, short-term sources of financing and the time value of money. Students are required to complete a financial statement analysis term project. (prereq: MS-354)

MS-358 Managerial Cost Accounting 3 0 3

This course introduces students to various methods used by companies to internally allocate and report costs. Topics covered include the scheduled cost of goods manufactured, cost allocations using job order costing, process costing, activity-based costing, variable costing, cash budgeting, flexible budgeting, the use of standard costs for variance analysis and the balanced scorecard. Students are required to prepare a complex cash budget term project. (prereq: MS-356)

MS-361 Marketing 3 0 3

An introductory course to marketing that familiarizes students with the marketing concept and helps them understand how the marketing concept influences various decisions made by managers in a firm. Topics include the evolution of marketing, the significance and use of marketing research, marketing segmentation, product and/or service positioning, distribution, pricing, customer relationship management, and a variety of strategies for marketing communication and promotion. (prereq: MS-221)

MS-361I Marketing 3 0 3

An introductory course to marketing that familiarizes students with the marketing concept and helps them understand how the marketing concept influences various decisions made by managers in a firm. Topics include the evolution of marketing, the significance and use of marketing research, marketing segmentation, product and/or service positioning, distribution, pricing, customer relationship management, and a variety of strategies for marketing communication and promotion. (prereq: MS-221)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

MS-363 E-business Marketing Strategies **3** **0** **3**

This course examines the business and marketing decisions a firm faces when attempting to establish an electronic business presence on the Internet. E-business involves more than just Internet sales transactions. It affects an organization's infrastructure, marketing channels, customers and supply chain. The course focuses on emerging e-business models, developing an Internet strategy, using the Internet for customer relationship management, conducting business through the Internet and establishing a Web presence. Students will analyze a number of companies that have successful e-business operations. (prereq: MS-361)

MS-365 Business-to-Business Marketing **3** **0** **3**

This course covers the strategies and activities involved in the marketing of products and services to business buyers, government and various marketing intermediaries. It involves investigating decision-making at all levels of business-to-business marketing. It will cover developing marketing programs and plans to build customer relationships with an emphasis on segmentation, personal selling and customer retention. A customer-focused approach will be used in analyzing marketing fundamentals. (prereq: MS-361)

MS-371 Introduction to Unix Operating Systems **2** **2** **3**

This first course in Unix is designed to acquaint the student with the usage, philosophy and design behind a robust, open system. The student is exposed to the standard utilities, shell scripting languages and environment, plus some of the tools that are available to Unix users. The goal of this course is to familiarize students with the Unix basics for further study, and to acquaint students with the ideals of an open system utilizing multitasking, electronic mail, source code and project control, networking and high-level computing language.

MS-373 Advanced Unix and System Administration **2** **2** **3**

This second course in Unix is a continuation of MS-371, with more emphasis on some of the topics covered briefly in the earlier course. In-depth coverage of system control and administration, process manipulation, specialized utilities and document preparation is presented.

MS-3803 Intermediate Java Programming **3** **0** **3**

This, the second course in the Java programming sequence, introduces core object-oriented principles and their implementation in Java. Topics covered include objects and classes, inheritance and polymorphism, interfaces and inner classes, graphics programming basics, event handling and exception handling techniques. (prereq: MS-382)

MS-3804 Advanced Java Programming **3** **0** **3**

This, the third course in the Java programming sequence, introduces topics that are the basis for building robust, reliable systems in Java. Topics covered include data structures and the collections API, streams and files, multithreading, networking, and database connectivity. (prereq: MS-3803)

MS-3805 Introduction to Enterprise Java Programming **3** **0** **3**

The Java 2 Enterprise Edition (J2EE) is introduced in this course by exploring servlets (Java server-side components that complement "applets" on the client-side). All aspects of servlets are introduced via hands-on programming assignments that exercise the details of how servlets interface with the client by using HyperText Markup Language (HTML) and HyperText Transfer Protocol (HTTP). Open source components such as Apache, Tomcat-Catalina and Ant will be used in the hands-on portion of the course. (prereq: MS-3804)

MS-3806 Intermediate Enterprise Java Programming **3** **0** **3**

The Java 2 Enterprise Edition (J2EE) is further investigated in this course by using JavaServer Pages (JSP) as a server-side scripting language to quickly develop Enterprise Java Web sites. JSP expressions, declarations, scriptlets, directives and custom tag libraries are investigated and used in course programming assignments. Open source components such as Apache, Tomcat-Jasper, Ant, JUnit, Struts and Velocity are used in the hands-on portion of the course. (prereq: MS-3805)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-3807 Advanced Enterprise Java Programming 3 0 3

The Java 2 Enterprise Edition (J2EE) is further explored in this course by using Enterprise JavaBeans (EJB) as a gateway into legacy applications such as databases, transactions and security frameworks made popular in enterprise computing environments. EJB home interfaces, remote interfaces, local interfaces, session beans, entity beans and message beans are investigated and used in the course programming assignments. Open source components such as JBoss, JUnit, CVS and Xdoclet are used in the hands-on portion of this course. (prereq: MS-3806)

MS-3811 C++ Programming for Business 3 2 4

This course introduces the object-oriented programmer to the syntax and semantics of the C++ programming language. Students write several programs exploring basic techniques covering the concepts of C++ expressions, data types, program documentation and commenting style. Data structures and algorithms from the Standard Template Library are introduced, along with the basic object model concept and the class construct. Problems from the world of business are used in programming assignments. (prereq: MS-373, MS-3803)

MS-382 Introduction to Java 3 0 3

The beginning programmer is introduced to the syntax and semantics of the Java programming language. Students write several programs exploring basic techniques covering the concepts of expressions, data types, flow of control, modularity of code, program documentation and commenting style. Simple data structures are introduced, along with the basic object model concept and simple class constructs. Problems from the world of business are used in programming assignments.

MS-3831 Advanced C++ Programming for Business 3 2 4

This second course in C++ is a continuation of MS-3811, with more emphasis on some of the topics covered briefly in the earlier course. In-depth coverage of proper object-oriented programming using C++ is presented. Topics include classes, operator and function overloading, copy constructors, destructors and good OOA techniques. (prereq: MS-3811)

MS-387 Computer Systems Analysis and Design I 3 0 3

This course provides a survey of business systems development methodologies, as well as an overview of the systems development life cycle and the concepts, tools and techniques currently used in the analysis of management information systems and the design of new systems and applications. (prereq: MS-383, or consent of instructor or program director)

MS-388 Computer Systems Analysis and Design II 3 0 3

This course continues the use of systems analysis skills learned in MS-387. Students are assigned to a project team that does a feasibility study and new system design for a “real-world” client. (prereq: MS-387)

MS-389 Data Center Management 3 0 3

This course emphasizes managerial control and the administration of management information systems. Topics covered include the structure of the organization, operational logistics, recruitment of skilled employees and acquisition of hardware and software. (prereq: junior standing)

MS-393 Quantitative Techniques 3 0 3

This course introduces students to various models and techniques used to assist managers in decision-making, including application of many of the statistical techniques from MA-340. Topics covered include decision analysis, linear programming, transportation models, facility location techniques, waiting lines, simulation and time-series forecasting techniques. (prereq: MA-340, MS-340)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-395 E-business Technologies 3 0 3

Today's businesses are global in nature. An Internet presence is essential to the marketing and sales efforts of any organization. Network technologies allow virtual storefronts to compete with traditional brick-and-mortar sales vendors. Unfortunately, this technology comes with a steep price; the amount of computing technologies can be staggering. This course examines a requirement to produce a "Web presence" using a number of tools and technologies. It emphasizes that the business model, expressed as use-case requirements, has to be satisfactorily completed prior to embarking on a development project. An overview of e-business technologies will be covered, along with the building of an e-business site. (prereq: MS-373)

MS-3991 Supply Chain Management 3 0 3

With the growth of information systems, expansion of international competition and the deregulation of the transportation system, many companies are analyzing and working to optimize their entire supply chain, from raw materials to ultimate customer. This course examines the elements of supply chain, including logistics, inventory and information. Throughout, it emphasizes the need to develop strategies and incentives that optimize the entire supply chain, not just single units of it. (prereq: MS-340)

MS-3992 Operations Management Simulation 3 0 3

Simulation is a powerful tool used to better understand the implications of business decisions and improve the quality of those decisions, particularly decisions made under conditions of uncertainty. With the wide use of spreadsheets and of specialized simulation programs and add-ins, simulation is no longer a tool for specialists. This course looks at the use of simulation, using several approaches, in a number of business areas, including operations and production management, financial modeling, forecasting of demand and waiting lines. (prereq: MS-340)

MS-419 A+ Certification Course 2 2 3

This course provides students with the knowledge and hands-on lab-based experience necessary to support personal computers and peripherals. It prepares students for the CompTia A+ certification exam by providing a firm foundation of technical skills and knowledge. Topics covered include computer bus architecture, memory technologies, microprocessors, disk storage, troubleshooting, and operating system installation and configuration. This course is designed to prepare non-computer literate individuals with the background necessary to enter the Microsoft MCSE or Novell CNE programs.

MS-420 Microsoft Windows 2000 Professional 3 2 4

This course provides students with the knowledge and skills necessary to install and configure Microsoft Windows 2000 Professional. MS-420 is a hands-on lab-based course designed to provide students with the opportunity to gain experience in a Windows 2000 environment. Topics include installation and configuration of Windows 2000 Professional, managing users and groups, installing and configuring protocols, DNS, Active Directory Services and troubleshooting resources. The course covers material in Microsoft's official curriculum course #2152-Supporting Microsoft Windows 2000 Professional and Windows 2000 Server. (prereq: MS-479, networking experience equivalent, or consent of instructor or program director)

MS-421 Microsoft Windows 2000 Server 3 2 4

This is an intensive lab-based course that provides students with the knowledge and skills necessary to install, configure and customize Windows 2000 Server. Topics covered include installation and configuration of Windows 2000 Server, managing Windows 2000 file systems, Active Directory Services, routing and remote access, monitoring and optimization, and troubleshooting. MS-421 covers material in Microsoft's official curriculum course #2152-Supporting Microsoft Windows 2000 Professional and Windows 2000 Server. (prereq: MS-420, networking experience equivalent, or consent of instructor or program director)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-422 Microsoft Windows 2000 Active Directory Services 3 2 4

This hands-on lab-based course provides students with the knowledge and skills necessary to install, configure, manage and support Active Directory Services in a Windows 2000 environment. MS-422 covers material in Microsoft's official curriculum course #2154-Implementing and Administering Microsoft Windows 2000 Active Directory Services. Topics covered include configuring and administering Active Directory Services, implementing group policy, configuring DNS and maintaining the Active Directory database. (prereq: MS-421, or consent of instructor or program director)

MS-423 Microsoft Windows 2000 Network Infrastructure Administration 3 2 4

This lab-based course shows students how to plan their network infrastructure around features supported by Windows 2000. Topics include in-depth study of TCP/IP, DNS, WINS, DHCP, and Active Directory-enabled environments in enterprise networks. Students will also learn how to troubleshoot features and services for Windows 2000 enterprise networks, including routing and remote access. This course covers material in Microsoft's official curriculum course #2153-Implementing a Microsoft Windows 2000 Network Infrastructure. (prereq: MS-421, or consent of instructor or program director)

MS-424 Designing a Microsoft Windows 2000 Directory Services Infrastructure 3 2 4

This lab-based course introduces students to Microsoft Windows 2000 Active Directory and prepares them to plan, configure and administer their Active Directory infrastructure. Students learn how to configure the domain name system (DNS) to manage name resolution, schema and replication. They also learn how to use Active Directory to centrally manage users, groups and shared folders; network resources; administer the user environment and software with group policy; and deploy Windows 2000 using RIS (remote installation service). This course covers material in Microsoft's official curriculum course #1561-Designing a Microsoft Windows 2000 Directory Services Infrastructure. (prereq: MS-421, MS-422)

MS-425 Designing a Microsoft Windows 2000 Network Infrastructure 3 2 4

This lab-based course provides students with the information and skills needed to analyze the business requirements for a network infrastructure and design a network infrastructure that meets the business requirements. Topics covered include network topology, routing, DHCP, IP addressing, WINS, DNS, virtual private networks, remote access and telephony solutions. This course covers material in Microsoft's official curriculum course #1562-Designing a Microsoft Windows 2000 Networking Services Infrastructure. (prereq: MS-421, MS-423)

MS-426 Designing Microsoft Windows 2000 Network Security 3 2 4

This is a lab-based course that provides students with the knowledge and skills necessary to design security frameworks for small, medium and enterprise networks by using Windows 2000 technologies. Students learn how to control access to resources and audit access to resources. Other topics covered include authentication and encryption methods, including certificate-based authentication; Kerberos authentication; clear-text passwords; digest authentication; smart cards; NTLM; RADIUS; and SSL. This course covers material in Microsoft's official curriculum course #2150-Designing a Secure Microsoft Windows 2000 Network. (prereq: MS-421, MS-422, MS-424)

MS-433 Small Business Management 3 0 3

Small business management emphasizes the aspects of management that are most important to the success of a small business firm: understanding the importance of planning, knowing the customer, and recognizing the problems of owning your own business. Comparison of the management techniques required in both small and large organizations allows students to see themselves in the role of entrepreneur, member of a small business organization and member of the larger corporation. (prereq: MS-342, MS-356)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MS-439	**Principles of Real Estate**	**3**	**0**	**3**

This course is an overview of how to select, finance and maintain real property for personal or investment purposes. It includes discussions of the real estate market, property rights, tax issues, cash flow analysis, property valuation and the lending process. (prereq: junior standing)

MS-441	**Supervision**	**3**	**0**	**3**

This course investigates the supervisor's role in a modern business including human relations, motivation and communication. It emphasizes the planning, organizing, staffing, directing and controlling aspects of supervision through the application of principles to real-life case situations. (prereq: junior standing)

MS-442	**Management in the Era of Rapid Technological Change**	**3**	**0**	**3**

This course is an assessment of factors critical to the management of organizations experiencing rapid technological change. Today's exponential growth of technology is redefining the resources that are critical in the management of business and industry. In the twentieth century the critical resources were cash, equipment, facility, raw materials and transportation. Tomorrow's critical resources include information. Management's challenge is twofold. First is to gather and transform data into useful information. Second is to develop the knowledge and ability to use the information to successfully manage an organization's resources.

MS-443	**Labor Relations**	**3**	**0**	**3**

This course provides students with a basic understanding of the history, purpose and development of the labor movement in the United States and describes the various labor organizations that have evolved, merged and become viable elements of organized labor. It also takes up the collective bargaining process, and issues and provisions of typical labor agreements are reviewed and interpreted. (prereq: MS-221; MS-331 is recommended)

MS-444	**Business and Government Relations**	**3**	**0**	**3**

This course emphasizes economic and legal analysis of governmental policies toward business. A review of microeconomic theory is presented in the first section of the material, and such theory is then applied to analyze statutes in the following areas: consumer protection, environment, equal employment and the workplace. The rationale and procedures utilized in traditional economic regulation and deregulation are covered in detail. The course concludes with suggestions for reforming government regulation of business. (prereq: MS-221, MS-331)

MS-446	**General Management Policies**	**3**	**0**	**3**

This course covers strategic planning and managing of businesses with an emphasis on integrating major concepts developed in earlier business and management courses. Case studies are used to ensure a practical appreciation of managing the entire enterprise ñ from the development of a mission statement to the implementation of programs to fulfill strategic objectives. (prereq: MS-342, MS-358, senior standing)

MS-447	**Management Readings and Issues**	**3**	**0**	**3**

In this course students study the basic functions of management, planning, organizing, actuating and controlling a seminar setting. Current concepts and controversies are investigated and discussed based on readings and reference materials in current journals. Attendance at management association meetings and professional lectures is encouraged. (prereq: junior standing)

MS-448	**Employment Law**	**3**	**0**	**3**

This course provides students with a basic understanding of laws that affect or influence the personnel function within the firm. An overview of the following topics or laws is included: discrimination laws, fair labor standards act, equal pay act, regulation of employee benefit plans, employment-at-will doctrine, and unemployment and workers' compensation laws. (prereq: MS-331 and junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-449 Human Resource Management 3 0 3

From the early selection process of acquiring personnel, this course surveys the evolution of the activity to the emergence of today's human resource management (HRM). For those preparing to become part of a management team, the scope and intent of human resource practices are clearly identified with special emphasis on the following: ethics, equal employment opportunity, motivation, leadership, complaint handling, rights and responsibilities of employer/employee, and the professionalism of the HRM practitioner. (prereq: junior standing)

MS-450 Management Control Systems 3 0 3

This course uses case studies to analyze and evaluate methods of controlling and motivating responsibility centers. This includes cost, revenue, profit and investment centers. The following topics and their implications in responsibility accounting are also covered: motivational aspects and techniques for measuring performance of those responsible for budgets; return on investment and residual income; and transfer pricing techniques. (prereq: MS-4599)

MS-451 Personal Tax 3 0 3

Personal tax introduces federal taxation concepts. This user-based course teaches students successful tax preparation and planning techniques. Students are required to prepare taxes as part of a term project. (prereq: MS-356)

MS-452 Investment and Portfolio Analysis 3 0 3

This course is designed to provide students with a detailed understanding of how to develop, manage and monitor an investment portfolio. Specific topics covered include a historic overview of investment returns, security analysis techniques, investment asset allocation, market efficiency, and modern portfolio theory. The course concludes with an explanation of optimal investment strategies given a particular individual's age and financial situation. (prereq: MS-457)

MS-453 Personal Investments 3 0 3

This course investigates methods of obtaining, preserving and increasing personal assets. It covers career planning, personal financial statements, budgeting, housing decisions, taxes, borrowing, banking and insurance. Students are involved in stock investment teams.

MS-4544 Financial Management Policies 3 0 3

This course provides students with a survey of current accounting and financial management trends. Special topics include, but are not limited to, internal control systems, long-range planning, accounting information systems, emerging technologies, internal and external auditing, tax strategy and international finance. This course serves as a capstone for the financial management concentration. (prereq: MS-451, MS-457, MS-459)

MS-4545 Finance and Accounting 3 0 3

This course considers the perspective of financial accounting, operation and analysis in business and industry from the standpoint of professionals working at the middle or project level of a corporation. Background is presented in the following: elements of financial mechanics including time value, discounted cash flow and return on investment; financial statements, specifically income statements and balance sheets; financial concepts of depreciation, income taxes and cost of capital; and financial operations, in particular capital budgets. Practical applications also are provided relating to capital investment justification and new product evaluation. Consideration also is given to the specific operating controls used in business and how they relate to the day-to-day activities of the professional in marketing, production and engineering. (prereq: junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MS-4545S* Finance and Accounting Suite	**3**	**0**	**3**

This course considers the perspective of financial accounting, operation and analysis in business and industry from the standpoint of professionals working at the middle or project level of a corporation. Background is presented in the following: elements of financial mechanics including time value, discounted cash flow and return on investment; financial statements, specifically income statements and balance sheets; financial concepts of depreciation, income taxes and cost of capital; and financial operations, in particular capital budgets. Practical applications also are provided relating to capital investment justification and new product evaluation. Consideration also is given to the specific operating controls used in business and how they relate to the day-to-day activities of the professional in marketing, production and engineering. (prereq: junior standing)

MS-457 Financial Intermediaries	**3**	**0**	**3**

This course explains the specific functions of the different types of financial intermediaries, the markets in which they operate, and the value and attributes of the financial instruments they utilize. Intermediaries discussed include the Federal Reserve, depository institutions, insurance companies, mutual funds, pension funds and investment bankers. Expanding on topics introduced in previous finance courses, detail is provided on the structure and operation of the markets for, and the attributes and valuation of, different financial instruments including stocks, bonds and derivative securities. (prereq: MS-4599)

MS-459 Intermediate Accounting	**3**	**0**	**3**

This course is a continuation of MS-354. The emphasis is on accounting concepts and their application to stockholder's equity, working capital, inflation accounting and payroll accounting. The course also investigates methodology for accounting for partnerships, not-for-profit organizations, and company mergers and acquisitions. (prereq: MS-4599)

MS-4599 Managerial Finance	**3**	**0**	**3**

This course applies the concepts covered in previous finance and accounting courses. Topics covered include valuation and rates of return, cost of capital, relevant costs in decision making, capital budgeting, adjusting for taxes and risk, make vs. buy vs. lease decisions, segment reporting, internal transfer pricing, external pricing of products and services, and investment banking. Students are required to complete a term project analyzing the desirability of a major capital acquisition under different financing alternatives. (prereq: MS-358)

MS-462 Technical Selling	**3**	**0**	**3**

In this course the work of the individual sales representative or sales engineer employed by the manufacturer, wholesaler or retailer is reviewed with emphasis on sales to and for industrial and business enterprises. Characteristics of the successful salesperson, making a good sales presentation, prospecting for leads, and time and territory management are all discussed in detail. Role playing of both the salesperson and the purchasing agent is an integral part of the learning process in this course. (prereq: MS-361)

MS-467 Marketing Research	**3**	**0**	**3**

This course introduces students to the fundamentals of market research. It covers the major applications areas for market research, the design and application of basic research tools, the role of marketing research, and the measurement and evaluation tools used in market research. (prereq: MS-361 and junior standing)

MS-468 Promotion and Advertising Strategies	**3**	**0**	**3**

This course provides an in-depth examination of the promotional alternatives available to firms' advertising, personal sales, sales promotions and public relations. Promotional strategies are analyzed in view of the company's marketing objectives, market conditions and the competitive environment. A basic objective of the course is to study the variables that will determine the optimal promotional "mix." (prereq: MS-361 and junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-469 Advanced Marketing Strategies 3 0 3

The primary objective of this course is to provide an in-depth experience to help students understand the dynamic nature of marketing and how to successfully compete in it. It will enable students to understand the challenges of competing in quickly changing environments and how firms are successfully meeting those challenges. Emphasis is placed on strategic marketing analysis and on strategy implementation via marketing mix variables. (prereq: MS-468 and senior standing)

MS-4716 Foundations of Novell Networking 3 2 4

This course is now MS-4716. This course provides students with basic knowledge about implementing Netware and using its management tools. The class covers the material in Novell course number 3001, Foundations of Novell Networking. It is a hands-on, lab-based course, designed to provide students with the opportunity to gain experience in a NetWare environment. Topics covered include managing Novell eDirectory, storage space, security, printing and implementing Internet services. (prereq: basic understanding of networking and personal computers, and operating systems such as Windows 98, NT or 2000)

MS-4733 Novell E-directory Design & Implementation 2 2 3

Students in this course learn to design and implement Novell e-directory trees and related components in any type of organization for different organizational goals using different types of network operating systems. This lab-based course covers the material in Novell course #575 and uses real-world scenarios where students design and implement Novell e-directory trees for internal needs of the organization and for an e-business organization focused on meeting the needs of its external customers. (prereq: MS-4745 or experience with basic Netware system administration)

MS-4745 Novell Network Management 3 2 4

Novell Network Management provides students with the knowledge and skills to perform the network management tasks that are most common yet critical to administrators of LANs and WANs. This course covers the material in Novell course #3004, Novell Network Management. Emphasis is placed on use of the network management utilities of NetWare, deployment of NetWare features, and troubleshooting skills that a student in an entry-level network administration position must have to manage the daily network operations of an organization. MS-4745 is a hands-on, lab-based course designed to provide students with the opportunity to gain experience in a NetWare environment. (prereq: MS-4715 or experience with basic NetWare system administration)

MS-479 Network+ Certification 2 2 3

This course replaces MS-4732 Networking Essentials. Developed by CompTia, earning the Network+ Certification means that the candidate possesses the knowledge needed to configure and install the TCP/IP client. The Network+ exam covers a wide range of vendor and product neutral networking technologies that can also serve as a prerequisite for vendor-specific IT certifications. Novell accepts the Network+ certification exam in place of its Networking Technologies exam for all Certified Novell Engineer (CNE) candidates. Topics covered include in-depth coverage of the OSI Model and the corresponding protocols, transmission media, protocols, bridging, switching hubs, routers, the 802.x standards and WAN technologies.

MS-4795 Security+ Certification 2 2 3

The CompTIA Security+ vendor-neutral certification exam is the worldwide standard of competency for foundation-level security practitioner. Companies that have contributed to the development of the Security+ Certification include IBM, Microsoft, Verisign, and the FBI and US Secret Service. This lab-based course covers general security topics such as access control and virus attacks, basics of cryptography, communication security for remote access, e-mail, wireless networks, operational and organizational security, and infrastructure security. (prereq: MS-479 or a basic understanding of networks)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-480 XML/XSL Programming 3 0 3

Extensible Markup Language (XML) and Extensible Stylesheet Language (XSL) have emerged as replacement languages for HTML technologies. This course covers core XML elements such as the Simple API for XML (SAX), the Document Object Model (DOM), XPath, XPointer and Formatting Objects Protocol (FOP). Open source parsers and translators for XML, such as Xerces and Xalan, are used in the programming assignments associated with this course. Application programs in XML are written using either the Java API for XML Processing (JAXP) or the ASP and C# APIs available in the Microsoft .NET platform. (prereq: MS-2775 or MS-3805)

MS-4801 Project Management 3 0 3

This course is designed to expose students to the realities of project management through lecture, discussion and participation in a project meeting. It addresses the topics of people in projects, project teams and management styles, as well as the tools used to plan, track and control the outcome such as budgets, Gantt charts, work breakdown structures, critical path management and project wrap-ups. (prereq: junior standing)

MS-4803 Application Development 3 0 3

The Microsoft Solutions Framework (MSF) provides guidance to manage people and processes in the application development cycle. Created as a framework instead of methodology, MSF is flexible enough to adapt to meet project and organizational needs. The Application Development course teaches students how to apply MSF principles and models to technology application development projects. This course applies to all distributed computing solutions (not only Microsoft). It introduces a milestone-driven process model to manage the risks that are inherent in a dynamic environment and to focus teams on delivering value to the organization. The course's project progress milestones help managers balance the commitments of schedule, budget and functionality. (prereq: MS-4801)

MS-4805 Principles of Infrastructure Deployment 3 0 3

The Microsoft Solutions Framework (MSF) provides guidance to manage people and processes in the application development cycle. Created as a framework instead of a methodology, MSF is flexible enough to adapt to meet project and organizational needs. The Principles of Infrastructure Deployment course describes how to apply MSF principles and models to technology infrastructure deployment projects. This course is applicable to all distributed computing solutions (not only Microsoft). It introduces a milestone-driven process model to manage the risks inherent in a dynamic environment and focus teams on delivering value to the organization. The course's project progress milestones help managers balance the commitments of schedule, budget and functionality. (prereq: MS-4803)

MS-4807 Principles of Enterprise Architecture 2 0 2

The Microsoft Solutions Framework (MSF) provides guidance to manage people and processes in the application development cycle. Created as a framework instead of a methodology, MSF is flexible enough to adapt to meet project and organizational needs. This is an introductory course that shows students how to combine four perspectives - business, applications, information and technology - into a cohesive enterprise architecture plan that adapts to their needs over time. The resulting plan includes infrastructure and application projects as well as help with standards, guidelines and other activities necessary to reach the desired state for the organization. (prereq: MS-4805)

MS-481 Introduction to C+ 3 0 3

Microsoft's strategy for new products is to tightly integrate data, resources, web services, documentation and content into a "framework," commonly referred to as the ".NET framework." The ".NET" term refers to Net-enabled services that span platforms and systems. This course presents an introduction to the C+ programming language in a Windows environment using the .NET framework. The Common Language Runtime (CLR) and the (Framework Class Library (FCL) are explored along with event handling and typical Windows controls. (prereq: MS-3803 or MS-3831)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-482 Introduction to ASP.NET 3 0 3

ASP.NET leverages the power of the Internet with new technologies such as the C# language, VB.NET and ADO.NET. ASP.NET allows the Internet developer to use a fine-grained approach to a Web page by utilizing individual code behind each Web control. This course presents an introduction to the Active Server Pages framework provided by Microsoft's .NET platform. This platform allows Web Services to be published and consumed by any user of Web-based devices. (prereq: MS-481)

MS-483 Database Management Systems 2 2 3

An introduction to the elements of database management systems (DBMS) is presented in this course. Several database models are covered (Hierarchical, Network and Relational), with the Relational database model emphasized as the most important of the three. Entity relationship diagrams are used to illustrate the concepts of database design, schemas and normalization. Relational algebra is used as a basis for the understanding of Structured Query Language (SQL). The use of relational databases as persistence layers for object-oriented languages is described through the presentation of database drivers and object-relational mapping mechanisms. (prereq: one course in computer programming)

MS-4831 Advanced Database Management 3 0 3

Topics explored in this advanced study of database systems course include performance enhancement, distributed databases, security models, the Web as a presentation layer to data, XML as a standard language for data exchange, data warehouses and data mining. (prereq: MS-483)

MS-484 Business Use and Management of Networks 3 0 3

This course prepares the graduating senior to understand the position of supervisor of the people who manage the network at a large corporation. Capacity planning, service and lease negotiations, diagnostic hardware and software, and budgeting are also covered. (prereq: junior standing)

MS-485 Telecommunications 3 0 3

This course provides an overview for both voice and data communications. This course examines the industry, develops technical understanding of the operation of various devices, and provides background on the legislative, judicial and regulatory aspects of the telecommunications industry. A special emphasis is placed on Local Area Networks (LANs). (prereq: one course in computer programming)

MS-486 Web Services 3 0 3

As XML is established as the data language for application integration, Web protocols are being established that automate the business-to-business transactions that take place over the Internet. This course covers the major protocols that support a service-oriented architecture on the web, such as the Simple Object Access Protocol (SOAP), the Universal Description, Discovery and Integration protocol (UDDI), the Web Services Description Language (WSDL), and other protocols that emerge as important for interoperability. (prereq: MS-480)

MS-488 Wireless Programming 3 0 3

Wireless communications are becoming commonplace in business transactions. This course investigates the protocols, languages and environments that have emerged as important in wireless processing, such as the Wireless Access Protocol (WAP), the Wireless Markup Language (WML), the Binary Runtime Environment for Wireless (BREW), and the Java 2 Micro Edition (J2ME) implementations of CDC, CLDC, MIDP and other protocols important in wireless communications. (prereq: MS-480)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-4951 German Practicum 9 0 9

This course is required at the end of the formal studies in the dual-degree exchange program with the Lübeck University of Applied Sciences, Germany. The practicum and its oral defense is the culmination of the degree work, when students must complete an extensive project/internship that entails a mixture of theory and application. The intent is for students to create an interesting and challenging project that can provide high value for an organization, where the outcome is a thesis and implementation of recommendations. Projects are typically at firms with international operations. (coreq: MS-4953 and consent of instructor)

MS-4953 German Colloquium 3 0 3

This course is required at the end of the formal studies in the dual-degree exchange program with the Lübeck University of Applied Sciences, Germany. It is the complement of the German Practicum experience. Students are required to have an oral defense of their thesis, and at the discretion of the review committee, a defense of their academic studies. (coreq: MS-4951 and consent of instructor)

MS-498 Management Internship Experience 1 3 3

This course is designed to allow the junior or senior student to receive credit for valid work experience in the student's area of concentration under the guidance of both a faculty member and a representative of a cooperating firm. The expectation is that the student's work experience will extend and/or intensify the student's understanding of a chosen field of study. Internship students are expected to take enough additional course work during their internship to continue to maintain full-time student status. (prereq: BCS or BSMS major and consent of instructor)

MS-499 Management Internship Experience 1 3 3

This selection allows the student, with faculty guidance, to concentrate on an approved subject of special interest not covered in regularly scheduled courses. This may take the form of individual or small group supervised study, literature survey, analysis, design or laboratory study. (prereq: junior standing and approval of a faculty adviser and the program director)

MT-1201 Materials and Processes 3 0 3

This course is an introduction to a variety of industrially important materials and processing methods. This includes basic mechanical properties and structure for metals, plastics and ceramics, and select examples of specific steels, aluminums and plastics. The basics of casting, forging, extrusion, sheet metal forming, injection molding and welding are covered. (prereq: none)

MT-200 Statics 4 0 4

This subject investigates force systems in equilibrium. Topics include resultants, moments, couples, force couple systems, trusses, frames, machines, friction, centroids and moments of inertia. (prereq: MA-127, PT-110)

MT-205 Strength of Materials 4 0 4

This subject is concerned with the behavior of materials and structures under load. Topics of study include simple stress and strain; torsion; shear and bending moment; corresponding stresses in beam, beam deflection, combined stresses, Mohr's Circle; and column theory. (prereq: MT-200)

MT-215 Thermodynamic Fundamentals 3 0 3

This is an introduction to the fundamentals of thermodynamics for the student in mechanical engineering technology. The fundamentals of the first law, and property relations for the pure substance, and real and ideal gases are covered. (prereq: MA-128, PT-110)

MT-216 Thermodynamic Fundamentals 4 0 4

This is an introduction to the fundamentals of thermodynamics for the student in mechanical engineering technology. The fundamentals of equilibrium thermodynamics, the first and second laws, entropy, general relations for the pure substance, and real and ideal pure substances, their processes and cycles are covered. (prereq: MA-128, PT-110)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MT-218 Fluid Mechanics 3 2 4

This course covers statics, dynamics and properties of incompressible fluids. Statics includes pressure measurement and forces on submerged surfaces. Dynamics includes continuity, Bernoulli's equation, pipe friction and hydrodynamic forces. Applications studied are flow meters, hydraulic machinery and pipe networks. Laboratory experiments are conducted on fluid properties, instrumentation, pump testing and flow resistance. (prereq: MA-128, PT-110)

MT-228 Machining Processes 2 2 3

This course deals with the various types of machining operations such as turning, milling, drilling, and reaming. The interpretation of information from engineering drawings into physical parts is also discussed. (prereq: EG-123, MT-267)

MT-2601 Mechanical Components 4 0 4

This course introduces the design process. Fundamentals of gears, shafts, bearings, belts and chains, and miscellaneous other hardware are studied. Selection of components from catalogs and handbooks is emphasized. Tolerances and fits are also introduced. (prereq: MT-205)

MT-2611 Mechanisms 4 0 4

This class presents the fundamentals of position, velocity and acceleration analysis of mechanisms. Graphical methods are emphasized, and computer analysis is introduced. Other topics include cam and gear train design. (prereq: MA-126, EG-125)

MT-267 Dimensioning and Tolerancing 2 2 3

This course introduces students to the study of measurements and their applications. Tolerances, or variances of measurements, are studied with the aid of various types of engineering drawings and laboratory experiments. An abbreviated laboratory study of statistics is also included. (prereq: EG-124, MA-126; coreq: MA-127)

MT-302 Strength of Materials Laboratory 0 1 1

This course is the study of the behavior of materials and mechanical components. Under static loading and within Hooke's Law through the vehicle of nondestructive testing. Principles of strength of materials and techniques of strain measurements are discussed. (prereq: MT-205)

MT-303 Dynamics 3 0 3

This subject deals with the motions of particles and rigid bodies and the forces causing them. Topics include rectilinear and curvilinear motion, rotation and plane motion. Principles include Newton's Lws, work and energy, conservation of energy, and impulse and momentum. (prereq: MA-225, MT-200)

MT-3101 Fluid Mechanics 2 2 3

This course examines the basic characteristics of fluids, including fundamental fluid properties (density, viscosity). Fluid statics focuses on the concept of fluid pressure and its variation. Fluid dynamics establishes the fluid flow energy equation and examines the concept of losses. Laboratory experiments support the concepts introduced in the lecture. (prereq: MA-128, PH-113)

MT-3111 Thermodynamics 4 0 4

This course begins with the study of the properties of pure substances and the ideal gas model. The concept of the balance equation is introduced, and then is applied to the mass balance and the First Law of Thermodynamics. Energy balances for closed and open systems are applied to various processes and devices. Cycles are examined, with emphasis on refrigeration and gas power cycles. Finally, the Second Law and its effect on the performance of systems is examined. (prereq: MA-128, PH-113)

MT-3121 Heat Transfer 3 2 4

This course focuses on the basics of heat transfer: conduction, convection and radiation. The laboratory demonstrates both thermodynamic and heat transfer principles through experimentation. (prereq: MT-3101, MT-3111)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MT-314 Thermodynamic Cycles 3 3 4

A continuation of MT-215, this subject covers the Second Law, gaseous mixtures, thermodynamic processes, gas cycles, two-phase cycles and combustion. The laboratory consists of experiments designed to show the practical application of basic theory by evaluating operating characteristics, efficiency and energy flows in applying the conservation of energy to liquid vapor systems. (prereq: CS-150, MT-215)

MT-316 Thermodynamic Applications 3 0 3

The course applies thermodynamic theory to refrigeration systems, gas mixtures, combustion systems, psychrometrics and high speed flows. (prereq: MT-314)

MT-317 Heat Transfer 3 2 4

The course covers the basics of conduction, convection and radiation with the required numerical methods to solve by computer math modeling, an actual problem where computer predictions can be compared with test results. Special topics include thermo-physical properties of materials and test analysis, strategies used to solve thermal design problems. (prereq: CS-150, MA-227, MT-215, MT-218)

MT-3301 Electromechanical Instrumentation 2 2 3

Measurement and control devices and their properties are examined. Electrical, mechanical, thermal, fluid flow and other measurement elements are described and tested. Static, dynamic and frequency response performance measures are applied to device operating characteristics. Analog and digital signal conditioning methods are explored including their effects on measurement precision and accuracy. (prereq: ET-2550)

MT-331 Electrical Motors 4 0 4

In this course, students are provided with instruction in the common industrial power systems and the corresponding calculations. Students are exposed to the operating characteristics of various types of AC and DC machines, as well as their proper selection, connections, and applications. (prereq: MA-126, MA-127, ET-151, MT-262, PT-220)

MT-3401 Quality in Manufacturing 3 0 3

This course covers the fundamental concepts in statistical process control, reliability, quality assurance and design of experiments. (prereq: MA-262, MT-1201)

MT-342 Manufacturing Process Engineering 3 2 4

Starting with the product design drawings, students learn how to select and plan the manufacturing processes and sequence required to produce the part, taking into consideration quality, quantity, cost and the environmental impact. (prereq: MT-123, MT-228, IE-423)

MT-353 Statics & Strength of Materials 4 0 4

This course is designed for electrical engineering technology students. The statics portion covers the study of resultants and the conditions of equilibrium of force systems including trusses, frames, and friction. The strength of materials portion includes stress-strain relationships, torsion, bending and shear stresses. (prereq: MA-127, PT-110)

MT-354 Dynamics 3 0 3

Designed for electrical engineering technology students: This subject deals with the motions of particles and rigid bodies and the forces causing them. Topics include rectilinear and curvilinear motion, rotation and plane motion. Principles include Newton's Law, impulse and momentum, work, and energy. (prereq: MA-225, MT-353)

MT-355 Thermodynamics and Heat Transfer 3 0 3

Designed for electrical and manufacturing engineering technology students: this is an introduction to engineering thermodynamic fundamentals. Topics include work, temperature and heat, properties of systems, pure substances and the laws of thermodynamics. The latter part of the course is devoted to heat transfer concepts, applications to heat sink design, and device cooling considerations. (prereq: MA-226; coreq: MA-226)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MT-356 Fluid Mechanics 3 0 3

Designed for electrical engineering technology students, this subject covers incompressible fluids and their application. Specific topics deal with fluid properties, hydrostatics, hydrodynamics, flow regimen, and resistance to fluid flow. (prereq: MT-355)

MT-3601 Finite Element Analysis 3 2 4

This course is designed as an introduction to the finite element method and a continuation of the study of solid mechanics begun in MT-205. Lecture topics include steps in the finite element analysis process; element formulations of spring, truss and beam elements using direct equilibrium and energy methods; assembly of equations and application of loads and boundary conditions; interpretation of FEA results; static failure criteria; beam deflections; pressure vessel theory; and column buckling. Lab exercises will alternate between mechanical testing laboratories and computer simulations. These exercises will include stress concentrations, beam stresses/deflections, thick-wall pressure vessels, combined bending/torsional loading and column buckling. Students will use a commercial finite element program to simulate the experiments performed in the mechanical testing laboratory. (prereq: MA-225, MT-205)

MT-3611 Solid Modeling 3 2 4

In this course, the use of solid modeling in engineering design will be explored. Students will learn to create part models, assemblies and drawings using solid modeling software. The integration of solid modeling into the product design process, including data management, rapid prototyping and structural analysis, will be studied. (prereq: EG-124)

MT-383 Internal Combustion Engines 3 3 4

This subject covers the basic theory of internal combustion engines including spark ignition, compression ignition, and rotary and gas turbine cycles. Also included are engine performance characteristics, mixture preparation, fuels, knock ratings, and ignition systems. (prereq: MT-316)

MT-3901 Computer Tools 2 2 3

This course introduces basic concepts of computer programming using MATLAB software. Topics include plotting, root finding, matrix operations, functions, and loops and logical branchin. Also included are advanced features of EXCEL spreadsheets. (prereq: none)

MT-393 Applied Finite Element Analysis 2 2 3

This is an introduction to the finite element method with emphasis on applications in computer-aided design. The basic concepts are introduced, but the major portion of the course covers learning how to use a general-purpose, finite element program such as ALGOR for analysis of typical structures and machines to determine loads, displacements and stresses. Application of the finite element method for heat transfer is also included. (prereq: MT-205)

MT-400 Senior Design Project 1 0 3

This one-term course can be taken in lieu of the two-course sequence, MT-494 and MT-495. The major aim of this course is to aid the student in developing his/her ability to deal with engineering problems using the project approach with limited supervision. Subjects that deal with design, analysis, testing, an in-depth literature search or a combination of these areas are eligible topics for investigation. Factors such as cost, environmental impact, manufacturing methods, use of computer programs, engineering drawings, and standards and/or codes should be considered, depending upon the nature of the project that the student selects. Manuals and handbooks should be consulted when appropriate. (It is recommended that students have completed term 10 engineering technology subjects.) (prereq: HS-494 or consent of instructor)

MT-4001 Advanced Mechanics 3 0 3

This course includes advanced topics in mechanics of materials and dynamics. Mechanics of materials topics include static and fatigue failure theories, analysis of statically indeterminate structures, reliability concepts and impact loadings. Dynamics topics include velocity and acceleration analysis of mechanisms. The use of motion analysis software is introduced. (prereq: MT-205, MT-2601, MT-2611, MT-303)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MT-412 Thermodynamics Laboratory II 0 3 1

This laboratory is designed to show the application of gas compressors, fans, supersonic nozzles, steam turbines, internal combustion engines, and refrigeration cycles. (prereq: CS-150, MT-317, MT-316)

MT-4201 Advanced Materials 3 2 4

This course continues the study of industrially important materials and processing methods with an emphasis on the relationship between structure, property and processing. Topics include heat treating, phase diagrams, failure modes, fatigue, creep, fracture toughness, strengthening mechanisms in metals, composite materials and engineering plastics. The course includes a lab component for the verification of heat-treating steel, brass and aluminum, and for testing of mechanical properties. (prereq: CH-310, MT-1201, MT-205)

MT-4301 Feedback Control Systems 3 2 4

This course introduces open-loop and closed-loop control systems by means of Laplace-domain block diagrams. Differential equations are used to write mathematical models of mechanical, electrical and other systems. Transient and steady-state responses of first-order and second-order systems are examined. Frequency response, including the development of Bode plots, is used to empirically determine model parameters. Feedback systems employing controllers are implemented in both laboratory sessions and computer simulations to study the performance of components and systems. (prereq: MA-226, MT-3301, MT-3901)

MT-432 Power Transmission Control 2 2 3

This course compares the various systems of power transmission and distribution, single and three-phase, that is generally found in industry. The roles of various electrical equipment, like transformers and motors, and their part in modern transmission is studied. Switchgear equipment and their role in modern electrical distribution and control is also studied. Motor control, as applicable to modern industrial equipment, is a major topic of this course, which includes the various motor starting methods, reduced voltage starters and the related sensors and protection devices. The control symbols used for motor control circuits, including ladder diagrams leading to relay logic, for controlling electrical industrial equipment, is studied. The speed characteristics of electric motors and how that can be used in control circuits is taught. Related topics include speed reducers, adjustable speed drives and programmable controllers. (prereq: ET-251 or MT-331, MT-262)

MT-433 Feedback Control Systems 3 2 4

Closed-loop control systems are introduced by means of block diagrams. Differential equations are used to write mathematical models of mechanical, electrical and other systems. Response of selected systems that can be defined by first- or second-order differential equations is expanded. The Laplace transform is used with linear differential equations. Feedback control systems with control are included, as well as Bode plots. Laboratory sessions are used to study the operation and performance of components and systems along with computer simulation. (prereq: ET-355, FP-272 or MT-372, MA-227, MT-332 or MT-432)

MT-4401 Hardware in Manufacturing 3 0 3

This course is an overview of modern equipment used in many automated manufacturing environments. Topics include robotics, vision systems, materials handling systems, CNC equipment and other related topics. (prereq: MT-3401, MT-3611)

MT-4501 Mechanics 3 0 3

This course is designed as an introduction to engineering mechanics for electrical engineering technology students. Topics include a brief review of vector algebra; properties of plane areas; equilibrium of particles and rigid bodies in a plane; velocity and acceleration analysis of simple mechanisms; Hooke's Law; and stresses in members subjected to axial, torsion and bending loads. (prereq: ET-3201, MA-225, PH-113 or PT-110)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MT-4511 Thermodynamics and Heat Transfer	**3**	**0**	**3**

This course is a study of the fundamental concepts and laws of heat transfer, with supporting foundation in thermodynamics. Applications include heat sink design and cooling considerations in electrical and electronic systems. (prereq: CH-310, MA-227)

MT-466 Tool Design	**2**	**2**	**3**

Modern industrial organizations use a wide variety of tools to machine or assemble raw materials or partially finished products into commercial products. This course includes a project that requires the locating and clamping of a product piece part in jigs or fixtures. Industrial part drawings and physical samples before and after fabrication are provided. Students are required to make drawings of their design so that their project could be built by a toolmaker utilizing MSOE shop equipment. Estimates of cost and time required to design and fabricate the design are also required. Standard components, which are selected from tooling catalogs, are used whenever possible. (prereq: IE-423, MT-123, MT-228, MT-342)

MT-468 Mechanical Design Projects	**3**	**3**	**4**

Course work for this class includes the design of a double reduction geared speed reducer using individual specifications assigned for horsepower, speed, and gear ratio. The AGMA spur gear computer program from MT-262 is utilized. Components such as bearings are selected from manufacturer's catalogs. A design report as well as an assembly drawing, bill of materials, and some detail drawings are required. A second project requires assigned team members to conceptually design an automated production machine from detail drawings and parts supplied by local industry. Each team leader and member makes an oral presentation before the Mechanical Engineering Technology Industrial Advisory Committee for a critique. Cost, the environmental impact and production quantities are also considered in the design. (prereq: EN-332, MT-262, MT-342 or MT-442, MT-363)

MT-490 Professional Orientation	**2**	**0**	**0**

This course is designed to prepare the graduating engineering senior student for the business/engineering world. Structure of a typical company, the relationship of the engineering department to the rest of the company, the different engineering disciplines and planning an engineering project will be covered. In addition, the subjects of personal skill assessment, job interviewing, working in engineering teams, and interrelationships with other company departments will be discussed. Occasional guest lectures from industry and the business world will be included. (prereq: senior standing; coreq: HS-461, HS-432 desired)

MT-4901 Capstone Project	**3**	**0**	**3**

Students work in small teams to investigate solutions to an engineering problem. The teams are expected to formulate a scope of work, research relevant literature, and design and analyze possible solutions. A written report and oral presentation are required. (prereq: consent of instructor and program director)

MT-494 Senior Design Project - Phase I	**1**	**0**	**1**

This is the first course of a two-course sequence. The one-term course, MT-400, can be taken in lieu of MT-494 and MT-495. The major aim of this course is to aid the student in developing his/her ability to deal with engineering problems using the project approach with limited supervision. Subjects that deal with design, analysis, testing, and in-depth literature search, or a combination of these areas, are eligible topics for investigation. Factors, such as cost, environmental impact, manufacturing methods, use of computer programs, engineering drawings, and standards and/or codes, should be considered, depending upon the nature of the project that the student selects. Manuals and handbooks should be consulted when appropriate. (It is recommended that students have completed term 10 engineering technology subjects.) (prereq: HS-494 or consent of instructor.)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MT-495 Senior Design Project - Phase II	**1**	**0**	**2**

This course is a continuation of MT-494. It must be taken following MT-494, otherwise MT-494 must be repeated. (prereq: EN-332, MT-494)

MT-498 Topics in Technology	**3**	**0**	**3**

This course allows students to obtain knowledge in emerging technologies. Subjects that can be studied are those that are not included in normal course work in the mechanical engineering technology program. The purpose is to promote the exploration of new and developing fields. (prereq: senior standing, consent of program director, consent of instructor)

MT-499 Independent Study	**1**	**0**	**3**

This course allows the student, with faculty guidance, to concentrate on an approved subject of special interest not covered in regularly scheduled courses. This may take the form of individual or small group supervised study, literature study, analysis, design or laboratory study. (prereq: senior standing, approval of instructor, approval of program director)

NA-417 Introduction to Industrial Wastewater **3.3 CEUs**

This course offers an introduction to the principles of designing an industrial water treatment system. It is useful to engineers of all disciplines who have a need to understand the basics of water pollution control in the industrial or manufacturing setting. Principles of water and wastewater chemistry, unit treatment process, federal environmental regulations affecting discharges of industrial wastewater, and the principles of system design are discussed. In addition, case studies of water treatment systems from several types of industries (e.g., plating and metal finishing, food and beverage, etc.) are discussed. (prereq: CH-100, junior standing in engineering or engineering technology)

NA-418 Introduction to Hazardous and Solid Waste Management **3.3 CEUs**

The emphasis of the course is an introduction to hazardous waste management. Regulations and regulatory trends are addressed; treatment or remediation alternatives are evaluated for effectiveness, cost and practicality; and waste minimization is introduced. Students are expected to complete a project that involves research, as well as posing and evaluating alternative solutions for a given waste problem. Solid waste management options, including recycling, are addressed for industrial and special wastes.(prereq: CH-100, junior standing in engineering or engineering technology)

NA-419 Introduction to Air Pollution Control **3.3 CEUs**

This course introduces the student to the concepts of air pollution control design. The course covers the regulatory and environmental concerns that drive the air pollution control industry. Students are led through the process design from basic theory through practical application and case studies. The sources of air pollution and the available control options are presented and discussed in detail. (prereq: CH-100, junior standing in engineering or engineering technology)

NA-500 Engineering Fundamentals Review **3.3 CEUs**

This course is designed as a review for the general FE exam. It is structured to assist students in making more efficient use of their preparatory time. The essential material pertinent to engineering fundamentals is covered. It is an excellent review of engineering principles for those considering entrance into a continuing education program. (prereq: bachelor's degree in engineering, engineering technology or equivalent)

NA-580 Computer-Aided Design and Drafting **2.2 CEUs**

This course introduces students to computer-aided design and drafting techniques available on many commercial CAD systems. No previous CAD or computer background is required, but a proficiency in drafting is essential to getting the most out of the course. Numerous types of CAD packages, along with related input and output devices, are discussed and compared. The fundamentals of 2-D drafting are extensively covered using MSOE's CAD laboratories, and 3-D design is also introduced. (prereq: technical degree and a proficiency in drafting and engineering graphics)

Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

NA-581 Advanced Computer-Aided Design and Drafting 2.2 CEUs

Expanding on the principles learned in NA-580, the student creates advanced 3-D wire frame models. Concepts of cutting planes, surfacing and shaded images are covered in depth. Solid modeling is introduced, and the techniques required for effective solid modeling are extensively covered. (prereq: NA-580 or consent of instructor)

NB-321 Leadership Skills 3.3 CEUs

This course challenges students to consider a new paradigm of leadership. At the core of this new paradigm is the belief that leadership development is a process of self development and personal challenge. This course enables individuals to assess their own leadership belief system, learn new skills and techniques, and then develop an integrated leadership plan for transferring those skills and techniques to the work environment. (prereq: none)

NB-323 Leading Projects in a Quality Way 3.3 CEUs

This course is intended to further develop the leadership skills necessary in the area of project management and to develop process monitoring systems to improve project team performance. Tools useful in developing process improvement and monitoring are covered, such as PERT (Project Evaluation in Review Techniques), QFD (Quality Functional Deployment), affinity diagrams, diagraph and matrix data analysis. In addition, techniques are introduced to help participants establish project vision, goals, benchmarking, organization, planning and implementation. Finally, assessment techniques are covered to help guide the continuous improvement of project activities. (prereq: none)

NB-348 Team Building 3.3 CEUs

This course emphasizes the importance of the manager's work in the system and how to improve it with help from the workers. It shows how to enable workers to do a better job through active participation in quality and productivity improvement. Organizing, managing and maintaining employee involvement teams are addressed from the manager's point of view. Continuous improvement also is discussed. (prereq: none)

NB-425 Engineering Law 1.8 CEUs

This course covers legal concepts that engineers will likely encounter in their employment. Basic principles of contract and agency law are reviewed as well as liability topics from tort law. Intellectual property and product liability law are the focal points of the course. Recommendations are offered regarding an engineer's possible involvement in the litigation process. This course is designed for engineers or individuals who want to review the aspects of business law that they are most likely to encounter in their job. It is of special benefit to those individuals who have a desire to learn the basic legal principles of intellectual property law (i.e., patents, trademarks and copyrights) and product liability law. (prereq: none)

NB-465 Strategic Market-Driven Engineering 3.3 CEUs

This course is designed to acquaint top management, engineers, scientists and other technical professionals with the value and processes of the market-driven organization from a strategic perspective. This course has been specifically developed for engineering managers, product engineers, application engineers, design engineers, system engineers, scientists and product development managers. It is also of interest to marketing managers and product managers of technology-based products who wish to broaden their knowledge of the strategic planning process. (prereq: technical degree)

NE-170 Introduction to Programmable Logic Controllers 2.8 CEUs

Programmable logic controllers are a staple component of industrial controls. They are widely used throughout most commercial and industrial processes. Today's PLC is designed with features that include the following: using hand-held or personal computers for programming; digital, analog input/output; positioning control; and network capabilities. This course provides individuals with the necessary background to understand PLC programming and operation. In addition, practical laboratory experience enables participants to program, debug and run simple programs. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

NE-572 Design of Programmable Controller Systems 2.5 CEUs

This course provides theory and hands-on experience necessary to enable the participant to design programmable controller system applications. Coverage begins with a review of controller basics and conventional approaches and proceeds through the concept of programmable logic including the use of microprocessors as controller elements. In addition, programming, input/output elements, peripherals, and standards and codes that govern interfacing aspects, are covered. The material is reinforced by laboratory sessions that provide the opportunity to learn how to develop several popular system applications. (prereq: technical degree)

NE-588 C Programming Language 2.5 CEUs

The C programming language is a popular language for application program development and embedded system design. This course introduces the set of operators and data types used in the C language. Structured programming skills are developed through the design of functions and their use in large and small programming assignments. (prereq: there are no specific course prerequisites, but knowledge of computers and another programming language would be helpful.)

NE-594 Computer Networking 3.3 CEUs

Computer networking has quickly become a major component of modern computer systems. The explosive growth in the personal computer and the engineering workstation markets has put significant amounts of computing power on the desks of the users. Users within an organization must be able to share information and coordinate activities. Tying these systems together using local and wide area networks is required for the efficient operation of the group. This course covers the theory behind computer networking. The goal is to provide individuals with an understanding of the issues and technologies involved in networks. This course is designed for engineers, technologists and managers involved in the design, implementation or justification of computer networks. (prereq: none)

NM-311 Plant Engineering Principles 2.2 CEUs

It is becoming more evident that plant engineering is more than just an engineering activity in a plant; it is a unique engineering discipline in need of its own specific educational preparedness and continuance. This course is intended for individuals who have been working in plant engineering for some time but perhaps not in management, or those who have not had formal educational training in plant engineering, and/or those who want to fine-tune their knowledge of plant engineering principles. Topics covered include mechanical equipment, electrical equipment, instrumentation and controls, energy conservation, structures and foundations, economic decisions, computerized maintenance management systems and environmental considerations. (prereq: none)

NM-349 The Team Approach to Quality ... Utilizing Statistical Problem Solving 1.0 CEUs

This course lays out a specific, yet simplistic, approach to problem solving within the workplace. The team approach to quality is a methodical, practical and results-oriented method that utilizes a variety of statistical tools. In addition, it focuses on the human resources in the workplace and the opportunity to improve productivity and morale. (prereq: none)

NM-541 Quality Engineering Fundamentals 2.4 CEUs

This course is designed as a review for the Certified Quality Engineer (CQE) exam. Individuals planning to take the CQE examination will find this an efficient method of preparing for the test. Quality practitioners will find it an excellent review of quality engineering principles. Topics covered include probability and statistics, MIL STD 105D and MIL STD 414, quality cost, statistical process control, test outlines, quality auditing, reliability and maintainability, test techniques, capability index, and capability ratio. (prereq: technical degree and knowledge of basic statistical quality control)

Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

NM-542 Quality Auditing Fundamentals **0.6 CEUs**

This course is designed as a review for the Certified Quality Auditor (CQA) exam. Individuals planning to take the CQA examination will find this an efficient method of preparing for the test. Quality practitioners will find it an excellent review of quality auditing principles. Topics covered include ISO 9000, Q90, purpose of audits, structural audit program, and policies. (prereq: technical degree or consent of instructor)

NS-001 Drill and Information Briefing **0 sem. hrs.**

Weekly formations focusing on Marine Corps and Navy drill, ceremonies and inspections. Classroom instruction on special interest areas to the prospective naval officer such as financial responsibilities, career opportunities, leadership, maritime strategy, national security and sailing. Instruction and application of the fundamentals of unit organization, the chain of command, and how to properly wear and inspect uniforms. This course is designed to develop teamwork, leadership, management and initiative. Required of all NROTC midshipmen every term. Offered every term.

NS-009 Introduction to Naval Science **2 sem. hrs.**

General introduction to sea power and naval service. The instruction places particular emphasis on the mission, organization, regulations and broad warfare components of the Navy. Included is an overview of officer and enlisted rank and rating structures, procurement and recruitment, training and education, promotion and advancement, and retirement policies. Offered fall term.

NS-022 Seminar in Sea Power and Maritime Affairs **2 sem. hrs.**

Influence of U.S. Sea Power and Maritime Affairs on international economic and political relationships. Classroom discussions based on independent reading. Offered spring term. (prereq: Non-NROTC students require consent of department chairperson.)

NS-142 Naval Ship Systems 1 **3 sem. hrs.**

Ship design, construction, types and missions. Ship compartmentation, interior communications, propulsion, auxiliary power and ship control systems. Elements of ship design for safe operation. Ship stability characteristics. Offered spring term.

NS-151 Navigation and Naval Operations 1 **3 sem. hrs.**

Theory, principles and procedures of ship navigation and movements. Nautical astronomy, oceanographic factors, piloting, celestial navigation, celestial sights, sextants, charts, publications, electronics aids and inertial navigation systems. Rules of the nautical road, lights, signals and navigational aids. Offered fall term. (prereq: Non-NROTC students require consent of department chairperson.)

NS-152 Navigation and Naval Operations 2 **3 sem. hrs.**

Theory, principles and procedures of ship navigation, movements and employment. Tactical formations and dispositions, relative motion and maneuvering board solutions. Analysis of tactical plots for force effectiveness. Offered spring term. (prereq: Non-NROTC students require consent of department chairperson.)

NS-161 Evolution of the Art of War **3 sem. hrs.**

Military principles and concepts throughout history. Tactical and strategic applications in selected engagements. Offered alternate spring terms.

NS-162 Naval Ship Systems 2 **3 sem. hrs.**

Theory and principles of operations of naval weapons systems including types, capabilities and limitations. Theory of target detection, acquisition, identification and tracking. Principles of trajectories. Offered fall term. (prereq: NS-142)

NS-181 Amphibious Warfare **3 sem. hrs.**

Application of amphibious doctrine to battles of World War II and the Korean conflict. Offered alternate spring terms. (prereq: Non-NROTC students require consent of department chairperson.)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

NS-185 Leadership and Management **3 sem. hrs.**

Stress on experiential approach to leadership and management with military emphasis. Motivation and communication theory and practice. Group dynamics and decision making techniques. Lines of control and organizational structure. Case studies, experiential exercises and situational problems will be used. Offered fall term. (prereq: Non-ROTC students require consent of department chairperson.)

NS-186 Leadership and Ethics **2 sem. hrs.**

Applied techniques and theories learned in NS-185. Practical application of sound leadership and ethics to Navy situations. Counseling, discipline and administration are explored. Offered spring term. (prereq: NS-185, and non-NROTC students require consent of department chairperson.)

NS-193 Practicum in U.S. Marine Corps Leadership and Management **4 sem. hrs.**

Provides instruction and practical application of leadership and management techniques used in the Marine Corps and naval service. The course is held at the Officer Candidate School at Quantico, Va. S/U grades only. (prereq: junior standing in USMC option.)

NS-195 Independent Study **1-3 sem. hrs.**

Independent study of special topics in military science under faculty supervision. Topics selected by student/faculty conference. Offered every term. (prereq: consent of department chairperson.)

NU-105 Professional Nursing Practice and Health **3** **0** **3**

Designed for nursing and non-nursing students, this course provides an overview of health. Emphasis is placed on factors such as dietary patterns, exercise, stress reduction and health behaviors. The student examines risk factors, assessment methods, and techniques to promote healthy life patterns. Gordon's Health Patterns are introduced in this course as an organizing framework. (prereq: none)

NU-200 History and Theories of Nursing **3** **0** **3**

This course is designed to enable the beginning student to examine nursing from a historical as well as present day perspective. The concepts of nursing, person, environment and health are examined. Conceptual frameworks, nursing theories, trends and issues and professional nursing practice are explored. (prereq: EN-131, EN-241)

NU-201 Health Assessment of Individual **3** **3** **4**

This course provides the student with the knowledge and skills necessary to perform a health assessment of individual clients of all ages. Emphasis is placed on taking a comprehensive health history and use of appropriate nursing diagnoses. Opportunities are provided to apply assessment skills in a variety of settings. Caring and transcultural concepts are integrated. (prereq: BI-256, EN-131, NU-105, SS-462, TC-452; prereq/coreq: BI-274; coreq: NU-202)

NU-202 Health Assessment of Family and Community **3** **3** **4**

The emphasis in this course is assessment of the environment of the individual client. Opportunities are afforded for community assessment in an urban and/or rural setting as well as assessment of the family at various life stages in the community. (prereq: NU-105, SS-471; prereq/coreq: NU-201, SS-473)

NU-252 Application of Professional Nursing **3** **12** **7**

This course introduces the student to the application of basic concepts appropriate to professional nursing care. These concepts include the nursing process, critical thinking, role expectations and health promotion-health maintenance across the life span for clients in a variety of settings. The concepts of illness prevention and health restoration are also introduced in this course. Laboratory settings include campus lab, senior living complex, community events, schools and in-patient units. (prereq: NU-105, NU-200, NU-201, NU-202; prereq/coreq: BI-260, BI-281, BI-290)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

NU-330 Nursing Care of Clients with Episodic Health Challenges I 3 12 7

The focus of this course is on the nursing concepts necessary to provide holistic care across the life span. Students are provided with opportunities to expand their abilities in critical thinking and decision making in multicultural clinical settings. This course is designed to integrate use of the nursing process in the planning, implementing and evaluating of care. (prereq: NU-252; prereq/coreq: BI-391, HU-332)

NU-331 Nursing Care of Clients with Episodic Health Challenges II 3 12 7

The focus of this course is a continuation of the nursing concepts necessary to provide holistic care across the life span. Students continue to explore all dimensions of health with an emphasis on developing collaborative skills. In this course, students expand their abilities to integrate the nursing process with individuals and families who are facing episodic health challenges. (prereq: NU-330)

NU-340 Nursing Care of Clients with Chronic Health Challenges 3 12 7

The emphasis of this course is on application of the nursing process to clients of all ages who are experiencing continuing challenges to their health status. Emphasis is placed on communication skills with these clients and their families in a variety of settings. (prereq: NU-330, NU-331, NU-390)

NU-360 Nursing Care of the Community 3 3 4

This course focuses on the community as client. Emphasis is placed on application of the nursing process to the community and includes political activism as an important aspect of nursing interventions for the community. (prereq: NU-330, NU-331, NU-390)

NU-390 Nursing Research 3 0 3

This course introduces the student to the concepts of the research process and its application to nursing practice. Emphasis is placed on students becoming knowledgeable consumers of research as they expand their nursing practice. (prereq: MA-315, NU-252 or RN licensure)

NU-460 Nursing Care of Clients with Episodic Mental Health Challenges 3 9 6

Pattern manifestations of mental health are the focus of this course. The student is offered the opportunity to develop a knowledge base, to develop competent communication skills and to explore the therapeutic use of self. Students participate in, observe and evaluate their clinical nursing, promoting mental health. The student explores aspects of individual traits and states, diverse mental health environments, transculturalism, legal and ethical issues, mental health research and current trends in mental health. (prereq: SS-466, NU-331, NU-340)

NU-470 Nursing Care of Clients with Complex Health Challenges 3 9 6

This course expands the application of the nursing process from clients with continuing health challenges to clients with multiple chronic nursing diagnoses. Emphasis is placed on nursing interventions that provide palliative care for the dying client as well as restorative care for the client with multiple health challenges. (prereq: NU-340, NU-390)

NU-471 Nursing Care of Clients with Complex Episodic Health Challenges 3 15 8

This course provides the student with the opportunity to apply theory and research findings to the critically ill person. Using critical thinking skills, the student interprets changing pattern manifestations in a complex technological setting and facilitates balance for the person and his/her environment. (prereq: NU-390, NU-460, NU-331)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

NU-485 Nursing Clinical Elective **2** **12** **6**

This course is designed to provide the student with the ability to integrate application of nursing concepts with a client population of interest. It is expected that students work with preceptors in a variety of settings. The student has the opportunity to formulate learning objectives and experiences within the context of the course. (prereq: NU-460, NU-470, NU-471; coreq: NU-486)

NU-486 Synthesis of Nursing Care **4** **0** **4**

This course is designed to assist the student in synthesizing the concepts of the curriculum into a model for professional nursing practice. The student is expected to exhibit critical thinking skills, independent decision making and judgment. (coreq: NU-485)

NU-490 Nursing Leadership and Professional Orientation **3** **6** **5**

The objective of this course is to prepare students for professional and managerial roles. The course provides students with opportunities to apply principles of management in a variety of settings. Through the development of a research based project, theories and principles of change, collaboration and organization are applied to maximize optimum health for people and their environment. Analysis of changes in health care and in nursing is emphasized. (prereq/coreq: NU-486)

NU-491 Nursing Leadership & Professional Orientation I **1** **0** **1**

This course is the first in a series of three designed to assist students in the transition from college life to professional life. Theories and principles of professional practice, leadership, and change are included in this first course. Students are expected to be able to identify individual practice concerns and continued learning needs in this course.

NU-493 Nursing Leadership & Professional Orientation II **0** **3** **1**

Theories learned in NU-491 are applied in this course. Students initiate the implementation of a change process in a clinical area where they will complete the clinical requirements for NU-485. Faculty supervision of this project will continue through the following quarter in NU-497. Students are also expected to apply the theories of professional practice and leadership as they interact with staff and management in the implantation of their project. (prereq: NU-491)

NU-495 Role Transition (for RN students only) **4** **6** **6**

The role expectations of the BSN are explored in this class. Students are required to critically reflect on these role expectations and document their personal role evolution. It is expected that students will address a specific role expectation in working with a preceptor in a clinical area of their own choosing. Consult with faculty in selecting a clinical area in which they will address the implementation of the role of the professional nurse.

NU-497 Nursing Leadership & Professional Orientation III **2** **3** **3**

In this course, students learn and apply theories of management in the classroom setting. Topics such as budgeting, scheduling, staff development, and management of clinical units are discussed. Students continue the implementation of the change process initiated in NU495 and prepare a professional presentation of this process at the end of the Spring Quarter. (prereq: NU-493)

OR-100 Freshman Seminar **1** **0** **0**

This course is designed to provide information and orientation to members of the freshman class. The lecture series greatly aids first-quarter students in successfully adjusting to their collegiate program and university life. Emphasis is placed on how and where to obtain help, policies and procedures, career choices, the mentoring program, learning and teaching styles, academic regulations and organization of the curricula. Open discussion and a question/answer period follow each presentation. (prereq: none)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

OR-101 Strategies for Academic Success 1 0 0

This course is designed to help students admitted to MSOE on probation develop effective study strategies and understand the learning process. Students learn to apply proven strategies for taking exams, managing time, reading efficiently, memorizing, setting goals and taking notes. Through discussion and writing, they reflect on their college experiences and begin to view learning as a process that can be planned and monitored. (prereq: probationary admission status)

OR-102 Orientation for Nursing 0 2 1

This course is designed to provide information and orientation to first-year nursing students. Course content includes development of academic, personal and interpersonal skills designed to encourage active student learning, help the student succeed in college and develop a sense of campus involvement. Topics covered include academic policies and procedures, time management, study skills, taking examinations and nursing career opportunities. Emphasis is placed on identifying and understanding the university resources available to students to aid them in obtaining information relevant to their academic career as well as their personal goals. Practice and feedback are given to enhance skills in oral presentation, written expression, classroom discussion and group participation. (prereq: none)

OR-307S Transfer Orientation Seminar 1 0 0

This course serves as an introduction to MSOE for transfer students who completed at least 24 semester credits or 36 quarter credits at another college or university. The course usually is held on one Saturday early in the quarter. Topics that are typically covered include overview of specific transfer programs, the MSOE computer system, the library, MSOE policies and procedures, campus resources, critical thinking and multicultural diversity. (prereq: consent of a program adviser)

OR-402 Professional Guidance 1 0 1

The objective of this course is to assist students in the transition from university life to professional life. The course provides students with both techniques for and experiences in conducting a successful job search, preparing letters of application and resumes and preparing for job interviews. It also examines the concepts of success, lifelong learning and professional responsibilities. (prereq: junior standing)

PH-090 Preparations for Physics 3 3 4

This subject will be taken by students who have not had one year of high school physics or who received grades lower than "B". Topics covered include units, technical math, vectors, forces and Newton's Laws, one-dimensional motion, work, energy and momentum. Laboratory experiments compliment the lecture material and provide additional work in basic experimental techniques such as uncertainty, graphical analysis, and report writing skills. Additional topics may include rotational motion, torques, reflection, refraction or optical devices. (coreq: MA-126)

PH-110 Physics of Mechanics 3 2 4

The purpose of this subject is to provide the four-year engineering student with the basic principles of mechanics. Topics covered include: linear and rotational kinematics, Newton's Laws of motion, work and energy, and momentum. The mathematical level of the course includes the use of vector algebra and elementary applications of differential and integral calculus. The laboratory sessions correlate theory with experimental results. Emphasis is placed upon measurement precision, experimental technique, analysis of data and report writing. Not for credit for students who have credit for PH-113 or PT-110. (prereq: PH-090 or one year of high school physics with a grade of B or better; coreq: MA-137)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

PH-113 College Physics I 3 3 4

This is an introductory presentation of the fundamental concepts and principles of mechanics and heat. Vectors, motion with constant acceleration, Newton's Laws, work, energy and momentum are discussed in the mechanics portion of the course. Temperature, thermal expansion, heat capacity and heat transfer mechanisms are discussed in the heat portion. The associated laboratory correlates theory with experimental results and gives students direct experience with some of the concepts presented in the lectures. The laboratory also provides an opportunity for students to become familiar with laboratory instruments, and techniques, and report writing. This course replaces PT-110. Not for credit for students who have credit for PH-110 or PT-110. (prereq: MA-127)

PH-123 College Physics II 3 3 4

The first section of this course covers the principles of electricity and magnetism. Specific topics covered include Coulomb's law, electric fields, electric potential, capacitance, simple DC circuits and Ohm's law, forces on charged particles in magnetic fields, and magnetic fields due to electric currents. The last section of this course covers the principles of geometric and physical optics. The laws of reflection and refraction are discussed and these laws are used to study the ways in which mirrors and lenses can be used to form images. Interference is discussed and applied to double slits and thin films. The associated laboratory is designed to give students direct experience with the concepts presented in lecture. The laboratory also serves to familiarize students with laboratory techniques and equipment. This course replaces PT-220. Not for credit for students who have credit for PH-230 or PT-220. (prereq: PH-113, PT-110)

PH-130 Applications of Physics 3 2 4

This course is intended to provide students in nontechnical fields with the fundamentals in physics. Topics include mechanics, energy, fluids, thermodynamics, electricity, optics and nuclear physics. (coreq: MA-127)

PH-199 Project in Physics 0 0 0

Students are given the opportunity to pursue an approved subject not covered in regularly scheduled course work. This may take the form of individual or small group studies, literature surveys, and laboratory or research projects. Weekly meetings with the course adviser are required. A final report to be filed in the Physics and Chemistry Department may also be required. This course is offered to students with freshman or sophomore standing and does not meet the requirements for the Minor in Physics. Credit in this course will be determined after consultation with the instructor. Students with junior or senior standing should request PH-499. (prereq: consent of the course adviser, and the Physics and Chemistry Department chairman.)

PH-220 Physics of Heat, Wave Motion and Optics 3 3 4

This course covers the fundamental concepts and principles of heat, wave motion and optics. The course is divided into three parts. The first section covers temperature and its measurement, heat and its relationship to work, the basic principles of thermodynamics and heat transfer, and an introduction to the kinetic theory of gases. The second section introduces simple harmonic motion, resonance and linear waves, which include elastic vibrations and sound waves. The Doppler effect and beat phenomena are also studied. The third section extends the ideas of waves and superposition into the electromagnetic spectrum, leading to the laws of reflection and refraction, geometrical optics and image formation, interference and diffraction. Laboratory sessions give students an opportunity to apply the theoretical ideas covered in lecture. (prereq: PH-110, MA-137)

PH-230 Physics of Electricity and Magnetism 3 3 4

The purpose of this subject is to acquaint engineering students with the fundamental laws and physical theories of electricity and magnetism. Particular topics include electrostatic vector and potential fields, capacitance and dielectrics, energy and force in electrostatic systems, current, resistance and electromotive force, and magnetic fields and forces. The associated laboratory correlates theory with experimental investigations. Not for credit for students who have credit for PH-123 or PT-220. (prereq: PH-110, MA-137)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

PH-250 Modern Physics 3 3 4

This subject is intended for four-year engineering students. The material is introduced by pointing out the failure of classical physics to explain new physical phenomena that have been observed. Experiments that are basic to the understanding and development of modern physics are discussed in detail. The results of these experiments are used in explaining and understanding the atom, which is the basic component of matter. The quantum nature of electromagnetic radiation is also studied in detail. An understanding of the laws, concepts and theories of modern physics is essential for an understanding of the structure of matter and for an understanding of the fundamental principles of semiconductor electronics. Topics covered include the special theory of relativity, theory for a one-electron atom, x-ray spectra, a study of the subatomic particles, assemblies of particles, blackbody radiation, photoelectric effect, Compton effect, pair production and quantum mechanics, including solutions to the Schrodinger equation for simple systems. In integrated laboratory sessions, students are introduced to activity of radioactive materials and dose received from radioactive materials, nuclear counting techniques, gamma-ray spectrometry and pulse height analysis, x-ray diffraction, emission and spectra, as well as optical spectra of gasses. This course cannot be taken for credit by students who have credit for PH-361. (prereq: PH-220, PH-230, MA-235)

PH-320 Lasers and Applications 2 2 3

This course prepares students for understanding the practical applications of lasers in industry. The course begins with a brief review of the principles of optics and a discussion of atomic structure and energy levels as related to lasers. Discussions of low power lasers include their application to telecommunications, reading, writing, alignment and holography. High-power laser applications including cutting, welding, drilling, and marking are discussed. Laboratory sessions give students hands-on experience in spectroscopy, laser safety, laser beam properties and laser applications. (prereq: PT-220 or PH-123, or PH-220 and PH-230, MA-137 or MA-225)

PH-322 Introduction to Optics and Photonics 2 2 3

This course is designed to help students gain an understanding of the fundamental principles of optics and photonics. Topics covered include the properties and operating principles of sources and detectors of light, the principles of reflection, refraction, image formation, image aberrations, absorption, scattering, fiber optic communications, polarization, diffraction, interference, lasers, and holography. Applications of the principles of optics and photonics are emphasized with examples that range from optics in nature to optics and photonics in science and engineering. In the associated laboratory section, students have opportunities to gain hands-on experience in the MSOE Applied Optics Laboratory and the Photonics and Sensors Laboratory. (prereq: PT-220, or PH-220 and PH-230)

PH-324 Fiber Optics and Fiber Optic Sensors 2 2 3

This course provides a theoretical and experimental foundation of fiber optics, fiber optic communication, sources, optical detectors and fiber optic sensors. Topics include electromagnetic propagation, reflection and refraction, optical modes, dispersion, scattering, carrier loss, optical time-domain reflectometry, light-emitting and laser diodes, photonic crystals and band-gap fibers. Techniques and applications for fiber optic communication systems will be studied, including bit rate and bandwidth, wavelength-division multiplexing, filters, optical switching and coupling, and optical amplifiers. (prereq: PT-220, PH-230)

PH-325 Acoustics and Illumination 3 0 3

The first part of this course covers the science of generation, propagation and reception of sound. Included are vibration of strings and membranes, acoustic radiation, transmission, diffraction and absorption coefficients, as well as room acoustics and the psychological effects of sound, music and noise. The second part of this course acquaints students with the basic physics of light and illumination. Included are lectures on photometry and photometric units, interaction of visible light and matter, color and lighting calculations for room interiors. (prereq: PH-220)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

PH-341 Introduction to Astronomy and Astrophysics 3 0 3

This is an introductory survey covering topics that range from a discussion of the observations and experiments of the earliest astronomers to a consideration of the most recent developments involving black holes and the detection of gravitational waves. Some time is spent discussing observational instruments, including a discussion of the procedure for constructing a reflecting telescope. A Maksutov-Cassegrain 5-inch reflecting telescope is available for student use off campus. (prereq: two college-level physics courses or consent of instructor.)

PH-342 Relativity and Cosmology 3 0 3

This course is a survey of topics related to relativity and cosmology: the 1905 Special Theory of Relativity, the 1916 General Theory of Relativity, and Big Bang Cosmology. Lectures will highlight the concepts and present some detailed examples. Discussions will seek to reconcile the paradoxes and conundrums that befuddle these topics. Homework involves reading a few inexpensive paperbacks aimed at understanding the essence of these concepts, working a few basic problems and preparing a final report. (prereq: junior standing or consent of instructor)

PH-352 Quantum Physics 3 0 3

This course is a survey of topics related to quantum mechanics, starting with a review of simple solutions to the Schroedinger Equation and its application to atoms, molecules and solid-state devices. This is followed by an overview of Fyneman Diagrams, relativistic quantum mechanics, quantum chromodynamics, elementary particles and the standard model. Quantum "weirdness" entangled states and implications for quantum computing will also be discussed, in addition to ferromagnetism, superconductivity, Bose-Einstein condenstates and other macroscopic quantum phenomena. (prereq: PH-250 or consent of instructor)

PH-354 Nuclear Power, Applications and Safety 3 0 3

This subject serves as an introduction to the physics of the use of nuclear power. It examines the nature of radioactivity and protection from it. It deals with the uses of radioactive isotopes in medicine and science. It examines the release, control and utilization of energy from fission and fusion reactions. (prereq: PT-220, or PH-220 and PH-230)

PH-360 Physics of Electronics 3 3 4

This subject provides students with the fundamentals of semiconductor physics. The concept of band theory is developed and applied to the p-n junction to explain its behavior. Devices discussed include rectifier diodes, zener diodes, varactor diodes, solar cells, light-emitting diodes, bipolar junction transistors, unijunction transistors and field-effect transistors. Laboratory experiments include projects associated with the fundamental properties of semiconductor materials and with the characteristics and properties of a variety of semiconductor devices. This course cannot be taken for credit by students who have credit for PH-361. (prereq: PH-250)

PH-361 Physics of Materials 3 2 4

This course begins with an in-depth discussion of the structure of the atom and the nucleus, as well as other quantum physics concepts. Material properties, such as hardness and ductility, are explained by examining the crystal structure of materials. The band structure of materials is discussed, and used to explain the wide range of electrical conductivities and optical absorption properties of conducting, semiconducting, insulating and superconducting materials. The magnetic properties of materials are also examined in some detail. The laboratory portion of the course is designed to give the student hands-on experience in determining various fundamental properties of materials, such as atomic and crystal structure, optical emission and absorption, electrical conductivity, x-ray emission and absorption and nuclear decay. This course cannot be taken for credit by students who have credit for PH-250. (prereq: CH-100 or CH-200 or CH-310, PH-123 or PT-220 or ET-3201, MA-128 or MA-129, ET-2550 or equivalent)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

PH-401 Topics in Physics 0 0 0

This course covers current topics in physics that are not covered in other classes. Topics and structure, as well as credits, may vary. Faculty areas of expertise and possible topics for this course are listed on the Physics and Chemistry Department pages in the undergraduate catalog and on the Web. Groups of students interested in a particular topic should contact the appropriate faculty member well in advance of registration for the quarter. This course may be taken for variable credit. (prereq: consent of instructor.)

PH-499 Independent Study 1 0 3

Students are given the opportunity to pursue an approved subject not covered in regularly scheduled course work. This may take the form of individual or small group studies, literature surveys, and laboratory or research projects. Weekly meetings with the course adviser are required. A final report to be filed in the Physics and Chemistry Department may also be required. This course is offered to students with junior or senior standing. Students with freshman or sophomore standing should request PH-199. Up to three credits in PH-499 may be counted towards the Minor in Physics. (prereq: consent of the course adviser, and the Physics and Chemistry Department chairman.)

PH-863 Electronic Materials and Devices 3 0 3

Four broad areas covered in this course are: the crystal structure of solids, electronic properties of solids, the principles of p-n junctions and semiconductor device and integrated-circuit technology. Specific topics covered include: space lattices and crystal structure, the energy band theory of solids, theory of the p-n junction, semiconductor diodes, zener diodes, varactor diodes, light-emitting diodes, solar cells, bipolar junction transistors, junction and insulated-gate field-effect transistors, and integrated-circuit design potentials and limitations. (prereq: graduate standing, one year of college physics)

SC-308 Environmental Science 3 0 3

The purpose of this course is to provide students with an increased understanding of impacts to the global environment (atmosphere, hydrosphere, biosphere) from human activities, including those due to the appropriation of land for food, housing, materials and transportation, and the use of energy. The course requires engineering students to consider the environmental impacts of engineering choices, in addition to performance and cost, when making design decisions. (prereq: junior standing)

SC-370 Geology and Geophysics 3 0 3

This course is a survey of geology and geophysics. It provides a description of how modern science can be used to probe the interior of the Earth, and how volcanoes, earthquakes and glaciers have changed and are changing the face of the Earth. A field trip to the Northern Kettle Morraine to study glacial features is included. (prereq: junior standing)

SC-371 Oceanography 3 0 3

This subject introduces the student to the physical study of the ocean and its basin. Specific topics include: the nature of the ocean bottom and its relation to continental drift; ocean currents, causes, locations, characteristics and effects on land masses;and ocean wave mechanics, physics of sea water, acoustical properties of the ocean and the instruments and techniques used to measure ocean properties. Also studied is the interaction between warm water masses and the atmosphere, which acts as a heat engine, causing energy interchanges which produce much of the Earth's weather. A detailed exploration is made of the potential of the ocean to supply large amounts of energy from its mechanical, electrical, thermal and chemical resources. The course includes a visit to the Milwaukee Maritime Center. (prereq: junior standing)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

SC-499 Independent Study 1 0 3

Students are given the opportunity to pursue an approved subject not covered in regularly scheduled course work. This may take the form of individual or small group studies, literature surveys, and laboratory or research projects. Weekly meetings with the course adviser are required. A final report to be filed in the Physics and Chemistry Department may also be required. This course is offered to students with junior or senior standing. (prereq: consent of the course adviser, and the Physics and Chemistry Department chairman.)

SE-280 Software Engineering Process 2 2 3

This course provides an introduction to the software engineering process and the management of software projects. Topics covered include the software life cycle, effort tracking, project planning, measurement and estimation, reviews and checklists, and software quality management. Laboratory assignments provide an opportunity for students to develop and enhance a defined process for their own work. (prereq: CS-183, CS-285)

SE-281 Software Component Design 3 2 4

This course deals with the design and implementation of software subsystems. The concept of design patterns is introduced and common patterns are applied to the development of software components. Laboratory projects provide an opportunity for teams of students to implement components and to integrate them into complete systems. (prereq: CS-285, SE-280)

SE-283 Introduction to Software Verification 2 2 3

This course introduces students to software testing and the integration of testing into the software development process. Topics covered include basic testing techniques, designing for testability and use of version control systems. Laboratory assignments provide an opportunity to apply software verification techniques and tools. (prereq: CS-183; coreq: CS-285)

SE-3091 Software Development Laboratory 1 3 3

The software development laboratory provides experience in various roles, working on large-scale projects using software engineering tools and techniques. In this first course in the sequence, students are introduced to the laboratory environment and work on assigned tasks as members of project teams. (prereq: SE-280, SE-281)

SE-3092 Software Development Laboratory II 1 3 3

This is the second course in the software development laboratory sequence, in which students work on large-scale software projects. As students develop their individual and team skills, they can take on additional roles and responsibilities on a project team or in laboratory staff positions. (prereq: SE-3091, SE-380)

SE-380 Principles of Software Architecture 3 2 4

This course provides an introduction to the architecture and design of complete software systems, building on components and patterns. Topics covered include architectural principles and alternatives, design documentation and the relationship between levels of abstraction. Laboratory assignments permit students to develop, evaluate and implement their designs. (prereq: SE-280, SE-281)

SE-3811 Formal Methods 2 2 3

This course introduces the use of formal mathematical notation and reasoning in the software development process. These methods have applications in requirements specification, design and verification. Course topics include mathematical foundations, predicates, preconditions and postconditions, alternative notations, types of formal models, and the strengths and limitations of formal methods. (prereq: MA-230, SE-280)

SE-3821 Software Requirements and Specification 3 2 4

This course covers activities that relate to the determination and documentation of software system requirements. Topics covered include requirements elicitation, object-oriented analysis techniques, prototyping, requirements tracking and re-engineering. (prereq: SE-280)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

SE-400 Senior Design Project I 3 0 3

This is the first course in the two-course senior design sequence, in which each student team works on a design project from conception through implementation and testing. Teams meet regularly with the instructor to track technical and project management issues. Written reports and oral presentations are required. (prereq: senior standing and consent of program director)

SE-401 Senior Design Project II 3 0 3

This is the second course in the two-course senior design sequence. Teams meet regularly with the instructor to track technical and project management issues. Complete project documentation, written reports and oral presentations are required. (prereq: SE-400)

SE-4093 Software Development Laboratory III 1 3 3

This is the third course in the software development laboratory sequence, in which students work on large-scale software projects. At this stage, students are expected to help define requirements for future project work and to contribute actively to laboratory process assessment and improvement. (prereq: SE-3092, SE-3821 or SE-382)

SE-4094 Software Development Management Laboratory 1 3 3

This course provides students with an opportunity to study important issues in the management of software development projects and organizations, and to apply related knowledge and skills to management activities and process improvement in the software development laboratory. As part of the course, each student is expected to define, implement and evaluate a significant project, and to contribute to the work of less experienced student teams. (prereq: SE-4093, consent of program director)

SE-4831 Software Quality Assurance 2 2 3

This course covers advanced topics in software verification, validation and quality management. These topics include testing strategies and techniques, management of the testing process, the role of inspections and formal methods in quality assurance, and the economics of software testing. (prereq: SE-280, SE-283, SE-3821)

SE-499 Independent Study 1 0 3

A student enrolled in this course is afforded the opportunity to pursue a specialized topic in his or her chosen field of study. After an approved area of study has been selected, weekly meetings with the course adviser are required. A final report, the format of which is left to the discretion of the adviser, is required at the end of the term. (prereq: senior standing, consent of program director)

SS-415 Cultural Dimensions 3 0 3

This course is designed to provide insight into a particular foreign culture. It includes such topics as geography, natural resources, historical background, society, politics and current affairs, art, religion, business, literature and other cultural traditions. (prereq: none)

SS-453 American Government 3 0 3

This is a study of the American governmental system and an analysis of the appropriateness of the system for the time. The challenge to democratic government, and the questions of constitutional government, individual rights, popular representation and responsible leadership are the basic topics treated. The course integrates political science, history and law to produce a greater awareness and understanding of current affairs. (prereq: none)

SS-454 Political Science 3 0 3

The purpose of this course is to provide basic information concerning the nature and scope of political science: the theory; organization and characteristics of the state; the forms of government; the philosophy and institutions of democracy; and the processes and functions of modern government. The governments of the various nations are compared and contrasted. Students are encouraged to keep themselves informed about current developments in these areas and to develop a critical attitude toward them. (prereq: none)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

SS-455 International Relations 3 0 3

This subject provides basic information concerning international relationships. Topics covered include foreign policy, national security, alliances, theories of war, the balance of power, the balance of terror, international law and diplomacy. Features of Russian, Chinese, U.S., U.S. ally, and Third World foreign policies and internal principles are examined. The student is encouraged to relate theoretical principles discussed with current developments in the international arena. (prereq: none)

SS-456 Public Policy and Urban America 3 0 3

This course examines the influences upon and consequences of federal and local decision making in shaping the spatial and demographic characteristics of urban areas in the 20th century. The course also examines the effects of land use, transportation, community development and housing policies upon the evolution of metropolitan areas, the increasing racial and economic segregation that has resulted from these policies, and the relationship of these policies to the growth of crime and welfare and the deterioration of urban education systems. (prereq: none)

SS-457 Current Affairs 3 0 3

This course is designed to encourage students to keep themselves informed about problems at the local, national and international level, and to develop a critical attitude toward them. Discussion of stories in the news, both in magazines and newspapers, and on radio and television, helps to complement material in the text. Students are expected to express their ideas orally, through both individual classroom contributions and through formal panels, and in writing. (prereq: none)

SS-460 Foundations of Psychology 3 0 3

This course is an introduction to the science of psychology. Topics include adjustment and mental health; theories of personality; the nature of stress management; an overview of developmental stages; values; interpersonal relationships; and human learning. A discussion of the theories is presented with an emphasis on personal and professional applications. (prereq: none)

SS-461 Organizational Psychology 3 0 3

This course is designed to show the application of psychological aspects of managerial processes such as personnel selection, motivation, group processes, communication, leadership, power, conflict resolution, working conditions and organizational structure, and to demonstrate their influence on job satisfaction. Basic research methodology principles are discussed to help students become critical thinkers and to understand the potential biases in research. Current trends and issues, such as the decreasing supply of skilled workers, downsizing, quality, market globalization, diversity and technological influences on the workplace, are emphasized throughout all aspects of the course. Emphasis is given not only to the theoretical context but to the practical consequences of psychological perspectives for organizations. (prereq: sophomore standing)

SS-462 Developmental Psychology 3 0 3

The student surveys human development for the entire life span beginning with prenatal development. Major theories, research and issues related to biosocial, cognitive and psychosocial growth are examined, and the interplay of these three domains is considered. Emphasis is placed on understanding a student's own development, past, present and future. (prereq: none)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
SS-464	**Human Factors in Engineering and Design**	**2**	**2**	**3**

This course examines the concept of the human, equipment and environmental interaction. Emphasis is on the human aspect of the man-machine systems to make the engineer more aware of the human being in the design of equipment, environment and work. Human sensory, psychological and biomechanical processes are examined, indicating the role these play in the design and application of controls, tools and displays. The effects of illumination, noise, color, temperature, motivation, stress, fatigue and boredom on human beings are also examined. The student researches one area of human factors. (This course may NOT be taken by IE students.) (prereq: junior standing)

SS-466	**Abnormal Psychology**	**3**	**0**	**3**

This course is designed to involve students in the subject matter of abnormal psychology and to assist them in achieving an integrated view of current knowledge about maladaptive behavior. Particular attention will be given to understanding the theories that address why maladaption occurs, and to specifying the pressures under which people live and the personal characteristics that might predispose them to breakdown affectively, cognitively, organically and/or psychosomatically. Types of therapeutic interventions will be explored. (prereq: none)

SS-471	**Sociology**	**3**	**0**	**3**

This course develops an awareness in the student of his/her individual and collective responsibilities and obligations to society. Specific areas of investigation and study include social organization, culture, socialization, family, stratification of societies, deviance, movements and issues. As he/she acquires a basic understanding of culture and of society, the student selects a major institution of modern society or an area involving changes affecting the social scene for concentrated, independent study. (prereq: none)

SS-472	**Social Problems**	**3**	**0**	**3**

The objective of this subject is to help make the student aware of the problems and challenges of our modern times. Included are problems associated with our high rate of divorce and other family problems. Other problems covered are those involving physical and mental health, poverty, ethnic and race relations, sex roles and inequality, and environmental concerns. (prereq: none)

SS-473	**World Societies**	**3**	**0**	**3**

The primary objective of this course is to attempt to help teach the student more about being human. The course also seeks to help students understand that cultural differences may have roots in physical and social environments, and to reduce intolerance by increasing understanding of other peoples and other ways of life. (prereq: none)

SS-474	**The Family**	**3**	**0**	**3**

This course is designed to provide the student with insight into the American family system. Three major aspects of family life are addressed: family forms, family functions and family problems. (prereq: none)

SS-475	**Addictions and Compulsions**	**3**	**0**	**3**

This course introduces the student to various causes/consequences and treatments of compulsive and addictive behaviors. The focus is on alcoholism and its treatments with parallels drawn to other compulsive behaviors, addictive drugs and their treatments. In addition, the course addresses codependency, compulsive gambling, eating disorders, etc. (prereq: none)

SS-476	**Death and Dying**	**3**	**0**	**3**

Death is a universal human event. This course considers how individuals and societies develop ways of coping with death and the process of dying. Topics covered include dying and death on a personal level, dying and death on a societal level, ethical decisions in health care, grief and others. (prereq: none)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

SS-492 Educational Methods **3** **0** **3**

This course acquaints the student with various learning styles, teaching styles and instructional methods. Time is devoted to the fundamentals and mechanics of classroom management, visual aids, assignments, evaluation techniques, course preparation and provision for individual differences in the classroom. Activities include lectures, discussion groups, group projects, student presentations and outside reading. (prereq: none)

SS-495 Social Sciences Selected Studies **3** **0** **3**

This course covers timely topics in the social sciences or specialized subjects that reflect the expertise/interest of current General Studies Department faculty. This class is limited to 15 students. (prereq: consent of the instructor)

TC-111 Introduction to Technical Communication **2** **0** **2**

The objective of this course is to introduce technical communication students to the field of technical communication in three ways. The main portion of the course provides students with information about technical writing style. What they learn about style can then be applied in all the upper-division technical writing courses they take. There are both in-class and out-of-class writing assignments to provide practical experience in working on style. Students are assigned readings they can use as models. Another portion of the course provides students with tours of facilities that employ communication majors so the students can carry real work images with them into the upper-division courses. These tour sites vary every year. The final portion provides students with an opportunity to make an oral presentation about technical material. This introduces them to the speech section of their major curriculum. (prereq: none)

TC-151 Theory of Human Communication **3** **0** **3**

Various theories of communication are examined in order to establish a framework for understanding the complex phenomenon of human communication. Theory is defined and a number of theories that cover a wide range of communication concepts, such as semantics, nonverbal communication and persuasion, are studied. Theories are examined critically to determine the social, political and historical factors which might have motivated their authors and perhaps colored their perceptions of communication. Various problems humans have while engaging in communication are also discussed and analyzed. (prereq: none)

TC-172 Information Processing **2** **2** **3**

This course combines classroom discussion and a “hands-on” computer lab to prepare students to design and develop page layouts on a Macintosh computer system. Students completing this course become literate in computer terminology through discussions on historical computer development, different operating systems and computer hardware/software. In addition, the principles of page design layout techniques are examined. The lab portion of the course allows students to use and learn several software programs at various levels: Microsoft Word, Microsoft PowerPoint, Adobe PageMaker, Adobe Illustrator and scanning software. After completing this course, students are able to use the desktop computer and various software programs in combination to create professional-looking documents. (prereq: none)

TC-233 Introduction to Report and Proposal Writing **4** **0** **4**

This course examines the qualities of effective report and proposal writing and emphasizes the practical application of these writing skills in the workplace. Hands-on research activities are combined with short reports and document drafting exercises to develop writing skills, with particular attention given to organization and document design strategies. For proposal writing, students investigate sources of funding, analyze techniques for persuasion and explore context-specific strategies for writing successful proposals. (prereq: EN-132 or TC-111)

TC-242 Persuasive Speech **3** **0** **3**

This course covers theories of attitude, change and audience analysis. Value-based, logical and emotional appeals are presented as a foundation for discussing persuasive movements, mass media, propaganda and advertising. Students study the organization of persuasive presentations and the ethical considerations necessary for persuasive communicators. (prereq: EN-241)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

TC-261 Research Methods 3 0 3

This course introduces students to the basics of the scientific method of conducting research. Research methods and design will be explained and techniques for gathering information will be explored. (prereq: EN-132 or prereq/coreq: TC-111)

TC-321 Visual Design Techniques 3 2 4

This is a survey course encompassing the fundamentals of visual communication, computer graphics, traditional techniques and their application to communication design. Production exercises include creation of 35mm slides, video, prepress graphics, and Web page design. Effective applications of typographic design and color are integrated throughout the course. (prereq: TC-233 or TC-332 or EN-132 or advanced writing skills)

TC-332 Advanced Technical Writing 3 0 3

This course gives the student practical experience in developing and preparing user documentation. The major requirement for this course is researching, writing and producing a user manual. In addition, students are responsible for a number of writing assignments, both individual and in groups. These include, but are not limited to, such assignments as proposals, client communication, meeting minutes, literature reviews and task analysis. (prereq: EN-132 or TC-111)

TC-342 Professional Presentation Techniques 2 2 3

This subject acquaints the student with various types of professional techniques used in industry. Emphasis is on being able to effectively communicate; organizing and developing ideas; using communication media; and applying guidelines for evaluating, selecting, planning, designing and delivering presentations in a business environment.. Projects are correlated to the topics covered to develop advanced presentation techniques and delivery skills. (prereq: EN-241)

TC-351 Organizational Communication 3 0 3

This subject investigates organizational structures and the possible impediments to effective communication within the structures. Various tactics are studied to promote better communication. Attention is paid to managerial problems, specialized jargon, filtering and distortion in directional communication, and informal communication channels. (prereq: none)

TC-381 Marketing Communications 3 0 3

This course focuses on integrated marketing communications which includes synchronized communication management, multichannel communication flow, message consistency, measurement and tailored relationship-building messages. It tightly integrates the marketing communication function with marketing and sales objectives, concentrating on controlling the communication pathways with the customer. Primary emphasis is on writing in the full-range of marketing communication techniques. (prereq: EN-241)

TC-432 Writing and Editing for Publication 3 0 3

This course focuses on the writing of review, tutorial, documentary, theoretical, and descriptive journalistic works on scientific and technological subjects. We shall investigate specific problems such as data selection, audience determination, and use of illustrations. The course also focuses on the art and craft of editing with specific attention to proofreading, style improvement, revision, and refereeing. Course goals are to acquaint students with the publishing process, to help students develop editing skills, and to expose students to a variety of rhetorical strategies employed by science writers. (prereq: TC-111)

TC-451 Mass Communication 3 0 3

This course surveys mass communication theories and practices. The course reviews all forms of historic and modern mass communication, including broadcasting and publishing. It also considers the advent of networking via the “information highway.” The course further examines the news business as well as the entertainment and information industries. Issues to be considered include mass media ownership and concentration; ethics and law; the influence of media upon public customs, attitudes and beliefs; and the credibility of media messengers. (prereq: none)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

TC-452 Interpersonal Communication **3** **0** **3**

This course is designed to help the student gain first-hand experience in the new, improved techniques of communication by exposure to some of the common problems that cause communication breakdowns. Through participation in group and interpersonal activities, students have an opportunity to analyze existing communication systems and to participate in developing practical solutions to specific communication problems. (prereq: none)

TC-453 Intercultural Communication **3** **0** **3**

This course focuses on the dynamics of communication that occur when people from different cultures interact with one another. This course will help students develop an understanding of cultures and to appreciate the opportunities and challenges that each culture presents to interpersonal communication. (prereq: TC-151)

TC-499 Internship **6** **0** **6**

The senior technical communication student is required to work in an approved technical writing situation. All internships must be arranged through the General Studies Department. This internship is designed to allow the student to experience the realities of the profession. Each student is required to submit a comprehensive final report documenting all aspects of the internship. (prereq: senior standing, one quarter advance application to the department and permission of the department chairman)

D

THE ROSTER

The MSOE Board of Regents

MSOE is a nonprofit, nonstock, independent coeducational institution of higher learning governed by a Board of Regents elected from the Corporation. The Corporation is comprised of representatives of business, industry, government and education.

Officers

Chairman
Robert J. Hillis
President and CEO
Direct Supply Inc.
Milwaukee, Wis.

Vice Chairmen
James L. Dorman
Chairman and CEO
Intercontinental Trading Ltd.
West Allis, Wis.

Robert D. Kern
D. Eng. (Hon.)
Chairman
Generac Power Systems
Waukesha, Wis.

Gerald F. Lestina
Retired President and CEO
Roundy's Inc.
Pewaukee, Wis.

John A. Mellowes
D. Eng. (Hon.)
Chairman and CEO
Charter Manufacturing Co.

Alan J. Ruud, P.E.
D. Eng. (Hon.)
Chairman and CEO
Ruud Lighting Inc.
Racine, Wis.

John S. Shiely
President and CEO
Briggs & Stratton Corp.
Pewaukee, Wis.

President
Hermann Viets, Ph.D.
Milwaukee School of Engineering
Milwaukee, Wis.
BS Polytechnic University '65;
MS Polytechnic University '66;
Ph.D. Polytechnic University '70

Vice President of Academics
Roger Frankowski, Ph.D.
Milwaukee School of Engineering
Milwaukee, Wis.
BA Marquette University '65;
MA Marquette University '68;
MEd Marquette University '86;
Ph.D. Marquette University '92

Vice President of Development
Frank Habib
Milwaukee School of Engineering
Milwaukee, Wis.
BS University of Wisconsin-Milwaukee '73
Working towards MS at Milwaukee School of Engineering

Vice President of Finance and Treasurer
Armund Janto
Milwaukee School of Engineering
Milwaukee, Wis.
BBA University of Wisconsin-Milwaukee '70

Vice President of Operations
Kenneth A. McAteer
Milwaukee School of Engineering
Milwaukee, Wis.
BS University of Wisconsin-Milwaukee '59

Vice President for Student Life
Patrick J. Coffey
Milwaukee School of Engineering
Milwaukee, Wis.
BA Holy Cross College '65;
MA University of Wisconsin-Madison '66

Controller
Pat Augustine
Milwaukee School of Engineering
Milwaukee, Wis.
BBA UW-Milwaukee '84

Corporate Counsel and Secretary to the Board of Regents
John K. MacIver
D. Laws and Econ. Dev. (Hon.)
Senior Partner
Michael Best & Friedrich LLP
Milwaukee, Wis.

Board of Regents

Thomas W. Alger '76
President and Owner
Prem Enterprises
McHenry, Ill.

Terry W. Anderson
CEO
Omni Tech Corp.
Pewaukee, Wis.

Jack M. Blank*
D. Eng. (Hon.)
Retired President
The Falk Corp.
Milwaukee, Wis.

J. Michael Borden
President and CEO
Hufcor Inc.
Janesville, Wis.

Michael J. Cudahy
D. Eng. (Hon.)
President and Owner
The Endeavors Group LLC
Milwaukee, Wis.

George D. Dalton*
D. Bus. Econ. (Hon.)
Chairman and CEO
Call_Solutions.com Inc.
Atlanta, Ga./Waukesha, Wis.

Clyde J. Denton '55
Retired President
Zetec Inc.
Deming, Wash./Ft. Lauderdale, Fla.

James D. Ericson
Chairman Emeritus
Northwestern Mutual
Milwaukee, Wis.

Susan Feith
President
Mead Witter Foundation Inc.
Wisconsin Rapids, Wis.

Dean A. Foate '99
President and CEO
Plexus Co.
Neenah, Wis.

Warner C. Frazier
Chairman of the Board
Simplicity Manufacturing Inc.
Mequon, Wis.

William C. Gebhardt
President
Monarch Corp.
Milwaukee, Wis.

Jodie K. Glore
Private Investor
Naples, Fla.

Richard R. Grigg
President and COO
We Energies
Executive Vice President
Wisconsin Energy Corp.
Milwaukee, Wis.

Eckhart G. Grohmann
D. Eng. (Hon.)
Chairman and President
Aluminum Casting & Engineering Co.
Milwaukee, Wis.

Thomas J. Hauske Jr.
Vice Chairman
Everett Smith Group Ltd.
Milwaukee, Wis.

Robert J. Hillis*
President and CEO
Direct Supply Inc.
Milwaukee, Wis.

Richard G. Jacobus*
D. Bus. Econ. (Hon.)
Chairman
Jacobus Wealth Management Inc.
Milwaukee, Wis.

Robert H. Jenkins
Retired Chairman and CEO
Sundstrand Corp.
Rockford, Ill.

Donald R. Johnson
Chairman
Modine Manufacturing Co.
Racine, Wis.

Gary H. Kaine
President
The Falk Corp.
Milwaukee, Wis.

Robert D. Kern*
D. Eng. (Hon.)
Chairman
Generac Power Systems
Waukesha, Wis.

Gerald F. Lestina*
Retired President and CEO
Roundy's Inc.
Pewaukee, Wis.

Fred G. Luber*
D. Eng. (Hon.)
Chairman and CEO
Super Steel Products Corp.
Milwaukee, Wis.

*Executive Committee

John K. MacIver*
D. Laws and Econ. Dev. (Hon.)
Senior Partner
Michael Best & Friedrich LLP
Milwaukee, Wis.

James F. McKinley Jr.
Retired Vice Chairman
Scot Forge
Cape Coral, Fla.

John A. Mellowes*
D. Eng. (Hon.)
Chairman and CEO
Charter Manufacturing Co. Inc.
Mequon, Wis.

Thomas L. Misiak '77
Pewaukee, Wis.

Daniel R. Perry
President and CEO
Milwaukee Electric Tool Corp.
Brookfield, Wis.

Alan J. Ruud '69, P.E.*
D. Eng. (Hon.)
Chairman and CEO
Ruud Lighting Inc.
Racine, Wis.

Loraine E. Schuffler
D. Hum. Ltrs. (Hon.)
Consultant
Glenn Humphrey Fund
Wisconsin Masonic Foundation
Milwaukee, Wis.

John S. Shiely*
Chairman, President and CEO
Briggs & Stratton Corp.
Milwaukee, Wis.

John W. Splude
Chairman and CEO
HK Systems Inc.
New Berlin, Wis.

Brian J. Stark '71
President, Controls Group
Johnson Controls Inc.
Milwaukee, Wis.

R. Baird Stephenson
Retired President and CEO
Siemens Power Corp.
Kirkland, Wash.

Gary A. Stimac '73
Consultant
Montgomery, Texas

Alfred J. Tector, M.D.
CEO, Midwest Heart Surgery Institute
Medical Director of Transplant Programs
St. Luke's Medical Center
Milwaukee, Wis.

John B. Torinus Jr.
President and CEO
Serigraph Inc.
West Bend, Wis.

Mark Train
President and CEO
Jason Inc.
Milwaukee, Wis.

David V. Uihlein Jr.
President
Uihlein Wilson Architects
Milwaukee, Wis.

Hermann Viets, Ph.D.*
President
Milwaukee School of Engineering
Milwaukee, Wis.

Robert A. Wagner
President
R&B Wagner Inc.
Butler, Wis.

James B. Wigdale
Chairman
Marshall & Ilsley Corp.
Milwaukee, Wis.

Kerry L. Woody
President and CEO
Ladish Co. Inc.
Cudahy, Wis.

Larry D. Yost '77
Chairman and CEO
ArvinMeritor Inc.
Troy, Mich.

*Executive Committee

Regents Emeriti

Jon R. Appel '62
President
Industrial Electronic Resources
Corona, Calif.

Foster A. (Jim) Blankenbaker '43
D. Eng. (Hon.)
President
FAB Holdings Inc.
Scottsdale, Ariz.

Jeffrey L. Bleustein, Ph.D.
D. Eng. (Hon.)
Chairman and CEO
Harley-Davidson Inc.
Milwaukee, Wis.

Paul F. Bronson
D. Bus. Econ. (Hon.)
Chairman
Best Block Co.
Milwaukee, Wis./Scottsdale, Ariz.

Francis J. Buckley Jr.
Retired General Manufacturing Manager
GM Electric
Roswell, Ga.

James J. Burns '56
Retired President/Associate
Anagram Associates Inc.
Tucson, Ariz.

Thomas J. Burns
Chairman
Burns-Milwaukee Inc.
Milwaukee, Wis.

Richard G. Carlson, Ph.D.
President
Whitnall Summit Co.
Milwaukee, Wis.

Gene P. Carter '60
D. Eng. (Hon.)
Retired Private Investor
Saratoga, Calif.

Don H. Davis Jr.
D. Eng. (Hon.)
Chairman and CEO
Rockwell Automation
Milwaukee, Wis.

Willie D. Davis
D. Bus. Econ. (Hon.)
President
All-Pro Broadcasting
Inglewood, Calif.

James L. Dorman
Chairman and CEO
Intercontinental Trading Ltd.
Milwaukee, Wis.

William K. Eastham
Retired Vice Chairman
SC Johnson & Son Inc.
Racine, Wis.

Richard D. Gebhardt
Chairman
Uihlein Electric Co. Inc.
Milwaukee, Wis.

Peter I. Georgeson
D. Eng. (Hon.)
Chairman
Scot Forge
Spring Grove, Ill./Naples, Fla.

David T. Kahler
D. Eng. (Hon.)
President
DK Consulting
Milwaukee, Wis.

Peter O. Kirchhoff
Retired Manager
Babcock & Wilcox
Milwaukee, Wis.

Peter G. Kohler
CEO
Kohler-General Corp.
Sheboygan Falls, Wis.

John C. Koss
D. Eng. (Hon.)
Chairman
Koss Corp.
Milwaukee, Wis.

Lewis G. Kranick
Management Consultant
L.G. Kranick & Associates
Plymouth, Wis./Naples, Fla.

Lester C. Krogh, Ph.D.
Retired Senior Vice President
3M
Woodbury, Minn.

Joan R. Lloyd
President
Joan Lloyd & Associates
Milwaukee, Wis.

James A. Lovell Jr.
D. Eng. (Hon.)
President
Lovell Communications
Lake Forest, Ill.

Carl R. Marschke
Chairman
MarquipWardUnited
Phillips, Wis.

Donald D. Maurer '60
President and Owner
Maurer & Associates Inc.
Marine-on-St. Croix, Minn./
Sanibel Island, Fla.

George W. Mead II
Chairman
Mead Witter Foundation Inc.
Wisconsin Rapids, Wis.

Richard M. Merriman '50
Retired Attorney
Reid & Priest
Washington, D.C.

Yuzaburo Mogi
President and CEO
Kikkoman Corp.
Tokyo, Japan

Scott Moon
CEO
DLSM Inc.
Milwaukee, Wis.

Greta W. Murphy
D. Comm. (Hon.)
Retired Director of Public Relations
Milwaukee School of Engineering
Milwaukee, Wis./Coral Gables, Fla.

M.E. Nevins
Retired Chairman
Wisconsin Centrifugal Inc.
Milwaukee,Wis./Naples, Fla.

Charles W. Parker Jr.
D. Eng. (Hon.)
President
Charles Parker & Associates Ltd.
Milwaukee, Wis.

Gerald S. Parshalle
Retired President and CEO
Realist Inc.
Mequon, Wis.

Bernard J. Peck
Proprietor
The Water Street Garage
Milwaukee, Wis./Ft. Lauderdale, Fla.

Edward W. Raether '68
Vice President and Assistant Manager
Industrial Valuation Group
American Appraisal Associates Inc.
Milwaukee, Wis.

Earl E. Richter
Retired President
Modine Manufacturing Co.
Racine, Wis.

Walter L. Robb, Ph.D.
D. Eng. (Hon.)
Consultant
Vantage Management Inc.
Schenectady, N.Y.

Paul J. Schierl
President and Director
Cornerstone Foundation of N.E. Wisconsin
De Pere, Wis.

Richard L. Schmidt
Chairman and CEO
C. G. Schmidt Inc.
Milwaukee, Wis.

Larry A. Schotz '73
D. Eng. (Hon.)
President and Owner
L.S. Research Inc.
Cedarburg, Wis.

John R. Seeger
Retired Legal Counsel
Milwaukee School of Engineering
Mequon, Wis./Sarasota, Fla.

Richard G. Sim, Ph.D.
Chairman, President and CEO
APW Ltd.
Waukesha, Wis.

Robert R. Spitzer, Ph.D.
D. Eng. (Hon.)
President Emeritus
Milwaukee School of Engineering
Burlington, Wis.

Warren R. Stumpe
D. Eng. (Hon.)
Retired Vice President
Chief Tech. Officer
Rexnord Technical Services
Mequon, Wis.

Robert D. Teece Sr.
D. Eng. (Hon.)
Retired Executive Vice President
Harnischfeger Industries Inc.
Naples, Fla.

Jean B. Tyler
Consultant
Local Government Issues
Milwaukee, Wis.

David V. Uihlein Sr.
D. Eng. (Hon.)
Director
Banner Welding Systems
Germantown, Wis.

Richard J. Ungrodt '41
D. Eng. (Hon.)
Retired Vice President for
Academic Affairs
Milwaukee School of Engineering
Mequon, Wis./Northport, Fla.

John J. Van Beckum
Retired Chairman,
President and CEO
Firstar Bank
Brookfield, Wis.

William D. Van Dyke III
D. Bus. Econ. (Hon.)
Senior Vice President
Salomon Smith Barney
Milwaukee, Wis.

George A. Wardeberg
Retired Vice Chairman
Wisconsin Energy Corp.
Naples, Wis.

Claude R. Whitney
D. Eng. (Hon.)
Retired Chairman
Allen-Bradley Co.
Hot Springs Village, Ark.

Nathaniel K. Zelazo
D. Eng. (Hon.)
Founder and Chairman Emeritus
Astronautics Corp. of America
Milwaukee, Wis.

Academic Administration of MSOE

President's Office
Hermann Viets, Ph.D.
President

Vice President of Academics' Office
Roger J. Frankowski, Ph.D.
Vice President of Academics

REPORTING ACADEMIC DEPARTMENTS

Architectural Engineering and Building Construction Department
Deborah L. Jackman, Ph.D., P.E.
Chairperson

Rader School of Business
Joseph Papp, P.E.
Chairman

Electrical Engineering and Computer Science Department
Ray W. Palmer, P.E.
Chairman

General Studies Department
R. David Kent, Ph.D.
Chairman

Mathematics Department
Karl H. David, Ph.D.
Chairman

Mechanical Engineering Department
Matthew A. Panhans, Ph.D., P.E.
Chairman

School of Nursing
Mary Louise Brown, Ph.D., R.N.
Chairperson

Physics and Chemistry Department
J. William Dawicke, Ph.D.
Chairman

Full-Time Faculty

Bass Abushakra, Assistant Professor, Architectural Engineering and Building Construction; BS American University '88; MS Concordia University '93; Ph.D. Texas A&M '00

Gul Afshan, Associate Professor, Physics and Chemistry; BS Lahore College, Pakistan '81; MS Quaid-I-Azam University, Pakistan '87; Ph.D. University of Wisconsin-Milwaukee '99

William O. Barnekow, Professor, Electrical Engineering and Computer Science; BA University of Wisconsin-Milwaukee '71; MS University of California-Berkeley '73

Cynthia W. Barnicki, Professor, Mechanical Engineering; BS Ohio State University '82; MS Ohio State University '86; Ph.D. Ohio State University '88

Steven L. Barnicki, Professor, Electrical Engineering and Computer Science; Program Director, Computer Engineering; BS Ohio State University '82; MS Ohio State University '84; Ph.D. Ohio State University '89

Brian E. Bennett, Assistant Professor, General Studies; BS University of Wisconsin-Stout '73; MA University of Northern Iowa '98

Steven C. Bialek, Associate Professor, Rader School of Business, Program Director, Business; Program Director, Management; BA University of Wisconsin-Green Bay '84; University of Wisconsin-Milwaukee '87; Ph.D. University of Wisconsin-Madison '98

Jeffrey J. Blessing, Associate Professor, Rader School of Business, Program Director, Management Information Systems; BS University of Wisconsin-Milwaukee '81; MS University of California-San Diego '84; Ph. D. University of Wisconsin-Milwaukee '99

Gary C. Boelkins, Associate Professor, General Studies; BA Grand Valley State College '75; MA Marquette University '98

Marvin L. Bollman, Professor, General Studies; Interim Chairman, General Studies Department; BS Stout State University '71; MS University of Wisconsin-Milwaukee '89

Jon K. Borowicz, Associate Professor, General Studies; BA University of Wisconsin-Madison '75; MA Johns Hopkins University '79; Ph.D. Johns Hopkins University '86

Mary Louise Brown, Professor, School of Nursing; Chairperson, School of Nursing; BS University of Maryland College Park '77; MSN Catholic University of America '83; Ph.D. University of Pittsburgh '90

Vincent R. Canino, Professor, Electrical Engineering and Computer Science; Program Director, Biomedical Engineering; BS Milwaukee School of Engineering '67; MS Milwaukee School of Engineering '69; Ph.D. Marquette University '76; Registered Professional Engineer in the State of Wisconsin

Craig Capano, Associate Professor, Architectural Engineering and Building Construction; Program Director, Construction Management; BS Wentworth Institute of Technology '93; MSCM Clemson University '94; Certified Professional Constructor

James P. Carr, Assistant Professor, Mathematics; BA Saint Cloud State University '86; MS University of Wisconsin-Milwaukee '95

Edward Chandler, Professor, Electrical Engineering and Computer Science; Program Director, BS in Electrical Engineering Technology; BS University of Wisconsin-Milwaukee '75; MS Illinois Institute of Technology '78; Ph.D. Purdue University '85; Registered Professional Engineer in the State of Wisconsin

Michael T. Chier, Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '64; MS University of Missouri '69; Ph.D. University of Missouri '71; Registered Professional Engineer in the State of Wisconsin

Lukie L. Christie, Associate Professor, Mechanical Engineering; BS Milwaukee School of Engineering '74; MS Milwaukee School of Engineering '80; MS University of Wisconsin-Milwaukee '85

Karl H. David, Associate Professor, Mathematics; Chairman, Mathematics Department; BA University of Richmond '69; MA University of Massachusetts '74; Ph.D. University of Massachusetts '78

J. William Dawicke, Professor, Physics and Chemistry; Chairman, Physics and Chemistry; BS University of Wisconsin-Milwaukee '65; MS University of Wisconsin-Milwaukee '68; Ph.D. Marquette University '80

Kenneth K. Dawson, Professor, Rader School of Business; BS Purdue University '61; MBA Marquette University '69

Richard A. DeVries, Associate Professor, Architectural Engineering and Building Construction; Program Director, MS in Structural Engineering; BS University of Texas, Austin '87; MS University of California, Berkeley '89; Ph.D. University of Texas, Austin '96; Registered Professional Engineer in the States of Oklahoma and Wisconsin

James W. Dieball, Associate Professor, Physics and Chemistry; BS University of Wisconsin-Milwaukee '70; MS University of Wisconsin-Milwaukee '73

Carol B. Diggelman, Professor, Architectural Engineering and Building Construction; BS University of Wisconsin-Milwaukee '65; MS University of Wisconsin-Milwaukee '86; Ph.D. University of Wisconsin-Madison '98

Eric A. Durant, Assistant Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '98; University of Michigan '99; Ph.D. University of Michigan '01

Joanne M. Dyskow, Professor, General Studies; BA Cardinal Stritch College '52; MA Marquette University '61

George L. Edenharder, Professor, Mathematics; BEd University of Wisconsin-Whitewater '66; MS Marquette University '68

Michael J. Emmer, Assistant Professor, Architectural Engineering and Building Construction; BS Wentworth Institute of Technology '02

John H. Farrow, Professor, Mechanical Engineering; BS Marquette University '56; MS Marquette University '80; registered Professional Engineer in the State of Wisconsin

William C. Farrow, Assistant Professor, Mechanical Engineering; BS Purdue University '83; MS Marquette University '87; Ph.D. Marquette University '92

Larry Fennigkoh, Associate Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '74; MS Milwaukee School of Engineering '86; Ph.D. University of Wisconsin-Milwaukee '95; Registered Professional Engineer in the State of Wisconsin

John L. Ficken, Associate Professor, Mechanical Engineering; BS Iowa State University '58; MS University of Wisconsin '66; Registered Professional Engineer in the State of Wisconsin

Roger J. Frankowski, Professor, General Studies; Vice President of Academics; BA Marquette University '65; MA Marquette University '68; MEd Marquette University '86; Ph.D. Marquette University '92

James W. Friauf, Associate Professor, General Studies; BA University of Wisconsin-Milwaukee '84; MA University of Wisconsin-Milwaukee '86

Matthew W. Fuchs, Professor, Architectural Engineering and Building Construction; BS Milwaukee School of Engineering '63; MS University of Wisconsin-Milwaukee '79; Registered Professional Engineer in the State of Wisconsin

John D. Gassert, Professor, Electrical Engineering and Computer Science; Vice Chairman, Electrical Engineering and Computer Science Department; BS Marquette University '71; MS Marquette University '74; Ph.D. Marquette University '95; Registered Professional Engineer in the State of Wisconsin

Ronald Gerrits, Associate Professor, Electrical Engineering and Computer Science; Program Director, MS in Perfusion; BS Milwaukee School of Engineering '94; Ph.D. Medical College of Wisconsin '99

N. Glenn Gratke, Associate Professor, Physics and Chemistry; Coordinator, Physics Minor; BS University of Wisconsin-Madison '67; MS University of Wisconsin-Milwaukee '92; Ph.D. University of Wisconsin-Milwaukee '00

Edward J. Griggs, Associate Professor, Mathematics; BS Carroll College '80; MS University of Wisconsin-Milwaukee '84

Veronica S. Haggerty, Professor, General Studies; BEd University of Wisconsin-Milwaukee '72; MS University of Wisconsin-Milwaukee '78

John M. Hassler, Instructor, Architectural Engineering and Building Construction, BS Almeda College '01; Registered Professional Engineer in the State of Wisconsin; Certified Professional Designer in the State of Wisconsin

William Edward Howard, Associate Professor, Mechanical Engineering; Program Director, Mechanical Engineering Technology; BS Virginia Tech '80; MS Virginia Tech '85; Ph.D. Marquette University '01; Registered Professional Engineer in the State of Wisconsin

Harvey L. Hoy, Associate Professor, Mechanical Engineering; BS University of Wisconsin-Madison '60; Registered Professional Engineer in the State of Wisconsin

Paul A. Hudec, Associate Professor, Rader School of Business; BA Saint Francis De Sales College '74; MBA Graduate Theological Foundation '92; MAPS Saint Francis Seminary '93; MBA Marquette University '93; Ph.D. Marquette University '99; Certified Network Administrator, Novell Inc.

H. Peter Huttelmaier, Professor, Architectural Engineering and Building Construction; Dipl. Ing. University of Stuttgart '68; MS Concordia University, Montreal '73; Ph.D. Concordia University, Montreal '79; Registered Professional Engineer in the State of Wisconsin

Deborah L. Jackman, Professor, Architectural Engineering and Building Construction; Chairperson, Architectural Engineering and Building Construction Department; BS Marquette University '79; MS University of Wisconsin-Milwaukee '81; Ph.D. University of Wisconsin-Milwaukee '92; Registered Professional Engineer in the State of Wisconsin, Certified Energy Manager

John Jezak, Instructor, Architectural Engineering and Building Construction; BBA Bienville University '01; MBA Bienville University '02; Master Electrician in the State of Wisconsin

Ronald W. Jorgensen, Associate Professor, Mathematics; BS Wittenberg University '73; MS University of Illinois-Champaign '75, '77; Ph.D. Indiana University '83

Matey G. Kaltchev, Assistant Professor, Physics and Chemistry; BS University of Sofia '82; MS University of Sofia '83; Ph.D. University of Wisconsin-Milwaukee '99.

R. David Kent, Associate Professor, General Studies; BA Marquette University '83; MA Marquette University '85; Ph.D. University of Wisconsin-Milwaukee '96

Robert A. Kern, Professor, Mechanical Engineering; BS Case Institute of Technology '63; Ph.D. Case Western Reserve University '71; Registered Professional Engineer in the State of Wisconsin

Firouzeh Keshmiri, Associate Professor, Mechanical Engineering; BS Illinois Institute of Technology '82; MS University of Wisconsin-Madison '84

Robert L. Kleppin, Professor, General Studies; BA Marquette University '65; MA Marquette University '67

Jeffrey B. Korn, Professor, Physics and Chemistry; BS University of Wisconsin-Milwaukee '78; MS University of Wisconsin-Milwaukee '82

Lawrence B. Korta, Professor, Mechanical Engineering; Program Director, Industrial Engineering; BS Marquette University '62; MS Marquette University '65

Subha K. Kumpaty, Associate Professor, Mechanical Engineering; BS University of Madras Engineering School '85; MS Kakatiya University Engineering School '87; Ph.D. University of Mississippi '91

Andrew J. Kwon, Professor, Electrical Engineering and Computer Science; BS Sogang University, Korea '66; MS Marquette University '78; Ph.D. Marquette University '82

Thomas J. Labus, Professor, Mechanical Engineering; BS Purdue University '68; MS University of Illinois '71; Registered Professional Engineer in the State of Wisconsin

Sherrill L. Leifer, Assistant Professor, School of Nursing; BSN University of Wisconsin-Madison '74; MSN University of Wisconsin-Milwaukee '89

Robert O. Lemke, Associate Professor, Architectural Engineering and Building Construction; BS University of Wisconsin-Milwaukee '83; MS Milwaukee School of Engineering '99; Registered Professional Architect in Wisconsin (NCARB certified)

George P. Lephardt, Professor, Rader School of Business; BS University of Delaware '69; MS University of Wisconsin-Milwaukee '71; Ph.D. University of Tennessee '76

John H. Lumkes Jr., Associate Professor, Mechanical Engineering; BS Calvin College '90; MSE University of Michigan-Ann Arbor '92; Ph.D. University of Wisconsin-Madison '97; Registered Professional Engineer in the State of Wisconsin

John Lunz, Adjunct Associate Professor, Electrical Engineering and Computer Science; BS Marquette University '66; MS University of Wisconsin-Milwaukee '70

Francis Mahuta Jr., Assistant Professor, Architectural Engineering and Building Construction; Program Director, M.S. Environmental Engineering; BS University of Wisconsin-Milwaukee '77; MS Marquette University '84; Ph.D. University of Wisconsin-Madison '91; Registered Professional Engineer in the State of Wisconsin

A. James Mallmann, Professor, Physics and Chemistry; Recipient, R. D. Peters Endowed Professorship in Materials Science; BS University of Wisconsin-Milwaukee '65; MS University of Wisconsin-Milwaukee '68; Ph.D. Marquette University '77

Carol Mannino, Associate Professor, Rader School of Business; BBA Southern Methodist '80; MPA University of Texas '81; Registered CPA in the States of Texas and Wisconsin

Steven P. Mayer, Professor, Physics and Chemistry; BS University of Wisconsin-Milwaukee '71; MS University of Wisconsin-Milwaukee '74; Ph.D. University of Wisconsin-Milwaukee '79

Michael McGeen, Associate Professor, Architectural Engineering and Building Construction; BS University of Wisconsin-Milwaukee '76; MS University of Wisconsin-Milwaukee '80; Registered Professional Architect in the State of Wisconsin

Russel D. Meier, Assistant Professor; Electrical Engineering and Computer Science; BS Iowa State University '92; MS Iowa State University '94; Ph.D. Iowa State University '98

Richard R. Mett, Associate Professor, Physics and Chemistry; BS Milwaukee School of Engineering '82; MS University of California-Berkeley '85; Ph.D. University of Wisconsin-Madison '90

Lisa M. Milkowski, Associate Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '91; MS Marquette University '93; Ph.D. Marquette University '95

Joerg Mossbrucker, Assistant Professor; BS University of Kaiserslautern Germany '92; MS University of Kaiserslautern Germany '94; Ph.D. University of Kaiserslautern Germany '94

Joseph C. Musto, Associate Professor, Mechanical Engineering; Program Director, Mechanical Engineering; BS Clarkson University '89; MS Rensselaer Polytechnic Institute '90; Ph.D. Rensselaer Polytechnic Institute '94; Registered Professional Engineer in the State of Wisconsin

Michele Nelson, Instructor, School of Nursing; BS University of Wisconsin-Milwaukee '90; MS University of Wisconsin-Milwaukee '92

Anne-Marie L. Nickel, Assistant Professor, Physics and Chemistry; BA Lawrence University '97; Ph.D. University of Wisconsin-Madison '02

Michael J. O'Donnell, Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '69; BA Metropolitan State University '81; MS Milwaukee School of Engineering '89; Registered Professional Engineer in the State of Wisconsin

Robert J. Olsson, Assistant Professor, Physics and Chemistry; BS University of Illinois at Urbana-Champaign '91; Ph.D. Michigan State University '00

Dudley M. Outcalt, Assistant Professor, Architectural Engineering and Building Construction; BS U.S. Naval Academy '73; MS University of Cincinnati '84; MS Northwestern '87

John E. Pakkala, Assistant Professor, Mechanical Engineering; BS Michigan State University '97; MS Michigan Technological University '99; Ph.D. Michigan Technological University '01

Ray W. Palmer, Professor, Electrical Engineering and Computer Science; Chairman, Electrical Engineering and Computer Science Department; BS Milwaukee School of Engineering '68; MS University of Wisconsin '71; Registered Professional Engineer in the State of Wisconsin

Matthew A. Panhans, Professor, Mechanical Engineering; Chairman, Mechanical Engineering Department; BS Marquette University '75; MS Marquette University '80; Ph.D. Marquette University '90; Registered Professional Engineer in the State of Wisconsin

Joseph R. Papp, Professor, Rader School of Business; Chairman, Rader School of Business; AA Engineering Morton College '63; BS University of Iowa '66; MS Milwaukee School of Engineering '94; Registered Professional Engineer in the State of Wisconsin; Certified in Production and Inventory Management by APICS

Owe G. Petersen, Professor, Electrical Engineering and Computer Science; Program Director, Electrical Engineering; BS University of Wisconsin '63; MS University of Pennsylvania '65; Ph.D. University of Pennsylvania '71

Vincent Prantil, Assistant Professor, Mechanical Engineering; BS Cornell University '81; MS Cornell University '84; Ph.D. Cornell University '92

Randy R. Rapp, Associate Professor, Architectural Engineering and Building Construction; Program Director, Construction Management; BS U.S. Military Academy '75; MS University of Missouri-Rolla '83. Registered Professional Engineer in the State of Virginia; Certified Cost Engineer (AACE-I); Certified Professional Constructor (AIC)

Douglas L. Reed, Professor, Rader School of Business; BS Indiana University '58; MBA Texas Technological College '61; JD Harvard Law School '71

Steven E. Reyer, Professor, Electrical Engineering and Computer Science; BS University of Wisconsin-Milwaukee '72; MS University of Wisconsin-Milwaukee '73; Ph.D. Marquette University '78; Registered Professional Engineer in the State of Wisconsin

Robert Rizza, Associate Professor, Mechanical Engineering; BS Illinois Institute of Technology '87; MS Illinois Institute of Technology '89; Ph.D. Illinois Institute of Technology '95

Teodoro Robles, Professor, Electrical Engineering and Computer Science; BS Central Philippine University '64; MS Montana State University '69; Ph.D. Montana State University '75

David J. Rohde, Assistant Professor, School of Nursing; BSN University of Wisconsin-Milwaukee '88; MSN University of Wisconsin-Madison '93

Harry E. Rollings III, Assistant Professor, General Studies; BA Wartburg College '65; Certificate in Secondary Education, Wartburg College '66; MA University of Nebraska-Omaha '70; Ph.D. Tulane University '72; Licensed Professional Psychologist in the State of Wisconsin

Darrin Rothe, Assistant Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '92; MS Marquette University '98; Ph.D. Arizona State University '01

Hadi M. Saadat, Professor, Electrical Engineering and Computer Science; Dipl. Faraday Engineering College '63; MS Illinois Institute of Technology '66; Ph.D. University of Missouri '72

Anders H. Schenstrom, Professor, Physics and Chemistry; MS Linkoping Institute of Technology, Sweden '80; MS University of Wisconsin-Milwaukee '82; Ph.D. University of Wisconsin-Milwaukee '87

Larry J. Schmedeman, Professor, Rader School of Business; Program Director, International Business; BS University of Wisconsin-Milwaukee '72; BIM Milwaukee School of Engineering '82; MBA University of Wisconsin-Whitewater '88

Thomas F. Schuppe, Assistant Professor, Mechanical Engineering; BS University of Wisconsin-Madison '67; MS Air Force Institute of Technology '76; Ph.D. Ohio State University '88

Ruth A. Schwartz, Instructor, Physics and Chemistry; BS University of Wisconsin-Madison '85; MS University of Wisconsin-Milwaukee '88

Mark J. Sebern, Professor, Electrical Engineering and Computer Science; Program Director, Software Engineering; BS Marquette University '72; Ph.D. Marquette University '74; Registered Professional Engineer in the State of Wisconsin

Darrell L. Seeley, Professor, Physics and Chemistry; BS Luther College '72; MS University of Iowa '75

Joyce M. Solochek, Instructor, Physics and Chemistry; BS University of Wisconsin-Madison '66; MBA Marquette University '83

Douglas C. Stahl, Associate Professor, Architectural Engineering and Building Construction; BSE Princeton University '85; MS University of Wisconsin-Madison '88; Ph.D. University of Wisconsin-Madison '96; Registered Professional Engineer in the State of Wisconsin

Carma M. Stahnke, Assistant Professor, General Studies; BA Southern Illinois University at Edwardsville '88; MA Bowling Green University '91; Ph.D. Southern Illinois University '00

John A. Starr, Associate Professor, Electrical Engineering and Computer Science; BS University of Wisconsin '69; MS University of Wisconsin-Madison '75

Robert A. Strangeway, Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '79; MS Marquette University '86; Ph.D. Marquette University '96

Mary Jo Suminski, Instructor, Rader School of Business; BS University of Wisconsin-Milwaukee '75; MCT, MCSE

Deepti Suri, Assistant Professor, Electrical Engineering and Computer Science; BS Birla Institute of Technology, India '89; MS University of Wisconsin-Milwaukee '91; Ph.D. University of Wisconsin-Milwaukee '99

Michael J. Swedish, Associate Professor, Mechanical Engineering; BS Marquette University '75; MS Marquette University '78; Registered Professional Engineer in the State of Wisconsin

Thomas J. Swiontek, Professor, Electrical Engineering and Computer Science; BS Marquette University '69; Ph.D. Marquette University '75

Christopher Taylor, Associate Professor, Electrical Engineering and Computer Science; BS South Dakota State University '92; MS Purdue University '94; Ph.D. Purdue University '98

Bruce R. Thompson, Professor, Rader School of Business; BA Amherst College '63; MS University of Pennsylvania '67; Ph.D. University of Pennsylvania '73; MBA University of Chicago '81

David E. Tietyen, Adjunct Associate Professor, Rader School of Business; BS University of Wisconsin-Milwaukee '65; MBA University of California at Los Angeles '82

Hue V. Tran, Associate Professor, Electrical Engineering and Computer Science; BS University of Wisconsin-Madison '71; MS University of Wisconsin-Madison '73; Registered Professional Engineer in the State of Wisconsin

John Traxler, Assistant Professor, Rader School of Business; Program Director, MS in Medical Informatics; BS University of Wisconsin-Madison '78, '81; MD Medical College of Wisconsin '89; MBA University of Wisconsin-Milwaukee '99; MS Milwaukee School of Engineering and Medical College of Wisconsin '00

Charles S. Tritt, Associate Professor, Electrical Engineering and Computer Science; BS Ohio State University '82; MS Ohio State University '86; Ph.D. Ohio State University '94

Paul H. Unangst, Professor, Mechanical Engineering; BS and AB University of Illinois '56; MS Milwaukee School of Engineering '78; Registered Professional Engineer in the State of Wisconsin

Hermann Viets, Professor, Mechanical Engineering; President, Milwaukee School of Engineering; BS Polytechnic University '65; MS Polytechnic University '66; Ph.D. Polytechnic University '70

Henry L. Welch, Professor, Electrical Engineering and Computer Science; BS Virginia Polytechnic Institute '85; MS Rensselaer Polytechnic Institute '86; Ph.D. Rensselaer Polytechnic Institute '90; Registered Professional Engineer in the State of Wisconsin

Katherine Wikoff, Associate Professor, General Studies; Program Director, Technical Communication; BA Wright State University '81; MA University of Wisconsin-Milwaukee '86; Ph.D. University of Wisconsin-Milwaukee '92

Stephen M. Williams, Associate Professor, Electrical Engineering and Computer Science; BS University of Missouri '85; MS University of Missouri '88; Ph.D. University of Missouri '90

Gerald A. Woelfl, Professor, Electrical Engineering and Computer Science; BS University of Wisconsin-Platteville '67; MS University of Notre Dame '69; Ph.D. University of Notre Dame '71; Registered Professional Engineer in the State of Wisconsin

Josanne Wollenhaupt, Assistant Professor, School of Nursing; BSN Marquette University '90; MSN Marquette University '96

Glenn T. Wrate, Associate Professor, Electrical Engineering and Computer Science; Program Director, MS in Engineering; BS Michigan Technological University '84; MS Michigan Technological University '86; Ph.D. Michigan Technological University '96; Registered Professional Engineer in the State of California

Linda K. Young, Associate Professor, School of Nursing; BSN University of Wisconsin-Milwaukee '76; MSN Marquette University '88

John A. Zachar, Professor, Architectural Engineering and Building Construction; Program Director, Architectural Engineering; BS University of Wisconsin-Milwaukee '71; MS University of Wisconsin-Milwaukee '73; Ph.D. University of Wisconsin-Milwaukee '91; Registered Professional Engineer in the State of Wisconsin

Lisa A. Zidek, Associate Professor, Mechanical Engineering; Program Director, Industrial Engineering; BS Marquette University '90; MS Marquette University '92; Ph.D. University of Wisconsin-Madison '03

Professors Emeriti

Edward Allan, Professor Emeritus, Mechanical Engineering; BS Lafayette College '43; MS Wayne State University '56

Robert W. Braun, Professor Emeritus, Chemistry; BEd Wisconsin State University-Whitewater '49; MEd Marquette University '63; Ed.D. Marquette University '71

Bernard R. Budny, Professor Emeritus, Electrical Engineering and Computer Science; BS Marquette University '51; MS University of Wisconsin-Madison '57; Registered Professional Engineer in the State of Wisconsin

Richard G. Cook, Professor Emeritus, Architectural Engineering and Building Construction; BS University of Wisconsin-Madison '56; MS Milwaukee School of Engineering '85; Registered Professional Engineer and Architect in the State of Wisconsin

Joseph L. Deverse, Professor Emeritus, Mechanical Engineering; BS University of Pittsburgh '48; Registered Professional Engineer in the State of Wisconsin

James Eckl, Professor Emeritus, Electrical Engineering and Computer Science; BS Marquette University '57; MS University of Wisconsin '62; Registered Professional Engineer in the State of Wisconsin

Frank Evans, Professor Emeritus, Electrical Engineering and Computer Science; BS University of New Mexico '62; MS University of Houston '74

Paul E. Feuerstein, Professor Emeritus, Architectural Engineering and Building Construction; BS Indiana Institute of Technology '58; MS University of Wisconsin-Milwaukee '82; Registered Professional Engineer in the State of Wisconsin

Stanley J. Guberud, Professor Emeritus, Mathematics; BS Wisconsin State University-Eau Claire '52; MS Marquette University '61

Paul A. Gutting, Professor Emeritus, Mechanical Engineering; BS Purdue University '47; MS University of Wisconsin-Milwaukee '66; Registered Professional Engineer in the State of Wisconsin

Charles F. James Jr., Professor Emeritus, Mechanical Engineering; BS Purdue University '58; MS Purdue University '60; Ph.D. Purdue University '63

Dorothy J. Johnson, Professor Emerita, Mathematics; BS Central Michigan University '51; MS Marquette University '80

Janet Klein, Professor Emerita, Mathematics; BA Mount Mary College '51; MA Marquette University '54

Ronald A. Kobiske, Professor Emeritus, Physics and Chemistry; BS Indiana Institute of Technology '61; MS New Mexico Highlands University '63; Ph.D. University of Wisconsin-Milwaukee '76

Peter K.F. Kuhfittig, Professor Emeritus, Mathematics; BS University of Wisconsin-Milwaukee '65; MS University of Wisconsin-Milwaukee '67; Ph.D. George Peabody College of Vanderbilt University '72

Janina Levy, Professor Emerita, Chemistry; BS Copernicus University in Torun, Poland '55; MS University of Warsaw '57

Susannah P. Locke, Professor Emerita, General Studies; BS Marquette University '58; MA Marquette University '64

Arthur B. Michael, Professor Emeritus, Mechanical Engineering; BS University of Wisconsin-Madison '44; MS University of Minnesota '47; ScD Massachusetts Institute of Technology '52; Registered Professional Engineer in the State of Wisconsin

Thomas D. Pease, Professor Emeritus, Rader School of Business; BS University of Denver '48; MBA University of Denver '52

Mary Ann Perdue, Professor Emerita, General Studies; BS Valparaiso University '67; MS University of Wisconsin-Milwaukee '77

Paul P. Perdue, Professor Emeritus, Mechanical Engineering; BS Iowa State University '48; MBA University of Wisconsin-Madison '56

Donald W. Petzold, Professor Emeritus, Electrical Engineering and Computer Science; BS University of Wisconsin-Madison '50; MS University of Wisconsin-Madison '68; Ph.D. Marquette University '80

Constantin Popescu, Professor Emeritus, General Studies; BA Bucharest University '54; MA University of Wisconsin-Milwaukee '72; Ph.D. University of Wisconsin-Milwaukee '73; MLS University of Wisconsin-Milwaukee '77

Robert P. Schilleman, Associate Professor, Mathematics; BS University of Wisconsin-Madison '59; MS Marquette University '76

Andrew B. Schmirler, Professor Emeritus, Mathematics; BS St. Norbert College '57; MA Marquette University '75

Harry A. Schopler, Professor Emeritus, Physics and Chemistry; BS University of Wisconsin-Madison '50; MS University of Wisconsin-Milwaukee '85

Hans Schroeder, Professor Emeritus, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '55; MS University of Wisconsin-Madison '70; Registered Professional Engineer in the States of Wisconsin and Ohio

John G. Slater, Professor Emeritus, Mechanical Engineering; BS University of Wisconsin-Madison '48; MS University of Wisconsin-Madison '50; Ph.D. University of Wisconsin-Madison '52; Registered Professional Engineer in the State of Wisconsin

Warren E. Snyder, Professor Emeritus, Mechanical Engineering; BS University of Kansas '43; MS University of Minnesota '48; Ph.D. University of Minnesota '50; Registered Professional Engineer in the State of Wisconsin

Judith Steininger, Professor Emerita, General Studies; BA University of Kentucky '65; MA Boston College '73

Thomas J. Tillman, Professor Emeritus, Electrical Engineering and Computer Science; BS Purdue University '49; MBA University of Toledo '69; MS Marquette University '86

Richard J. Ungrodt, Vice President Emeritus; Professor Emeritus, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '41; Doctor of Engineering (Honorary) Wentworth Institute of Technology '85; Doctor of Engineering (Honorary) Milwaukee School of Engineering '86; Registered Professional Engineer in the State of Wisconsin

Lloyd E. Vlies, Professor Emeritus, Mechanical Engineering; BS University of Wisconsin-Madison '59; MS University of Wisconsin-Milwaukee '62; Registered Professional Engineer in the State of Wisconsin

Ralph W. Wey, Professor Emeritus, Electrical Engineering and Computer Science; BS University of Wisconsin-Madison '48; MS University of Wisconsin-Milwaukee '72; Registered Professional Engineer in the State of Wisconsin

Business and Industrial Advisory Committees of MSOE

The first advisory committee at MSOE was formed in 1913. Dr. Charles P. Steinmetz, who was later acknowledged for his genius in AC electrical machinery and circuit research, was among those first committee members.

Listed below are the Academic Industrial Advisory Committees for undergraduate programs and the chairperson for each. Additional committees comprised of industrial and business representatives also exist to advise in other areas of the university such as recruitment and finance.

ARCHITECTURAL ENGINEERING
Norbert Schmidt
President
Wenninger Co. Inc.

RADER SCHOOL OF BUSINESS
- Business
- International Business
- Management
- Management Information Systems

Joseph R. Papp '94, P.E.
Professor and Chairman, Rader School of Business

COMPUTER ENGINEERING
Jeffrey Zingsheim
Vice President of Engineering & Technology
Engage Networks Inc.

CONSTRUCTION MANAGEMENT
Craig Jorgensen
President
Voss-Jorgensen-Schueler

ELECTRICAL ENGINEERING
Owe Petersen, Ph.D.
Program Director/Professor
Milwaukee School of Engineering

ELECTRICAL ENGINEERING TECHNOLOGY
Donald J. Backys
Staff Systems Engineer
Motorola Inc.

ENGINEERING GRAPHICS
Ron Fait
Program Manager
GE Medical Systems Operation

INDUSTRIAL ENGINEERING
James Schwai
Business Broker
Metropolitan Business Brokers

MECHANICAL ENGINEERING
Tom Calenberg
Vice President
MSC Technologies Inc.

MECHANICAL ENGINEERING TECHNOLOGY
Paul Sacotte
Corporate Vice President
Super Steel Products Corp.

NURSING
Mary Louise Brown, Ph.D., RN
Professor and Chairperson, School of Nursing
Milwaukee School of Engineering

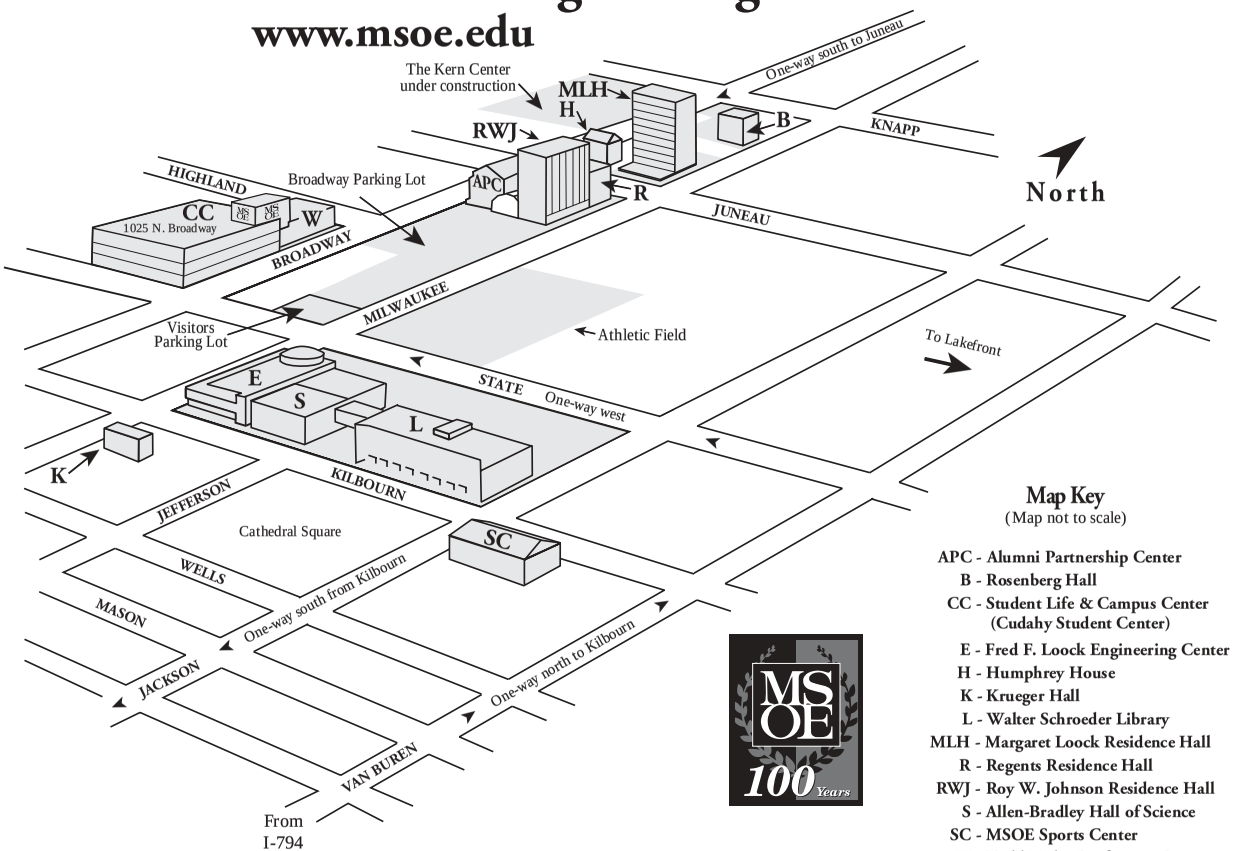
SOFTWARE ENGINEERING
Brenda DeJong
Engineering Manager
Quad Tech International

TECHNICAL COMMUNICATION
Dianne Weber
Senior Technical Writer
Dresser Industries

CAMPUS MAP

Milwaukee School of Engineering

www.msoe.edu



Map Key

(Map not to scale)

- APC - Alumni Partnership Center
- B - Rosenberg Hall
- CC - Student Life & Campus Center (Cudahy Student Center)
- E - Fred F. Loock Engineering Center
- H - Humphrey House
- K - Krueger Hall
- L - Walter Schroeder Library
- MLH - Margaret Loock Residence Hall
- R - Regents Residence Hall
- RWJ - Roy W. Johnson Residence Hall
- S - Allen-Bradley Hall of Science
- SC - MSOE Sports Center
- W - Todd Wehr Conference Center

Milwaukee School of Engineering admits male and female students of any race, color, national and ethnic origin to all the rights, privileges, programs and activities generally accorded, or made available, to students at the university. It does not discriminate, on the basis of race, color, national and ethnic origin, religion, age, gender, sexual orientation, marital status or disability in administration of its educational policies, admission policies, scholarship and loan programs, and athletic and other institutionally administered programs. MSOE also maintains its long-standing policy as an Equal Opportunity/Affirmative Action Employer of male and female personnel for its faculty and administrative staff.

Milwaukee School of Engineering reserves the right to revise at any time, without notice, any and all programs, fees and costs stated herein in accordance with the best academic and industrial standards as recommended by its advisory committees. The right also is reserved to cancel any course or subject at any time because of insufficient registration or other valid reason.

For admission information call
(800) 332-6763
(414) 277-6763 (in Milwaukee area)
or visit our Web site at
www.msoe.edu

A

Academic advising, 21
Academic calendar, 4, 9
Academic honesty, 19-21
Academic records, 21
Accreditation, 9, 28, 151
Add/drop classes, 23
Admission, 13-18
Advising, 21
Air Force ROTC, 175
Appeals processes, 20-21, 25, 34
Applied Technology Center™ (ATC), 35-39
Architectural engineering, 42-49, 56-58, 169
Architectural Engineering and Building Construction Department, 42
Army ROTC, 175
Attendance policy, 23
Auditing courses, 27

B

Biomedical engineering, 91-96
Business, 61-67
Business and Industrial Advisory Committees, 290
Business, Rader School of, 59-60, 170

C

Calendar, academic, 4, 9
Campus map, 291
Certificate programs, 17
Certifications, 88-89
Chemistry and Physics Department, 162-163
Communication, technical, 126-133, 171
Computer and Communication Services Department (CCSD), 40
Computer engineering, 97-100
Computer science (see computer engineering, software engineering or management information systems)
Construction management, 50-58, 169-170
Course descriptions, 178-276
Customized courses, 18

D

Dean's List, 28
Degree programs, 10
Directed study, 27
Directory information, privacy of, 21
Drop/add classes, 23

E

Electrical engineering, 101-111
Electrical Engineering and Computer Science Department, 90
Electrical engineering technology, 112-117
Engineering programs
Architectural engineering, 42-49, 56-58, 169
Biomedical engineering, 91-96
Computer engineering, 97-100
Electrical engineering, 101-111
Environmental engineering (BS/MS), 171-173
Industrial engineering, 139-142
Mechanical engineering, 143-147
Software engineering, 118-121
Structural engineering (BS/MS), 172-173
Engineering technology programs, 12
Electrical, 112-117
Mechanical, 148-150
Enrollment Management Department, 13-18
Enrollment status requirement, 22
Environmental engineering (BS/MS), 171-173

F

Faculty, list of full-time, 284-288
Financial assistance, 29-34
Four-year graduation guarantee, 1, 7

G

General Studies Department, 122-125
German exchange program, 11, 68-71, 107-111
GPA (grade point average)
Cumulative, 24
Major, 24-25
Grading system, 24
Graduate studies, 172-173
Graduation, 28-29
Grievance process, 21

H

Honors List, 28
Humanities and social sciences, 123-125

I

Incomplete grades, 26
Independent study, 184, 193, 199, 207 217, 237, 258, 262, 269, 270, 271
Industrial engineering, 139-142
International business, 68-73
International study programs, 11, 68-71, 107-111

L

Laptop (notebook) computers, 33, 40
Library, 35
Lifelong Learning Institute, 16

M

Major grade point average, 24-25
Management, 74-79, 86, 170
Management information systems, 80-85, 170
Map, 291
Mathematics Department, 134-136
Mechanical Engineering Department, 137-138
Mechanical engineering, 143-147
Mechanical engineering technology, 148-150
Microsoft certification, 88
Midterm progress reports, 28
Minors, 86-87, 133, 136, 167

N

Navy ROTC, 176
Noncredit offerings, 17
Nondegree status, 16
Notebook computers, 33-40
Novell certification, 88
NR grade, 26
Nursing, School of, 151-161

P

Physics and Chemistry Department, 162-168
Privacy, academic, 21
Physics Minor, 167-168
Probation, 14, 25

R

Rader School of Business, 59-60, 170
Records, academic, 21
Refund policies/schedule, 31-32
Regents, Board of, 278-280
Repeating courses, 26
Research, 35-39
RN to BSN, 158-161
ROTC, 174-176

S

School of Nursing, 151-161
Software engineering, 118-121
Structural Engineering, 172-173
Student Advancement Committee, 25
Student Financial Assistance, 29-34

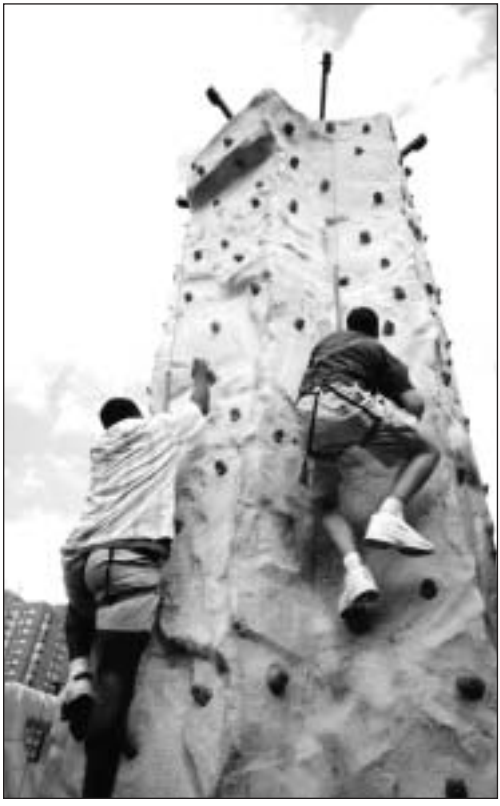
T

Technical communication, 126-133, 171
Technology package, 33, 40
Transfer students, 14-15
Tuition and fees, 30-31
Tuition refund schedule, 31-32
Two-degree programs, 169-172

U

Undergraduate admission, 13

W

Withdrawal from all classes, 23-24

After Class