WELCOME

MSOE is unique in many ways. A major distinction is our four-year graduation guarantee for full-time baccalaureate students who stay on track and maintain the required grade point average. Furthermore, we also guarantee employers and graduates that courses may be retaken free of charge within three years of graduation if they will enhance job performance.

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 distinguishes them from graduates of other universities.
- **High placement rates.** During the last decade, MSOE has had a greater than 95 percent placement average. Opportunities for new MSOE graduates abound.
- **Exciting metropolitan setting.** Located in the eastern part of downtown Milwaukee, MSOE is a short walk from the theater district, museums, sports arenas, Lake Michigan, shopping and city festivals. Part-time employment opportunities are numerous.
- **Diverse offerings.** Along with great academic programs, MSOE also offers many other personal and professional growth opportunities. From sports to student government, to writing for the school newspaper, there are abundant programs to give students a well-rounded education.

Over the course of 96 years, Milwaukee School of Engineering has grown to a diverse undergraduate and graduate institution with programs in fields related to engineering, business, communication and nursing.

At MSOE, we believe 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

COURSE DESCRIPTIONS C

THE ROSTER D

MILWAUKEE SCHOOL OF ENGINEERING
ACADEMIC CALENDAR 1999-2002

Fall Quarter (11 Weeks)	**1999**	**2000**	**2001**
Registration	May 5 – Sept. 3	May 3 – Sept. 1	May 2 – Aug. 31
Labor Day	Monday, Sept. 6	Monday, Sept. 4	Monday, Sept. 3
Classes Begin 8 a.m.	Tuesday, Sept. 7	Tuesday, Sept. 5	Tuesday, Sept. 4
End of Fall Quarter 5 p.m.	Saturday, Nov. 20	Saturday, Nov. 18	Saturday, Nov. 17
Commencement Exercises	Saturday, Nov. 20	Saturday, Nov. 18	Saturday, Nov. 17

Winter Quarter (11 Weeks)	**1999-2000**	**2000-2001**	**2001-2002**
Registration	Nov. 3 – Nov. 24	Nov. 1 – Nov. 22	Oct. 31 – Nov. 21
Thanksgiving Day	Thursday, Nov. 25	Thursday, Nov. 23	Thursday, Nov. 22
Classes Begin 8 a.m.	Monday, Nov. 29	Monday, Nov. 27	Monday, Nov. 26
Christmas Recess Begins 5 p.m.	Saturday, Dec. 18	Saturday, Dec. 23	Saturday, Dec. 22
Classes Resume 8 a.m.	Monday, Jan. 3	Monday, Jan. 8	Monday, Jan. 7
End of Winter Quarter 5 p.m.	Saturday, Feb. 26	Saturday, Feb. 24	Saturday, Feb. 23
Commencement Exercises	Saturday, Feb. 26	Saturday, Feb. 24	Saturday, Feb. 23

Spring Quarter (11 Weeks)	**2000**	**2001**	**2002**
Registration	Feb. 9 – March 3	Feb. 7 – March 2	Feb. 6 – March 1
Classes Begin 8 a.m.	Monday, March 6	Monday,March 5	Monday, March 4
Easter Recess Begins 10 p.m.	Thursday, April 20	Thursday, April 12	Thursday, March 28
Classes Resume 8 a.m.	Monday, April 24	Monday, April 16	Monday, April 1
End of Spring Quarter 5 p.m.	Saturday, May 20	Saturday, May 19	Saturday, May 18
Commencement Exercises	Saturday, May 20	Saturday,May 19	Saturday, May 18

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.

A
GENERAL INFORMATION

UNIVERSITY OVERVIEW

The MSOE Doctrine

MSOE is a private, coeducational, nonsectarian university located in a metropolitan center. It provides a balanced education – undergraduate and graduate – for men and women in the disciplines of engineering, engineering technology, communication, business, construction management and nursing.

Vision Statement

MSOE will always be at the forefront of professional education with particular emphasis on 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 the Milwaukee School of Engineering are the following:

- Lifelong learning is essential for success.
- The focus is on the individual student.
- Students, faculty, staff and volunteers all share the responsibility of learning.
- Dedicated faculty with practical experience are the heart of our teaching process.
- The student experience is strengthened by interaction with the business, industry and health care fields.
- The alumni strengthen the institution through their counsel, encouragement and support.
- Strong personal values are necessary for success.
- Freedom with responsibility is the foundation of free enterprise.
- A multicultural awareness is paramount.
- Global awareness must be reflected in all our activities.
- Acceptance of change is required to anticipate and capitalize on opportunities.

THE MSOE GUARANTEE

This fall, about 2.5 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 that 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 Admission Office (414) 277-6763 for further information regarding the four-year guarantee and the Institutional Research Department (414) 277-7154 for information on repeating a course.

History

At the turn of the 19th century, American industry began a period of rapid expansion. This accelerated the use of electrical and mechanical power. As a result, new occupations emerged in technical fields. Engineers and technicians with knowledge and skill were badly needed, but few people were available who had a combined technical training and formal education. Industry's need spurred the development of progressive programs of technical education.

In this context, Oscar Werwath organized the School of Engineering of Milwaukee in 1903. Werwath was a practicing engineer who was a graduate of European technical schools. He was the first man to plan an American engineering educational institution based on an applications-oriented curriculum. Milwaukee industries were vitally interested in this kind of training and called on Werwath to provide education and training for their employees.

From the beginning, leaders of business and industry cooperated in the institution's development, and a close relationship was established that has continued throughout MSOE's history. These early supporters realized that their future depended upon educational institutions that could prepare men and women to fill the newly created engineering and managerial positions.

In 1932, MSOE became a private, nonprofit, nonstock institution governed by a Board of Regents comprised of leaders from business, industry and the professions. MSOE is an independent coeducational institution that is incorporated under the laws of the State of Wisconsin.

Today, MSOE offers 14 bachelor's degrees and six master's degrees.

Location

MSOE has a small university atmosphere within an exciting city environment. The 13-acre, user friendly campus is located in a historic downtown district, just blocks from beautiful Lake Michigan. Called The Genuine American City, Milwaukee boasts hundreds of parks 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 Commission on Institutions of Higher Education 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 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, the National League for Nursing 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.

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 Admission Office at (414) 277-6763 or toll free at (800) 332-6763. Graduate degree programs offered by MSOE include the following:

Master of Science Degrees

Architectural Engineering
Engineering
Engineering Management
Environmental Engineering
Medical Informatics (offered jointly with Medical College of Wisconsin)
Perfusion

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 and Computer Systems
Computer Engineering
Construction Management
Electrical Engineering
Electrical Engineering Technology
Industrial Engineering
Management Systems
Mechanical Engineering
Mechanical Engineering Technology
Nursing
Software Engineering
Technical Communication (bachelor of arts option also available)

INTERNATIONAL PROGRAMS

Students attending MSOE have the opportunity to participate in three foreign study programs through agreements with MSOE and universities in Germany, India and the Czech Republic.

Germany: Electrical engineering and business and computer systems (beginning fall 2000) students may spend their junior year at Fachhochschule Lübeck, University of Applied Sciences, an engineering university in Lübeck, Germany. The program includes two semesters at FHLUAS with a five-week semester break to travel through Germany and Europe; opportunities to attend cultural programs and tour industrial sites; and a degree from both universities upon completion of all course work. All courses are taught in English.

India: MSOE sophomores may attend Manipal Institute of Technology (MIT), a world-class engineering studies and research university in Manipal, Karnataka, India. MSOE students at MIT work with state-of-the-art laboratory equipment and are taught, in English, by expert faculty, many of whom are educated and licensed as Professional Engineers in the United States. MIT has extensive sports facilities; is easily accessible by rail, road and air; and is only 150 miles from the resort state of Goa and its beaches, where students can take full advantage of India's warm weather.

Czech Republic: Through a collaboration between Rockwell International/Allen-Bradley and MSOE, students have the opportunity to study at the Czech Technical University (CTU), one of the oldest technical universities in the world, located in Prague, Czech Republic. The CTU program has two parts: six weeks of course work at MSOE during the summer called Rockwell Global Development Program (jointly run by Allen-Bradley and MSOE) and three months of course work, taught in English, at CTU. Program participants receive a certificate of completion and may receive some academic credit. A more extensive, one-year student exchange program with full credit is being developed.

Companies competing internationally look for graduates who have traveled internationally and speak a foreign language. Those who do may have a marked advantage over other competitors in the job market.

For further information on these programs, contact the Admission Office.

ENGINEERING OR ENGINEERING TECHNOLOGY?

It is important for students to know the essential features of these two different types of programs and what the future would hold as a graduate of the programs. MSOE's main recommendation is to encourage students to choose the type of program that is consistent with their talents and learning style, to assure that they will be successful in both their academic life and their subsequent career. Please contact the program directors for further information.

Which is right for me?

All undergraduate engineering and engineering technology programs at MSOE contain elements of math, basic science, engineering science, design, applications and general education. They differ from each other in the degree to which these elements are present. The distinguishing characteristics between the programs are summarized below.

The **engineering programs** at MSOE begin with an emphasis on calculus and calculus-based sciences, thus allowing a strong theoretical understanding in the later engineering courses. Design, applications and laboratories are integrated into the engineering course work, culminating in a major senior project design experience.

The **engineering technology programs** at MSOE introduce math and sciences as needed, thus allowing earlier introduction of technical courses. This curricular structure, combined with an intensive laboratory focus, appeals to the student who learns best in an experientially based (hands-on) environment.

Engineering Programs

- strong emphasis on theory
- strong emphasis on engineering design
- emphasis on applications
- math begins with calculus
- large number of math and science courses
- calculus-based math and science courses form the basis for engineering courses
- core engineering courses begin in sophomore year

Engineering Technology Programs

- moderate emphasis on theory
- moderate emphasis on the design process
- stronger emphasis on applications
- math begins with trigonometry/algebra II
- moderate number of math and science courses
- math and science introduced gradually in conjunction with technical courses
- core engineering technology courses begin in freshman year

Engineering Graduates

- may take exams for professional registration in all states
- preferred degree for continuation into engineering graduate school
- transfer from pre-engineering programs is possible

Engineering Technology Graduates

- some states restrict sitting for the professional registration exams
- graduate school is possible
- transfer process from two-year technical programs is well established

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 handicap, 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-time 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 the appropriate admission material by contacting the Enrollment Management Department.

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 ACT/SAT scores; 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 the probationary status have been developed jointly by the Learning Resource Center (LRC), 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, 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 year at MSOE.

These requirements will be enforced through university academic policies (see page 19). 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 Learning Resource Center at (414) 277-7266.

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 (CEUs) awarded. Grades will not be issued.

In order to receive a certificate, a student must:

1. Meet all prerequisite requirement

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

3. 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.

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.

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.

ACADEMIC REGULATIONS, POLICIES AND FEES

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 such as 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 same.

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 elsewhere in this publication 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, handicap 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.

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 will be subject to termination. 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 during the winter quarter.

Academic Advising

All new students must meet with their assigned advisor 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 advisors 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)	Years to Complete: Associate Degree (maximum)
Full-time	12+	36	6	3
Three-quarter Time	9-11	27	9	5
Half-time	6-8	18	12	8
Other	1-5	3	12	8

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 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

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 their 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 student 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 X after the first week and before the close of business on Monday of the 9th 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.

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 completely from school	
X	Subject dropped with approval	
*	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: AE and CM courses at the 300 and 400 level
Biomedical Engineering: all BE, EE and ME courses
Business and Computer Systems: all MS courses
Computer Engineering: all CS and EE courses
Construction Management: all CM courses; AE courses at the 300 and 400 level
Electrical Engineering: all EE courses
Electrical Engineering Technology: all ET courses
Industrial Engineering: all IE courses
Management Systems: all MS courses
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

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. The student must submit the required work to complete the course within the deadline set by the instructor, **but this may not be later than four months after the end of the quarter in which the incomplete grade was given.** 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.

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 Courses

If a student wants to repeat a course to replace a grade, the student must do so **within one calendar year from the time the original grade was received.** (If the course is not offered within one calendar year, the student must take it the next time that it is offered.) 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. Both grades will appear on the student's transcript, however, the original grade will not be used in calculating GPAs. No more than five (5) grades will be dropped out of any student's GPA. A student may repeat more than five courses; however, after the first five grades have been replaced, both of the grades earned in the course will be calculated into the student's GPA. A student who fails (F or F*) a course that is being repeated will be subject to termination. 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.

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 advisor. **Once a student takes a course as an audit, he/she cannot 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 chairman/chairwoman of the department under which the course is taught.

The nonrefundable fee (1999-2000 academic year) for taking an undergraduate directed study is $550 per credit.

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 midterm grades is kept.

Dean's List and Honors List

MSOE encourages excellence in academic achievement and, as a result, publishes the Dean's 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 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.

Academic Probation and Termination

An undergraduate student is placed on probation if the student earns a term undergraduate GPA of less than 2.00. A student is subject to termination if his/her cumulative or majorGPA falls below the 2.00 requirement based on the criteria in the following table.

A student in any of the following categories is subject to termination:

Credits Attempted	Cumulative GPA
0 - 30	No termination
31 - 75	1.70 or below
76 - 100	1.80 or below
101 - 149	1.90 or below
150 +	Below 2.00

or if:

Major Credits Attempted	Major GPA
9 - 20	1.50 or below
21 +	Below 2.00

or if a student earns two F grades in the same course or three F grades in one 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.

Termination 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 terminated for academic reasons.

Procedure

Students submit petitions in writing to the Registrar's Office, addressed to the Student Advancement Committee. If in the judgement 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.

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 degree candidates.

Undergraduate Two-Degree Candidates

To receive a second bachelor's degree, 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.**

Tuition and Fees (1999-2000 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)		
	new students	$ 5,950/quarter
	returning students	$ 5,550/quarter

Students registering for more than 19 credits will be charged $325 per credit for each credit over 19 credits.

Part Time (1 - 11 quarter credit hours)	$ 325/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

Due Dates

Tuition and fees are due and payable by Monday of the third week of classes. Residence hall fees and meal plan fees are also due and payable by Monday of the third week of classes. Meal plan fees are charged separately and vary according to the needs of the student. 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.

A one percent late payment fee per month (12 percent per annum) will be charged to accounts past due.

MSOE reserves the right to require FULL tuition payment prior to registration for those students who have not made payment on time for previous academic quarters.

Institutional Refund Schedule (For Students Not Receiving Financial Assistance)

(For 11-week classes; for shorter classes, see Registrar's Office bulletin board.)

Prior to the start of classes	100%	
During the first week of the quarter	100%	(*minus $50 fee)
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	

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

Satisfactory Academic Progress Policy for Financial Aid Recipients

A student's quarterly enrollment status is established at the end of the first week of a given quarter. MSOE students are classified as enrolled full time if they are registered for 12 or more credit hours as of 4:30 p.m. Friday of the first week of the quarter. Students registered for less than 12 credits but at least six credits at this time will have their financial aid awards adjusted during the second week of classes.

Every school participating in Student Financial Aid (SFA) programs must monitor its SFA recipients to ensure that they are meeting satisfactory academic progress standards. Federal regulations require that reasonable standards for measuring academic progress be developed by each school. Both qualitative and quantitative measures must be included in the school's satisfactory academic progress (SAP) policy. The SAP regulations were initially published in October 1983 and were amended on December 1, 1987; April 29, 1994; and November 29, 1994.

A student who does not maintain academic progress is subject to termination of financial aid and/or enrollment at MSOE.

Qualitative Component

The law specifies that by the end of the second year, the student must have a "C" average, or an academic standing consistent with the requirement for graduation from the program. At MSOE, cumulative and major grade point averages of 2.00, or higher, are required for graduation. The Registrar's Office will monitor the qualitative component of the academic progress policy. Any appeal of a qualitative nature should be directed in writing to the Registrar's Office and addressed to the Student Advancement Committee (SAC).

Quantitative Component

The GPA, by itself, is not a sufficient measure of progress. The SAP policy must include a quantitative measure to determine the number of credit hours completed to accurately measure a student's progress in a program. At MSOE, a student's yearly enrollment status will be determined at the end of each academic year (fall, winter and spring quarters) to ensure that SAP has been made. Students are expected to graduate within 150 percent of the published graduation time frame. The summer functions as a separate term and will count toward the 150 percent time frame.

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)	Years to Complete: Associate Degree (maximum)
Full-time	12-19	36	6 (18 quarters)	3 (9 quarters)
Three-quarter Time	9-11	27	9 (27 quarters)	5 (15 quarters)
Half-time	6-8	18	12 (36 quarters)	8 (24 quarters)
Other	1-5	3	12 (36 quarters)	8 (24 quarters)

*A student pursuing the two-degree option who enrolls on a full-time basis will have a total of 23 quarters to complete this program. Students who enroll on a less than full-time basis will have the maximum time frame for completion adjusted accordingly.

Probationary Periods

A student who is not making SAP will be placed on probation for the next quarter of enrollment at MSOE. During that quarter, the student must successfully complete the quarter at the same enrollment status as the quarter in which the student lost eligibility. For example, a student who was enrolled full time and did not maintain progress will be required to register and complete a quarter at full-time status to re-establish satisfactory academic progress. Students will be eligible to receive financial aid during this period of probation. A student who does not meet the aforementioned requirement during his/her probationary period will no longer be eligible for financial aid.

Appeal Procedures

Students may appeal the loss of their financial aid eligibility. One function of the Student Advancement Committee (SAC) is to allow for appeals on the part of those students whose financial aid eligibility has been terminated due to not maintaining satisfactory academic progress.

Any appeal of a quantitative nature should be submitted to the Student Financial Assistance Office addressed to the SAC. If the members of the committee concur that the student is in a position to continue with good probability of making satisfactory academic progress, permission is granted to continue on probation, and the student will be eligible to receive financial aid. The student will be notified of such in writing.

Appeals will be considered on a quarterly basis.

Procedures for Re-establishing Eligibility

Following the loss of eligibility, the student must successfully register and complete a term at MSOE with the same enrollment status as the term in which the student lost eligibility. Any financial obligations incurred during the term will be the student's responsibility.

Transfer Students

Transfer students will be monitored based on their grade level, which is determined by the Registrar's Office and based on the number of credits accepted for transfer credit. For full-time enrollment, a freshman will have a maximum of 18 quarters to complete his/her program, a sophomore will have a maximum of 14 quarters to complete his/her program, and a junior will have a maximum of nine quarters to complete his/her program. The number of quarters a student has to graduate will be adjusted accordingly for those who enroll less than full time.

Change in Major

A student wishing to change from one program to another within MSOE must complete a Change of Program request form. The student's record will then be reviewed by the program director for the new program. Internal transfer credit for courses completed at MSOE will be granted as follows:

1. Courses that are common to both programs will transfer with the grade earned. The grades earned will be used in the determination of the cumulative and major GPAs for the new program.

2. Credit will be given for a course completed in a prior program in lieu of a course in the new program provided there is equivalent coverage of required material and the student has earned a passing grade. In those cases where two or more courses from a prior program are being used in lieu of a course in the new program, the student must have earned a passing grade in all courses. The grades for these courses will be included in the student's major GPA and cumulative GPA for the new program. The program director has the authority to place stipulations on acceptance into a new program for those students who have earned a grade below "C" in a completed course. Those stipulations will be listed by the program director on the Change of Program form.

If, after completion of the transfer credit evaluation, the student is not in good academic standing, the program director for the new program may reject the student's request for admission into the new program or may place stipulations that will be listed on the Change of Program form, upon acceptance into the new program. A student who is NOT in good academic standing will be allowed to change programs only once.

A student who is in good academic standing will be allowed to change to a new program, subject to the approval of the program director for the new program, but may be subject to stipulations that will be listed on the Change of Program form.

Equivalent coverage of required material will be determined by the appropriate program director. A change in major will not automatically extend the maximum time frame to complete a degree.

Second Degree

A student who pursues a second degree at MSOE will have 150 percent of the published time frame to complete this degree.

Treatment of Incompletes, Repetitions

Financial aid will be available to eligible students for incomplete and repeated courses. However, courses that are listed as incomplete or that are repeated, will not automatically extend the maximum time frame for maintaining satisfactory academic progress.

Withdrawals

A student who completely withdraws will be placed on probation for one quarter. He/she will be expected to meet the requirements previously discussed under the "Probationary Periods" section when re-enrolling. Dropping courses will not automatically extend the maximum time frame for maintaining satisfactory academic progress.

Refund Policies for Financial Aid Recipients

A refund is only calculated for a student who totally withdraws from classes on or after the first day of class for the quarter. Students not receiving Federal Title IV funding (i.e., Pell and Supplemental Grants, Perkins and Stafford Loans, and Work-Study) will have their refund calculated using the MSOE institutional refund policies (tuition and residence hall/meals if applicable) as outlined in this *Undergraduate Academic Catalog*. In those cases, a student should receive approximately the same percentage in financial aid as the percentage he/she is charged.

When a federal Title IV recipient withdraws, federal regulations dictate which refund policy is required. A prorata refund will be calculated on tuition, room and meals for those attending MSOE for the first time and whose withdrawal date is during or before the sixth week of classes. Continuing students withdrawing prior to the 50 percent point in time of the quarter (day 28) will have their refund calculated using both the institutional and the federal formulas. The formula that provides the larger refund will be used. Once the refund is determined, funds must first be refunded to the Title IV aid programs, then to state and institutional programs, and finally to the student, if any funds remain.

Refund Schedules for Title IV Recipients

Withdrawal Date	**New Student Owes Under Prorata Formula:**
On or before first day of classes	0%
During the 1st week of classes	10%
During the 2nd week of classes	20%
During the 3rd week of classes	30%
During the 4th week of classes	40%
During the 5th week of classes	50%
During the 6th week of classes	60%
During the 7th week of classes	100%

Withdrawal Date	**Continuing Student Owes Either:**
	Institutional
Before the first day of classes	0%
During the 1st week of classes	$50 Fee
During the 2nd week of classes	20%
During the 3rd week of classes	60%
During the 4th week of classes	80%
During the 5th week of classes	100%
	Federal
On or before the first day of classes	0%
Day 2 through day 5	10%
Day 6 through day 13	50%
Day 14 through day 27	75%
After day 27	100%

($100 tuition deposit is nonrefundable; $75 room deposit is nonrefundable after July 1)

Prorata and federal formulas apply to all institutional charges.

Please note that, for federal aid recipients, receiving a 60 percent refund does not necessarily mean that the family will receive 60 percent of their payments/charges returned to them. The federal government expects the family resources/payments to be applied to charges first. For example, if the original charges were $5,000, of which $4,000 was paid from financial aid sources and $1,000 from the family, a 60 percent refund would leave charges of $2,000 (charged 40 percent of $5,000). The family would still be expected to pay their $1,000. The student would be able to use $1,000 of the financial aid to pay the balance, and $3,000 of financial aid would be refunded to the respective financial aid programs. Also, if a student withdraws from classes with an outstanding balance due, in most cases all financial aid must be refunded to the respective programs and the student is responsible for all charges. In addition, if a new student withdraws before he/she has completed 30 days of attendance, all Federal Stafford Loan funds will be cancelled.

Institutional Repayment Policy

MSOE's repayment policy is stated in terms of the amount of allowance included in the Financial Assistance budget for noninstitutional costs that a student can be expected to have incurred during the portion of the term that he/she was actually enrolled. A repayment may be required if a student received any cash disbursement of financial aid (other than Work-Study, Federal Stafford Unsubsidized & Subsidized Loans or Federal PLUS Loans) for unearned noninstitutional costs. MSOE's policy is that, if a student receives a cash disbursement to use for noninstitutional costs, the excess cash was the result first of Federal Stafford Loan assistance and then grant assistance.

For off-campus meals, personal expenses and transportation, MSOE pro-rates the allowances on a weekly basis (see below). Room charges follow the same schedule as charges for those living in the residence halls. There is no room allowance for students living with their parents.

Allowance given in Student Financial Assistance budget for 1999-2000:

Room (Off-campus)	$74/week
Meals	$51/week
Personal Miscellaneous	$40/week
Transportation	$30/week
Books and Supplies	$0 for first week of classes; $342 for weeks 2-11

Institutional Distribution Policy

Refunds and repayments are distributed back to the appropriate financial aid programs in the following order, up to the full amount received from each program for that term. Title IV programs will be refunded first with any additional refund going toward institutional loans next and finally pro-rated between state and institutional grants/scholarships.

Refund

Title IV Portion

- Federal Unsubsidized Stafford Loan
- Federal Stafford Loan
- Federal PLUS Loan
- Federal Perkins Loan
- Federal Pell Grant
- Federal Supplemental Grant
- Other Title IV Aid Programs
- Other Federal Sources of Aid

Non-Title IV Portion

- Institutional Loans
- State Grants
- Institutional Grant
- Institutional Scholarship
- Private Grant/Scholarship

Repayment

Title IV Portion

- Federal Perkins Loan
- Federal Pell Grant
- Federal Supplemental Grant

Non-Title IV Portion

- Same As Above

APPLIED RESEARCH

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

Applied Technology Center (ATC)

The ATC is the research arm of the university. It serves as a technology transfer catalyst among academia, business and industry, and governmental agencies. Professional education seminars based on this research help to ensure its benefits reach a large audience. The close association between MSOE and the business and industrial community has long been one of MSOE's strengths; applied research serves as a renewable resource in this linkage.

The ATC is organized into several Centers of Excellence, including the globally recognized Rapid Prototyping Center (RPC) and Fluid Power Institute (FPI). Others include High Impact Materials and Structures Center, Photonics and Applied Optics Center, Center for BioMolecular Modeling, Construction Science and Engineering Center and Electrical and Computer Programs.

There are a number of opportunities for undergraduate students to contribute to important cutting-edge developments while interacting with faculty, staff, industry and government. These students gain real-world experience while learning about and using state-of-the-art equipment. Students fulfill the roles of research assistants, participants in class projects working with business and industry representatives, student interns, part-time or summer employees. A limited number of opportunities for undergraduate students to do research in solid freeform fabrication are available in the Rapid Prototyping Center.

Faculty, staff and students who undertake applied research projects represent all the departments of the university. The projects include a variety of expertise such as CAD-CAM, environmental considerations, creative thinking, wind tunnel testing, materials, fuzzy logic, and product and process design. Interdisciplinary capabilities provide a major advantage and can span fields such as engineering, science, medical technology, business, computers and technical communication.

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 branches: the academic, dealing with educational functions, 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 will enable students to send and receive Internet and local e-mail, access to other Internet applications, and PC network 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 the 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

AEROSPACE STUDIES DEPARTMENT

Main Office: Student Life and Campus Center, CC-101
Phone: (414) 277-7682
Fax: (414) 288-3976 (Marquette University)

MSOE students have the opportunity to fully participate in the Air Force Reserve Officers Training Corps (AFROTC) Program. The required AFROTC courses are taught by the Aerospace Studies faculty from Marquette University at the Marquette campus. The faculty also maintains office hours each week in room CC-101 of the Student Life and Campus Center at MSOE.

Through this program, MSOE offers its students the opportunity to prepare for initial active duty assignments as Air Force commissioned officers. In order to receive a commission, Air Force ROTC cadets must complete all MSOE requirements for a degree and courses specified by the Air Force. AFROTC courses are normally taken for credit as part of a student's electives. The amount of credit given toward a degree for AFROTC academic work varies as determined by the student's college and major. AFROTC offers four-, three- and two-year programs leading to a commission as an Air Force officer. Four-year program students complete both the General Military Course and the Professional Officer Course in addition to a four-week Summer Field Training between their second and third years in the program. Two- and three-year students complete a six-week Summer Field Training before entering the Professional Officer Course. All courses are taught by Air Force officers.

Faculty:

Chairman and Professor:
Col. Robert Shappell

Assistant Professors:
Maj. Dan Wagner, Capt. Terri Jones, Capt. Frank Naughton

General Qualifications

- be a full-time student
- be a United States citizen (for scholarship appointment)
- be in good physical condition
- be of good moral character
- for pilot or navigator training, fulfill all commissioning requirements before age 26-1/2
- for scholarship recipients, fulfill commissioning requirements before reaching age 27 on June 30 in the estimated year of commissioning
- for non-scholarship students, fulfill all commissioning requirements before age 30

General Military Course (GMC)

The first and second year educational program in Air Force aerospace studies consists of a series of one-hour courses designed to give students basic information on the Air Force today and the role of the U.S. Air Force in the defense of the free world. All required textbooks and uniforms are provided free.

The GMC is open to all students qualified at MSOE without advance application and does not obligate students to the Air Force in any way.

Field Training

AFROTC Field Training is offered during the summer months at selected Air Force bases throughout the United States. The Air Force pays all expenses associated with field training. The major areas of study include junior officer training, aircraft and air crew orientation, career orientation, survival training, base functions and Air Force environment, and physical training.

Professional Officer Course (POC)

The third and fourth years of Air Force aerospace studies instruction are designed to develop skills and attitudes vital to the professional officer. Students completing the POC are commissioned as officers in the United States Air Force upon college graduation. All students in the POC receive a nontaxable subsistence allowance of $150 per month during the academic year. Students wishing to enter the POC should apply no later than the winter quarter in order to begin this course of study in the following fall quarter. Final selection of students rests with the professor of aerospace studies.

Leadership Laboratory

Leadership Laboratory is a cadet-centered activity. It is largely cadet planned and directed, in line with the premise that it provides leadership training experience that will improve a cadet's ability to perform as an Air Force officer. The freshman and sophomore Leadership Laboratory program introduces Air Force customs and courtesies, drill and ceremonies, wearing the uniform, career opportunities in the Air Force, education and training benefits, and the life and work of an Air Force officer. Opportunities for field trips to Air Force installations throughout the United States are also provided. Initial experiences include preparing the cadet for individual, squadron and flight movements in drill and ceremonies and for the Field Training assignment prior to the junior year. The junior and senior Leadership Laboratory program involves the cadets in advance leadership experiences. Cadet responsibilities include planning, organizing, directing, coordinating and controlling the activities of the cadet corps; preparing briefings and written communications; and providing interviews, guidance, information and other services that will increase the performance and motivation of other cadets.

AFROTC College Scholarship Program

This program provides scholarships to selected students participating in Air Force ROTC. While participating in AFROTC, students receive $150 per month along with paid tuition, fees, laboratory expenses and a fixed reimbursement for textbooks.

In order to be eligible for this scholarship, students must meet the following criteria:

- be a United States citizen
- be at least 17 years of age on the date of enrollment and under 27 years of age on June 30 of the estimated year of commissioning
- pass an Air Force physical exam
- be selected by a board of Air Force officers
- have no moral objections or personal convictions that will prevent bearing arms and supporting and defending the Constitution of the United States against all enemies, foreign and domestic. Applicants must not be conscientious objectors.
- achieve a qualifying score on the Air Force officer qualifying test
- maintain a quality grade point average

High school students may apply for this scholarship late in their junior year or early in their senior year. High school students may get preapplicant questionnaires by asking their guidance counselor or by telephoning the AFROTC Office at (414) 288-5383. Completed preapplication questionnaires should be submitted as soon as possible (to meet the earliest selection board) but will not be accepted if sent after December 1 the year before entering college.

For students already enrolled at MSOE, three- and two-year scholarships are available. Applications can be submitted through the professor of aerospace studies.

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 Architectural Engineering.

Bachelor's degrees are concentrated in building construction, construction economics and methodology, and construction management and building design (architectural, environmental and structural). The department uses the following technical facilities to support the specializations: CAD/CAM Laboratory, AE Microcomputer Laboratory, Senior Project Studios, Johnson Controls Building Environmental Systems Laboratory, Strength of Materials Laboratory, Construction Materials Laboratory and Structural/Construction Testing Laboratory.

Faculty:

Chairman:
Matthew W. Fuchs

Department Secretaries:
Lynn Kallas, Kristine Morrissey

Professors:
Paul E. Feuerstein, Matthew W. Fuchs, Dr. H. Peter Huttelmaier, Dr. Deborah Jackman, Dr. John A. Zachar

Associate Professors:
Craig D. Capano, Michael J. McGeen

Assistant Professors:
Dr. Richard A. DeVries, Robert O. Lemke, Randy R. Rapp, Dr. Douglas C. Stahl

Adjunct Associate Professors:
Dr. Noreen Gilbertsen, Larry Palank

Adjunct Assistant Professors:
Paul Boersma, Hiram Buffington, Ken Kaszubowski, Jeffrey MacDonald, Dr. Francis Mahuta, Mark Schueller, David Sheedy, Peter Zak, Michael Zebell

Senior Lecturer:
Gregg Achtenhagen

Lecturers:
Douglas Bade, Jeffrey Bateman, Donald Beres, Mark Beyer, Robert Burkhardt, Susan Caluwe, Gerard Capell, William Cummings, Daniel DeBuhr, Larry Groser, John M. Hassler, David Kakatsch, Ward Komorowski, Ann Lewis, James Nutter, Timothy O'Rorke, Gordon Pierret, Gaurie Rodman, Ann Woodhull

Professor Emeritus:
Richard Cook

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 contractors, 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. The graduate is 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 – V4.0

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
AE-100	Introduction to Architectural Engineering & Construction Management	2-2-3		
AE-103	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		
	Elective (HSS)[1]	3-0-3		
AE-130	Architectural Engineering Graphics		2-2-3	
MA-136	Calculus for Engineers I		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
HS-494	Creative Thinking		3-0-3	
AE-123	Building Construction Materials & Methods I			4-0-4
MA-137	Calculus for Engineers II			4-0-4
CH-201	Chemistry II			3-2-4
PH-110	Physics of Mechanics			3-2-4
EN-241	Speech			2-2-3
	TOTALS	**14-3-15**	**15-4-17**	**16-6-19**

SOPHOMORE YEAR		4	5	6
AE-200	Statics	4-0-4		
AE-220	Building Construction Materials & Methods II	3-2-4		
MA-231	Calculus for Engineers III	4-0-4		
MS-221	Microeconomics	3-0-3		
GE-205	Professional Growth	1-0-0		
PH-220	Physics of Heat, Wave Motion & Optics	3-3-4		
AE-201	Strength of Materials		4-0-4	
AE-222	Construction Materials Laboratory		1-2-1	
ME-252	Fundamentals of Thermodynamics		4-0-4	
MA-235	Differential Equations for Engineers		4-0-4	
PH-230	Physics of Electricity & Magnetism		3-3-4	
AE-225	Specifications and Contracts			3-0-3
EE-250	Electrical Systems			4-0-4
AE-213	Introduction to Fluid Mechanics			4-0-4
MA-262	Probability & Statistics			3-0-3
MA-232	Calculus for Engineers IV			3-0-3
	TOTALS	**18-5-19**	**16-5-17**	**17-0-17**

JUNIOR YEAR		QUARTER 7	QUARTER 8	QUARTER 9
AE-301	Basic Steel Design (BEPS students do not take this)	3-0-3		
AE-310	Basic Conditioning of Air	3-0-3		
CM-323	Construction Practices & Management	3-0-3		
CM-212	Surveying	2-3-3		
GE-305	Professional Growth	1-0-0		
OR-402	Professional Guidance	1-0-1		
	Design Specialty[2]			
	BSS: AE-305	*3-0-3*		
	BES: AE-315	*3-0-3*		
	BEPS: AE-357 & EE-351	*7-0-7*		
AE-308	Basic Concrete Design (BEPS students do not take this)		3-0-3	
HS-461	Organizational Psychology		3-0-3	
IE-423	Engineering Economy		3-0-3	
CM-224	Construction Estimating I		3-0-3	
	Design Specialty[2]			
	BSS: AE-306 & AE-309		*4-2-4*	
	BES: AE-311		*4-0-4*	
	BEPS: AE-359 & EE-353		*5-2-6*	
AE-3001	Dynamics			3-0-3
AE-342	Architectural History			3-0-3
CH-350	Chemistry of Building Materials			3-0-3
AE-345	Integrated Engineering Concepts			1-1-1
	Design Specialty[2]			
	BSS: AE-303 & AE-304			*7-2-8*
	BES: AE-313 & AE-317			*6-4-8*
	BEPS: EE-355 & AE-358			*7-2-8*
	TOTALS			
	BSS	**16-3-16**	**16-2-16**	**17-3-18**
	BES	**16-3-16**	**16-0-16**	**16-5-18**
	BEPS	**17-3-17**	**14-2-15**	**17-3-18**

[1]There are 12 credits of humanities and social science (HSS) electives required. Of these 12 credits, 6 must be taken from one HSS series.

[2]There are 22 credits of Building Environmental Systems (BES) or Building Structural Systems (BSS) Design Specialties, OR there are 28 credits of Building Electrical Systems (BEPS) Design Specialty. The selection must be made when junior standing has been established.

		----------QUARTER----------		
SENIOR YEAR		**10**	**11**	**12**
AE-431	Architectural Design	2-4-4		
AE-440	Office Management	3-0-3		
AE-441	Building Investment Economics	3-0-3		
EN-441	Professional Presentation Techniques	2-2-3		
GE-405	Professional Growth	1-0-0		
	Design Specialty[2]			
	BSS: AE-401	*3-2-4*		
	BES: AE-411	*3-2-4*		
	BEPS: AE-472	*3-2-4*		
AE-450	Architectural Engineering Design I		1-3-3	
MS-331	Business Law		3-0-3	
	Electives (HSS)[1]		6-0-6	
	Science Elective[3]		3-0-3	
	Design Specialty[2]			
	BSS: AE-407		*3-0-3*	
	BES: AE-412		*3-0-3*	
	BEPS: AE-476		*3-0-3*	
AE-432	Working Drawings			2-2-3
AE-451	Architectural Engineering Design II			1-3-4
HS-432	Ethics for Professional Managers & Engineers			3-0-3
	Elective (HSS)[1]			3-0-3
	Elective[4]			3-0-3
	TOTALS (ALL SPECIALTIES)	**14-8-17**	**16-3-18**	**12-5-16**

[1] There are 12 credits of HSS electives required. Of these 12 credits, 6 must be taken from one HSS series.
[2] There are 22 credits of Building Environmental Systems (BES) or Building Structural Systems (BSS) Design Specialties, OR there are 28 credits of Building Electrical Systems (BEPS) Design Specialty. The selection must be made when junior standing has been established.
[3] These 3 credits must be taken from the science area.
[4] These 3 credits may be taken from any field.

Students in the Air Force ROTC program may make the following substitutions: AF-300 for General Elective, AF-301 for EN-441, AF-302 for AE-440, AF-401 for HSS Elective, AF-402 for MS-331.

The Bachelor of Science in Architectural Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; (410) 347-7700).

Architectural Engineering Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
Building Electrical Systems Design Specialty				
AE-357	Illumination for Buildings	3	0	3
AE-358	Communication Systems	4	0	4
AE-359	National Electrical Code	2	0	2
AE-472	Electrical Power Quality for Buildings	3	2	4
AE-476	Electrical System Cost Estimating and Specifications	3	0	3
EE-351	Electrical Power Distribution Systems I	4	0	4
EE-353	Electrical Power Distribution Systems II	3	2	4
EE-355	Electrical Power Distribution Systems III	3	2	4
Building Environmental Systems Design Specialty				
AE-311	Building Energy Systems I	4	0	4
AE-313	Building Energy Systems II	3	2	4
AE-315	Plumbing Systems Design	3	0	3
AE-316	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-303	Soil Mechanics and Foundations	4	0	4
AE-304	Advanced Steel Design	3	2	4
AE-305	Structural Analysis I	3	0	3
AE-306	Structural Analysis II	3	0	3
AE-309	Strength of Materials Laboratory	1	2	1
AE-401	Advanced Concrete Design	3	2	4
AE-407	Wood and Masonry Design	3	0	3
Technical Electives				
AE-413	Building Energy Systems III	3	0	3
AE-414	Urban Planning and Municipal Engineering	2	2	3
AE-417	Advanced Plumbing Systems Design	3	0	3
AE-461	Advanced CAD with AE Applications I	2	2	3
AE-462	Advanced CAD with AE Applications II	2	2	3
AE-490	Independent Study	3	0	3

BACHELOR OF SCIENCE
CONSTRUCTION MANAGEMENT

Program Director:
Professor Craig Capano, AIC, CPC
Office: CC-61B
Phone: (414) 277-4501
Fax: (414) 277-7415
E-mail: capano@msoe.edu

The degree program is specialized for the building and construction industry. This educational path is for those wishing to pursue a career combining managerial skills with construction technology. Construction systems, business administration and basic engineering are emphasized in this program.

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.

A degree in construction management will help students develop the following personal qualities:

Human understanding — to work effectively with all personnel levels
Technical background — to visualize and solve practical construction problems
Managerial knowledge — to make decisions confidently in a challenging economy
Communication skills — to be able to listen and speak effectively
Leadership ability — to be an effective leader
Professional and ethical standards — to act with integrity

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

offer evening programs and classes to attract persons currently working in the construction industry

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 will also be understood

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 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 is responsible for delivering a construction project from its conception through project completion. The manager is involved with client contact, contractual relationships, budget performance and scheduling criteria.

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, that material and equipment are delivered to the site on time and that the various trade activities are not in conflict with one another.

Construction Estimator — A project could require a variety of estimates, depending on the contractual relationship. The estimator prepares an estimate which may be conceptual at the earlier phase of design or a very detailed and comprehensive quantity and value of materials and labor plus equipment necessary to construct the project.

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 the 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.

Construction Scheduler — The scheduler is responsible for creating the construction schedule, especially on very long projects that take years to complete.

Specification Writer — The writer of the specification, a part of the construction contract documents, requires knowledge of the design and construction process; construction materials and methods; and contracts. Specification writers also must have good writing skills.

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.

BACHELOR OF SCIENCE
CONSTRUCTION MANAGEMENT
Model Full-Time Track – V3.0

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
AE-100	Introduction to Architectural Engineering & Construction Management	2-2-3		
AE-103	Introduction to CAD	1-1-1		
MS-183	Introduction to Computer Methods & Applications	2-0-2		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
MA-127	College Algebra II	4-0-4		
AE-130	Architectural Graphics		2-2-3	
MA-136	Calculus for Engineers I		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
HS-494	Creative Thinking		3-0-3	
AE-123	Building Construction Materials & Methods I			4-0 4
MA-137	Calculus for Engineers II			4-0-4
PH-110	Physics of Mechanics			3-2-4
MS-221	Microeconomics			3-0-3
EN-241	Speech			2-2-3
	TOTALS	**15-3-16**	**15-4-17**	**16-4-18**
SOPHOMORE YEAR		**4**	**5**	**6**
AE-200	Statics	4-0-4		
AE-220	Building Construction Materials & Methods II	3-2-4		
MA-231	Calculus for Engineers III	4-0-4		
CM-212	Surveying	2-3-3		
MS-322	Macroeconomics	3-0-3		
GE-205	Professional Growth	1-0-0		
AE-201	Strength of Materials		4-0-4	
AE-222	Construction Materials Laboratory		1-2-1	
ME-252	Fundamentals of Thermodynamics		4-0-4	
AE-225	Specifications & Contracts		3-0-3	
	Elective (HSS)[1]		3-0-3	
CM-224	Construction Estimating I			3-0-3
EE-250	Electrical Systems			4-0-4
AE-213	Introduction to Fluid Mechanics			4-0-4
MA-262	Probability and Statistics			3-0-3
MS-331	Business Law			3-0-3
	TOTALS	**17-5-18**	**15-2-15**	**17-0-17**

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
AE-301	Basic Steel Design	3-0-3		
AE-310	Basic Conditioning of Air	3-0-3		
CM-325	Construction Estimating II	3-2-4		
CM-323	Construction Practices & Management	3-0-3		
MS-354	Principles of Accounting	3-0-3		
OR-402	Professional Guidance	1-0-1		
GE-305	Professional Growth	1-0-0		
CM-321	Construction Scheduling		2-2-3	
CM-301	Construction Law		3-0-3	
AE-308	Basic Concrete Design		3-0-3	
IE-423	Engineering Economy		3-0-3	
MS-356	Business Finance I		3-0-3	
AE-318	Building Environmental Systems I for CM			3-0 3
MS-342	Management Principles			3-0-3
CM-310	Construction Issues			3-2-4
AE-355	Communications & Illumination Systems			3-0 3
MS-358	Managerial Accounting I			3-0-3
	TOTALS	**17-2-17**	**14-2-15**	**15-2-16**
SENIOR YEAR		**10**	**11**	**12**
AE-431	Architectural Design	2-4-4		
AE-441	Building Investment Economics	3-0-3		
AE-419	Building Environmental Systems II for CM	4-0-4		
EN-441	Professional Presentation Techniques	2-2-3		
CM-420	Project Management I	3-2-4		
GE-405	Professional Growth	1-0-0		
CM-421	Project Management II		2-2-3	
CM-432	Construction Project I w/AE-450		1-3-3	
HS-461	Organizational Psychology		3-0-3	
MS-327	International Business		3-0-3	
	Elective[2]		3-0-3	
	Elective (HSS)[1]		3-0-3	
CH-350	Chemistry of Building Materials			3-0-3
CM-433	Construction Project II w/AE-451			1-3-4
HS-432	Ethics for Professional Managers & Engineers			3-0-3
AE-342	Architectural History			3-0-3
	TOTALS	**15-8-18**	**15-5-18**	**10-3-13**

[1] There are 6 credits of humanities and social sciences (HSS) electives required. One HSS series (400 level) is required. HSS program courses or AE-342 may be combined to form the HSS series.

[2] These 3 credits may be taken from any field.

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

The Bachelor of Science in Construction Management program is 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
For All Design Specialties
Model Full-Time Track – V2.0

		----------QUARTER----------		
FIRST YEAR		**1**	**2**	**3**
AE-100	Introduction to Architectural Engineering & Construction Management	2-2-3		
AE-103	Introduction to CAD	1-1-1		
MS-183	Introduction to Computer Methods & Applications	2-0-2		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
	Elective (HSS)[1]	3-0-3		
AE-130	Architectural Graphics		2-2-3	
MA-136	Calculus for Engineers I		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
HS-494	Creative Thinking		3-0-3	
AE-123	Building Construction Materials & Methods I			4-0-4
MA-137	Calculus for Engineers II			4-0-4
CH-201	Chemistry II			3-2-4
PH-110	Physics of Mechanics			3-2-4
EN-241	Speech			2-2-3
	TOTALS	**14-3-15**	**15-4-17**	**16-6-19**
SECOND YEAR		**4**	**5**	**6**
AE-200	Statics	4-0-4		
AE-220	Building Construction Materials & Methods II	3-2-4		
MA-231	Calculus for Engineers III	4-0-4		
PH-220	Physics of Heat, Wave Motion & Optics	3-3-4		
MS-221	Microeconomics	3-0-3		
GE-205	Professional Growth	1-0-0		
AE-201	Strength of Materials		4-0-4	
AE-222	Construction Materials Laboratory		1-2-1	
ME-252	Fundamentals of Thermodynamics		4-0-4	
MA-235	Differential Equations for Engineers		4-0-4	
PH-230	Physics of Electricity & Magnetism		3-3-4	
AE-225	Specifications and Contracts			3-0-3
EE-250	Electrical Systems			4-0-4
AE-213	Introduction to Fluid Mechanics			4-0-4
MA-262	Probability and Statistics			3-0-3
MA-232	Calculus for Engineers IV			3-0-3
	TOTALS	**18-5-19**	**16-5-17**	**17-0-17**

		----------QUARTER----------		
THIRD YEAR		**7**	**8**	**9**
AE-301	Basic Steel Design (BEPS students do not take this)	3-0-3		
AE-310	Basic Conditioning of Air	3-0-3		
CM-212	Surveying	2-3-3		
	Design Specialty[2]			
	BSS: AE-305	*3-0-3*		
	BES: AE-315)	*3-0-3*		
	BEPS: AE-357 & EE-351	*7-0-7*		
GE-305	Professional Growth	1-0-0		
CM-323	Construction Practices & Management	3-0-3		
AE-308	Basic Concrete Design			
	(BEPS students do not take this)		3-0-3	
	Design Specialty[2]			
	BSS: AE-306 & AE-309		*4-2-4*	
	BES: AE-311		*4-0-4*	
	BEPS: AE-359 & EE-353		*5-2-6*	
CM-224	Construction Estimating I		3-0-3	
MS-342	Management Principles		3-0-3	
MS-331	Business Law		3-0-3	
AE-345	Integrated Engineering Concepts			1-1-1
CM-310	Construction Issues			3-2-4
	Design Specialty[2]			
	BSS: AE-303 & AE-304			*7-2-8*
	BES: AE-313 & AE-317			*6-4-8*
	BEPS: AE-355 & AE-358			*7-2-8*
AE-355	Communications & Illumination Systems (BEPS students do not take this)			3-0-3
IE-423	Engineering Economy			3-0-3
PH-408	Environmental Issues (only BEPS students take this course)			3-0-3
	TOTALS			
	BSS	**15-3-15**	**16-2-16**	**17-5-19**
	BES	**15-3-15**	**16-2-16**	**17-5-19**
	BEPS	**16-3-16**	**15-0-15**	**17-6-19**

FOURTH YEAR		**10**	**11**	**12**
AE-441	Building Investment Economics	3-0-3		
AE-431	Architectural Design	2-4-4		
	Design Specialty[2]			
	BSS: AE-401	*3-2-4*		
	BES: AE-411	*3-2-4*		
	BEPS: AE-472	*3-2-4*		
EN-441	Professional Presentation Techniques	2-2-3		
CM-325	Construction Estimating II	3-2-4		
MS-354	Principles of Accounting	3-0-3		
AE-450	Architectural Engineering Design I		1-3-3	
	Design Specialty[2]			
	BSS: AE-407		*3-0-3*	
	BES: AE-412		*3-0-3*	
	BEPS: AE-476		*3-0-3*	
CM-321	Construction Scheduling		2-2-3	
MS-322	Macroeconomics		3-0-3	
OR-402	Professional Guidance		1-0-1	
	Elective (HSS)[1]		3-0-3	

FOURTH YEAR/continued		----------QUARTER---------- 10	11	12
AE-3001	Dynamics			3-0-3
AE-451	Architectural Engineering Design II			1-3-4
AE-432	Working Drawings			2-2-3
AE-318	Building Environmental Systems I for CM (Only BSS & BEPS take this course)			3-0-3
PH-408	Environmental Issues (Only BES take this course)			3-0-3
MS-354	Principles of Accounting			3-0-3
	TOTALS (ALL SPECIALTIES)	**14-10-18**	**13-5-16**	**12-5-16**
FIFTH YEAR		**13**	**14**	**15**
GE-405	Professional Growth	1-0-0		
AE-419	Building Environmental Systems II for CM	4-0-4		
	Elective (HSS)[1]	3-0-3		
CM-420	Project Management I	3-2-4		
MS-356	Business Finance I	3-0-3		
HS-461	Organizational Psychology	3-0-3		
CM-421	Project Management II		2-2-3	
CM-432	Construction Project I w/AE-450		1-3-3	
CM-301	Construction Law		3-0-3	
MS-358	Managerial Accounting I		3-0-3	
	Science Elective[3]		3-0-3	
	Elective (HSS)[1]		3-0-3	
CM-433	Construction Project II w/AE-451			1-3-4
AE-342	Architectural History			3-0-3
CH-350	Chemistry of Building Materials			3-0-3
MS-327	International Business			3-0-3
HS-432	Ethics for Professional Managers & Engineers			3-0-3
	TOTALS (ALL SPECIALTIES)	**17-2-17**	**15-5-18**	**13-3-16**

[1] There are 12 credits of humanities and social sciences (HSS) electives, 6 of which must be taken from one HSS series.

[2] There are 22 credits of Building Environmental Systems (BES) or Building Structural Systems (BSS.) Design Specialties, OR there are 28 credits of Building Electrical Systems (BEPS) Design Specialty. The selection must be made when junior standing has been established.

[3] These 3 credits must be taken from the science area.

Students in the Air Force ROTC program may make the following substitutions: AF-300 for General Elective, AF-300 for EN-441, AF-302 for MS-342, AF-401 for HSS elective, and AF-402 for MS-331.

The Bachelor of Science in Architectural Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, (410) 347-7700).

The Bachelor of Science in Construction Management program is accredited by the American Council for Construction Education (ACCE, 1300 Hudson Lane, Suite #3, Monroe, LA 71201-6054; telephone: (318) 323-2816).

SCHOOL OF BUSINESS

Main Office: Student Life and Campus Center, B-106
Phone: (414) 277-7279
Fax: (414) 277-7479

The School of Business serves MSOE and its students through the following major academic functions:

offering courses in accounting, computer information systems, economics, finance, law, management, human resource management and marketing, in support of all programs at the university

offering a minor in management

granting the following undergraduate degrees in business and management:
- Bachelor of Science in Business and Computer Systems
- Bachelor of Science in Management Systems

each degree with specialties in the following:
- Computer Systems
- Financial Management
- International Business (available in fall 2000)
- Manufacturing Management
- Marketing Management
- Network Management

granting the following graduate degrees:
- Master of Science in Engineering Management
- Master of Science in Medical Informatics (a joint degree offered with the Medical College of Wisconsin)

The faculty in the School of Business combine a unique mixture of business and academic experience. They are devoted to aiding students develop a high degree of understanding about business and management in a market-oriented world economy. This means preparing students for the economic, legal and technical environment and the opportunities that exist, and helping students develop the managerial skills and leadership qualities required in the coming century.

Studying business and management at an institution renowned for its engineering programs provides students with a rare opportunity. As production techniques are shifted to more highly technical and computer monitored processes, and new products and services are developed, the manager of the future must be conversant with engineering terminology and emerging computer technology, and have the human skills necessary for the management of change. The integration of business and engineering students in our programs ensures that this takes place.

In addition, because of the unique qualities of the School of Business, it has been recognized by the Novell Corporation as one of its national Novell Education Academic Partners and by Microsoft as part of that company's Authorized Academic Training. We are one of the few undergraduate degree programs in the country that are permitted to offer courses which lead to Certified Novell NetWare Administrator and NetWare Engineer and Microsoft Certified Systems Engineer.

The School of Business faculty and students also serve off campus by presenting educational programs at company locations, consulting, and cooperating with business firms in need of student internships and special projects.

Faculty:

Chairman:
Dr. George P. Lephardt

Department Secretary:
Kimberly Popp Benson

Professors:
Kenneth K. Dawson, Dr. George P. Lephardt, Dr. Douglas L. Reed, Larry J. Schmedeman, Dr. Bruce R. Thompson, Dr. Dennis L. Wanless

Associate Professor:
Carol S. Mannino

Assistant Professor:
Charles Nailen

Instructors:
Mary Jo Suminski, Mary P. Voell

Adjunct Assistant Professors:
Brian Bogan, Dennis Dillman, James Froh, John D. Geder, Robert Hankes, John Henrich, Wendy Jensen, Julie A. Kriewaldt, Kenneth Mannino Paul E. Rampson, Thomas R. Repko Jr., Jeffrey Santaga, Thomas Scott, David Spears, Michael Vargo

Adjunct Associate Professors:
Thomas J. Jerger, Jerry Lieberthal, Randall Schneider, Michael J. Talbot Sr., David Tietyen, Hilary G. Woodhouse

BACHELOR OF SCIENCE
BUSINESS AND COMPUTER SYSTEMS

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

MSOE is proud to offer an undergraduate degree in business and computer systems. The curriculum provides a unique and sophisticated combination of business and management courses 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 organizations of the future.

Why Study Business and Computer Systems?

Effective management of organizations has always been a key factor in maintaining and improving productivity, enhancing the quality of work life, and advancing technically-oriented products, services and information. Graduates are management oriented and administratively skilled. They understand the methodology and tools of quantitative analysis, and the systems approach to the application of knowledge and decision making. This degree is of the utmost importance in the era of information technology and our graduates are prepared to lead business and industry in a global information and communication dominated economy. MSOE business and computer systems students are "power users" of computers and computer information technology.

Program Goals

This program's objective is to offer a high quality, application oriented undergraduate degree in business and computer systems. The goals it has adopted express its commitment to:

create technologically proficient professionals who are competent and effective communicators

graduate men and women who possess the skills to become exceptional managers and leaders

develop graduates who understand the importance of integrity and professional responsibility

develop professionals who have the broad education necessary to understand the societal and global impact of their profession

BACHELOR OF SCIENCE
BUSINESS AND COMPUTER SYSTEMS
Model Full-Time Track – V8.o

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
MS-184	Intro to Computer Methods & Applications.	3-0-3		
MS-211	Principles of Organization	3-0-3		
EN-131	Composition	3-0-3		
MA-126	Trigonometry	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
PH-100	Intro to Physical Science I[2]	3-2-4		
MS-221	Microeconomics		3-0-3	
MS-280	Intro to Management Info. Systems		3-0-3	
EN-132	Technical Composition		3-0-3	
MA-127	College Algebra II		4-0-4	
PH-101	Physical Science II		3-2-4	
MS-322	Macroeconomics			3-0-3
EN-241	Speech			2-2-3
HU-100	Contemporary Issues			3-0-3
MA-128	Analytic Geometry & Calculus I			4-0-4
	Elective (HU or HSS)[5]			3-0-3
	TOTALS	**17-2-17**	**16-2-17**	**15-2-16**
SOPHOMORE YEAR		**4**	**5**	**6**
MS-282	Intro to COBOL Programming[3]	3-2-4		
MS-331	Business Law	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-361	Marketing	3-0-3		
HS-453	American Government	3-0-3		
MS-358	Managerial Accounting I		3-0-3	
EN-342	Group Discussion		3-0-3	
MA-341	Business Statistics I		3-0-3	
MS-284	Advanced COBOL Programming[3]		3-2-4	
	Elective (HU or HSS)[5]		3-0-3	
MS-342	Management Principles			3-0-3
MS-359	Managerial Accounting II			3-0-3
MA-342	Business Statistics II			3-0-3
HS-494	Creative Thinking			3-0-3
	Elective (Concentration)[4]			3-0-3
	TOTALS	**15-2-16**	**15-2-16**	**15-0-15**

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MS-300	Principles of Operating Systems	3-0-3		
MS-483	Database Management	2-2-3		
EN-432	Business Communication	3-0-3		
	Electives (Concentration)[4]	6-0-6		
MS-356	Business Finance I		3-0-3	
MS-387	Systems Analysis and Design I		3-0-3	
MS-450	Management Control Systems		3-0-3	
	Electives (Concentration)[4]		6-0-6	
	Elective (HU or HSS)[5]		3-0-3	
MS-357	Business Finance II			3-0-3
MS-449	Human Resource Management			3-0-3
MS-487	Business Internship I[6]			1-2-2
HS-432	Ethics for Professional Managers & Engineers			3-0-3
	Electives (Concentration)[4]			6-0-6
	TOTALS	**14-2-15**	**18-0-18**	**16-2-17**
SENIOR YEAR		**10**	**11**	**12**
MS-341	Leadership Skills	3-0-3		
MS-489	Business Internship II[6]	1-2-2		
OR-402	Professional Guidance	1-0-1		
	Electives (Concentration)[4]	9-0-9		
MS-444	Business & Government Relations		3-0-3	
MS-445	Business Forecasting		3-0-3	
	Electives (Concentration)[4]		6-0-6	
	Elective (HU or HSS)[5]		3-0-3	
MS-446	General Management Policies			3-0-3
	Electives (Concentration)[4]			9-0-9
	Elective (HU or HSS)[5]			3-0-3
	TOTALS	**14-2-15**	**15-0-15**	**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] Students may be required to take PH-100 and 101 during the evening.

[3] MS-3811 C++ Programming for Business and MS-3831 Advanced C++ Programming may be substituted for MS-282 and MS-284 in quarters 4 and 5.

[4] There are 15 courses (45 credits) of required concentration or elective courses in the BCS program. Required concentration courses are specified in the Concentration Requirements List for Computer Systems, Network Management, Marketing, Financial Management, and Manufacturing. Please see your advisor.

[5] There are 15 credits of humanities and social science electives (9 credit hours must be humanities). HS-461 cannot be used as an HS elective.

[6] Business Internship I and II are not required for students who can show evidence of an internship experience appropriate to their professional development in the BCS program. One MS elective will be substituted with consent of advisor.

BACHELOR OF SCIENCE
BUSINESS AND COMPUTER SYSTEMS
Model Part-Time Track – V5.0

FRESHMAN AND SOPHOMORE YEARS		QUARTER FA	QUARTER WI	QUARTER SP
EN-131	Composition	3-0-3		
MA-127	College Algebra II	4-0-4		
MS-184	Intro to Computer Methods & Applications		3-0-3	
MS-211	Principles of Organization		3-0-3	
MA-126	Trigonometry			4-0-4
MA-128	Analytic Geometry & Calculus I	4-0-4		
MS-221	Microeconomics	3-0-3		
EN-132	Technical Composition		3-0-3	
MS-322	Macroeconomics		3-0-3	
HU-100	Contemporary Issues			3-0-3
PH-100	Intro to Physical Science I[1]			3-2-4
MS-282	Intro to COBOL Programming[2]	3-2-4		
PH-101	Physical Science II[1]	3-2-4		
EN-241	Speech		2-2-3	
MS-284	Advanced COBOL Programming[2]		3-2-4	
MS-331	Business Law			3-0-3
	Elective (Concentration)[3]			3-0-3
MS-280	Intro to Management Info. Systems	3-0-3		
MS-341	Leadership Skills	3-0-3		
MS-354	Principles of Accounting		3-0-3	
	Elective (HU or HSS)[4]		3-0-3	
MS-342	Management Principles			3-0-3
MS-358	Managerial Accounting I			3-0-3
MS-359	Managerial Accounting II	3-0-3		
HS-453	American Government	3-0-3		
MA-341	Business Statistics I	3-0-3		
MA-342	Business Statistics II		3-0-3	
MS-361	Marketing		3-0-3	
MS-356	Business Finance I			3-0-3
	Elective (HU or HSS)[4]			3-0-3
	TOTALS	**35-4-37**	**29-2-31**	**28-2-29**

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-300	Principles of Operating Systems	3-0-3		
MS-357	Business Finance II	3-0-3		
EN-432	Business Communications	3-0-3		
HS-494	Creative Thinking		3-0-3	
	Elective (HU or HSS)[4]		3-0-3	
HS-432	Ethics for Professional Managers & Engineers			3-0-3
	Elective (Concentration)[3]			3-0-3
MS-387	Computer Systems Analysis & Design I	3-0-3		
	Elective (Concentration)[3]	3-0-3		
	Elective (HU or HSS)[4]		3-0-3	
	Elective (Concentration)[3]		3-0-3	
MS-450	Management Control Systems			3-0-3
	Elective (Concentration)[3]			3-0-3
EN-342	Group Discussion	3-0-3		
	Elective (Concentration)[3]	3-0-3		
MS-449	Human Resource Management		3-0-3	
	Elective (HU or HSS)[4]		3-0-3	
MS-487	Business Internship I[5]			1-2-2
	Elective (Concentration)[3]			3-0-3
OR-402	Professional Guidance	1-0-1		
MS-489	Business Internship II[5]	1-2-2		
	Elective (Concentration)[3]	3-0-3		
MS-445	Business Forecasting		3-0-3	
	Elective (Concentration)[3]		3-0-3	
MS-444	Business & Government Relations			3-0-3
MS-446	General Management Policies			3-0-3
	Elective (Concentration)[3]			3-0-3
MS-483	Database Management Systems	2-2-3		
	Elective (Concentration)[3]	3-0-3		
	Elective (Concentration)[3]		3-0-3	
	Elective (Concentration)[3]		3-0-3	
	Elective (Concentration)[3]			3-0-3
	Elective (Concentration)[3]			3-0-3
	TOTALS	**31-4-33**	**30-0-30**	**31-2-32**

[1] PH-100 and 101 will only be offered once every three years in the evening.

[2] MS-3811 C++ Programming for Business and MS-3831 Advanced C++ Programming may be substituted for MS-282 and MS-284.

[3] There are 15 courses (45 credits) of concentration or elective courses in the BCS program. Required concentration courses are specified in the Concentration Requirements List for Computer Systems, Network Management, Marketing, Financial Management, and Manufacturing. Please see your advisor.

[4] There are 15 credits of humanities and social science electives (9 credit hours must be humanities). HS-461 may not be used as an HS elective.

[5] Business Internship I and II are not required for students who can show evidence of an internship experience appropriate to their professional development in the BCS program. One MS elective will be substituted with consent of advisor.

Bachelor of Science Business and Computer Systems Concentration Requirements

Computer Systems		Quarter
MS-485	Telecommunications	6
MS-340	Production Management	7
MS-412X	Administrating Microsoft Windows NT	7
MS-327	International Business	8
MS-448	Employment Law	8 or 11
MS-388	Computer Systems Analysis and Design II	9
MS-390	Quantitative Management	10
MS-389	Data Center Management	12

Manufacturing Management		Quarter
MS-340	Production Management	6
MS-390	Quantitative Management	7
MS-448	Employment Law	8
MS-327	International Business	8
MS-388	Computer Systems Analysis and Design II	9
TC-452	Interpersonal Communication	9
MS-441	Supervision	10
TC-351	Organizational Communication	10
MS-433	Small Business Management	11
MS-443	Labor Relations	12

Financial Management		Quarter
MS-340	Production Management	6
MS-390	Quantitative Management	7
MS-451	Personal Tax	8
MS-388	Computer Systems Analysis and Design II	9
MS-459	Intermediate Accounting	9
MS-457	Financial Intermediaries	10
MS-327	International Business	11
MS-448	Employment Law	11
MS-4544	Financial Management Policies	11
MS-452	Investment and Portfolio Analysis	12
TC-452	Interpersonal Communication	12

Marketing Management		**Quarter**
MS-462	Technical Selling	5
MS-340	Production Management	6
TC-151	Theory of Communication	7
MS-327	International Business	8
MS-467	Marketing Research	8
TC-242	Persuasive Speech	9
MS-468	Promotion & Advertising Strategies	9
MS-390	Quantitative Management	10
TC-351	Organizational Communication	10
MS-448	Employment Law	11
MS-433	Small Business Management	11
TC-452	Interpersonal Communication	12

Network Management		**Quarter**
MS-485	Telecommunications	6
MS-471X	Novell NetWare Administration (4 credits)	7
MS-371	Intro to Unix Operating Systems	7
MS-373	Advanced Unix and System Administration	8
MS-388	Computer Systems Analysis and Design II	9
ET-351	Survey of Communication Circuits	10
MS-412X	Administrating Microsoft Windows NT	10
MS-390	Quantitative Management	10
MS-484	Business Use and Management of Networks	11
MS-389	Data Center Management	12

International Business (available in fall 2000)

The junior year of study is at Fachhochschule Lübeck, University of Applied Sciences in Lübeck, Germany. All courses are taught in English.

International Marketing
Production and Quantitative Management
Finance and Investment
Planning of Technological Investments
Basic Logistics Management
Planning of Technological Systems and Simulation
Materials Management and Purchasing
Transportation Systems
Business Administration of Transportation Enterprises
Contrastive German-American Studies
German Language

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS

Program Director:
Professor Kenneth Dawson
Office: B-308
Phone: (414) 277-7354
Fax: (414) 277-7479
E-mail: dawson@msoe.edu

The senior college program in management systems offered by MSOE is aimed at providing the opportunity for those with an associate's degree or two years of college to complete a four-year degree in management. It is an especially attractive option for those considering a career change, or who have found their career path limited by the lack of a formal degree in a business-related field. The management systems program may lead to one of five majors:

Computer Systems
Financial Management
International Business (available in fall 2000)
Manufacturing Management
Marketing Management
Network Management

Students who are presently enrolled in or are graduates of an associate's degree program, or have completed two years of undergraduate course work (60 semester credits or 99 quarter credits), have a satisfactory achievement record, and wish to enroll in the Bachelor of Science in Management Systems program, will be admitted with junior standing. Prerequisite subjects, if needed, may be scheduled with added time for completion of the degree. Prerequisite subjects include the following: business law, economics, college mathematics (college algebra II and trigonometry), English composition, technical composition, speech, general psychology, and introduction to computer systems and applications.

Program Goals

The competencies or goals of the management systems degree are to:

create technologically proficient professionals who are competent and effective communicators

graduate men and women who possess the skills to become exceptional managers and leaders

develop graduates who understand the importance of integrity and professional responsibility

develop professionals who have the broad education necessary to understand the societal and global impact of their profession

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - COMPUTER SYSTEMS MAJOR[1]
Model Full-Time Track – V7.1

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MS-282	Intro to COBOL Programming[4]	3-2-4		
MS-354	Principles of Accounting	3-0-3		
MS-342	Management Principles	3-0-3		
EN-432	Business Communication	3-0-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
	Elective (HU or HSS)[3]	3-0-3		
MS-280	Intro to Management Information Systems		3-0-3	
MS-284	Advanced COBOL Programming[4]		3-2-4	
MS-356	Business Finance I		3-0-3	
MS-358	Managerial Accounting I		3-0-3	
MA-341	Business Statistics I		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-485	Telecommunications			3-0-3
MS-341	Leadership Skills			3-0-3
MS-361	Marketing			3-0-3
MA-342	Business Statistics II			3-0-3
TC-452	Interpersonal Communication			3-0-3
	Elective (Concentration)[5]			3-0-3
	TOTALS	**16-2-16**	**18-2-19**	**18-0-18**
SENIOR YEAR		**10**	**11**	**12**
MS-300	Principles of Operating Systems	3-0-3		
MS-340	Production Management	3-0-3		
MS-483	Database Management Systems	2-2-3		
HS-432	Ethics for Professional Managers & Engineers	3-0-3		
HS-494	Creative Thinking	3-0-3		
OR-402	Professional Guidance	1-0-1		
MS-327	International Business		3-0-3	
MS-387	Computer Systems Analysis & Design I		3-0-3	
MS-445	Business Forecasting		3-0-3	
HS-453	American Government		3-0-3	
	Electives (Concentration)[5]		6-0-6	
MS-388	Computer Systems Analysis & Design II			3-0-3
MS-389	Data Center Management			3-0-3
MS-446	General Management Policies			3-0-3
	Elective (HU or HSS)[3]			3-0-3
	Elective (Concentration)[5]			3-0-3
	TOTALS	**15-2-16**	**18-0-18**	**15-0-15**

[1] The Bachelor of Science in Management Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301 Transfer Student Orientation.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] MS-3811 and MS-3831 may be substituted for MS-282 and MS-284.

[5] Concentration electives may be selected from the fields of Management Systems, Air Force, Engineering Technology, or Computer Science. See suggested electives list for Computer Systems Concentration.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - COMPUTER SYSTEMS MAJOR[1]
Model Part-Time Track – V7.0

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-280	Intro to Management Info. Systems	3-0-3		
MS-282	Intro to COBOL Programming[3]	3-2-4		
OR-301	Transfer Student Orientation[2]	1-0-0		
MS-284	Advanced COBOL Programming		3-2-4	
MS-354	Principles of Accounting		3-0-3	
	Elective (HU or HSS)[3]			3-0-3
MS-358	Managerial Accounting I			3-0-3
MS-341	Leadership Skills	3-0-3		
EN-432	Business Communications	3-0-3		
MS-342	Management Principles		3-0-3	
MS-356	Business Finance I		3-0-3	
MS-327	International Business			3-0-3
MS-361	Marketing			3-0-3
	Elective (HU or HSS)[3]			3-0-3
MA-341	Business Statistics I	3-0-3		
	Elective (Concentration)[4]	3-0-3		
MA-342	Business Statistics II		3-0-3	
HS-494	Creative Thinking			3-0-3
	Elective (Concentration)[4]			3-0-3
MS-300	Principles of Operating Systems	3-0-3		
MS-387	Computer Systems Analysis & Design I	3-0-3		
TC-452	Interpersonal Communication	3-0-3		
MS-388	Computer Systems Analysis & Design II		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-389	Data Center Management			3-0-3
MS-485	Telecommunications			3-0-3
MS-483	Database Management Systems	2-2-3		
HS-453	American Government	3-0-3		
MS-445	Business Forecasting		3-0-3	
	Elective (Concentration)		3-0-3	
OR-402	Professional Guidance		1-0-1	
MS-446	General Management Policies			3-0-3
	Elective (Concentration)[4]			3-0-3
MS-340	Production Management	3-0-3		
HS-432	Ethics for Professional Managers & Engineers	3-0-3		
	TOTALS	**39-4-40**	**28-2-29**	**33-0-33**

[1] The Bachelor of Science in Management Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301 Transfer Student Orientation.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] Computer Systems Majors may substitute MS-3811 and MS-3831 for MS-282 and MS-284

[5] Concentration electives may be selected from the fields of Management Systems, Air Force, Engineering Technology or Computer Science. See suggested electives list for Computer Systems Concentration.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - FINANCIAL MANAGEMENT MAJOR[1]
Model Full-Time Track – V7.1

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MS-342	Management Principles	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-356	Business Finance I	3-0-3		
EN-432	Business Communications	3-0-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
	Elective (HU or HSS)[3]	3-0-3		
MS-280	Intro to Management Info. Systems		3-0-3	
MS-327	International Business		3-0-3	
MS-357	Business Finance II		3-0-3	
MS-358	Managerial Accounting I		3-0-3	
MA-341	Business Statistics I		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-341	Leadership Skills			3-0-3
MS-359	Managerial Accounting II			3-0-3
MS-361	Marketing			3-0-3
MS-459	Intermediate Accounting			3-0-3
MA-342	Business Statistics II			3-0-3
	Elective (HU or HSS)[3]			3-0-3
	TOTALS	**16-0-15**	**18-0-18**	**18-0-18**
SENIOR YEAR		**10**	**11**	**12**
MS-457	Financial Intermediaries	3-0-3		
HS-432	Ethics for Professional Mgrs. & Engineers	3-0-3		
HS-494	Creative Thinking	3-0-3		
OR-402	Professional Guidance	1-0-1		
	Elective (Concentration)[4]	6-0-6		
MS-444	Business & Government Relations		3-0-3	
MS-445	Business Forecasting		3-0-3	
MS-450	Management Control Systems		3-0-3	
MS-451	Personal Tax		3-0-3	
HS-453	American Government		3-0-3	
	Elective (Concentration)[4]		3-0-3	
MS-446	General Management Policies			3-0-3
MS-452	Investments and Portfolio Analysis			3-0-3
MS-340	Production Management			3-0-3
TC-452	Interpersonal Communication			3-0-3
MS-4544	Financial Management Policies			3-0-3
	TOTALS	**16-0-16**	**18-0-18**	**15-0-15**

[1] The Bachelor of Science in Management Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301 Transfer Student Orientation.

[3] There are 9 credits of humanities and social science electives. (2 humanities and 1 social science). HS-461 will no longer be possible as an HSS elective.

[4] Concentration electives may be selected from the fields of Management Systems, Air Force, or see suggested electives list.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - FINANCIAL MANAGEMENT MAJOR[1]
Model Part-Time Track – V7.1

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-342	Management Principles	3-0-3		
EN-432	Business Communications	3-0-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
MS-341	Leadership Skills		3-0-3	
MS-354	Principles of Accounting		3-0-3	
MS-358	Managerial Accounting I			3-0-3
	Elective (HU or HSS)[3]			3-0-3
MS-280	Intro to Management Info. Systems	3-0-3		
MS-359	Managerial Accounting II	3-0-3		
MS-356	Business Finance I		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-357	Business Finance II			3-0-3
MS-459	Intermediate Accounting			3-0-3
MS-340	Production Management	3-0-3		
MA-341	Business Statistics I	3-0-3		
MA-342	Business Statistics II		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-361	Marketing			3-0-3
HS-432	Ethics for Professional Managers & Engineers			3-0-3
HS-453	American Government	3-0-3		
MS-457	Financial Intermediaries	3-0-3		
TC-452	Interpersonal Communication	3-0-3		
	Elective (Concentration)[4]		3-0-3	
MS-451	Personal Income Tax		3-0-3	
MS-327	International Business			3-0-3
MS-450	Management Control Systems			3-0-3
HS-494	Creative Thinking	3-0-3		
	Elective (Concentration)[4]	3-0-3		
MS-444	Business & Government Relations		3-0-3	
MS-445	Business Forecasting		3-0-3	
OR-402	Professional Guidance		1-0-1	
MS-446	General Management Policies			3-0-3
MS-4544	Financial Management Policies			3-0-3
MS-452	Investment & Portfolio Analysis	3-0-3		
	Elective (Concentration)[4]	3-0-3		
	TOTALS	**40-0-39**	**31-0-31**	**30-0-30**

[1] The Bachelor of Science in Management Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] Concentration electives may be selected from the fields of Management Systems or Air Force. See suggested electives list.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - MANUFACTURING MANAGEMENT MAJOR[1]
Model Full-Time Track – V6.2

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MS-342	Management Principles	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-356	Business Finance I	3-0-3		
EN-432	Business Communications	3-0-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
	Elective (HU or HSS)[3]	3-0-3		
MS-327	International Business		3-0-3	
MS-357	Business Finance II		3-0-3	
MS-358	Managerial Accounting I		3-0-3	
HS-461	Organizational Psychology		3-0-3	
MA-341	Business Statistics I		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-340	Production Management			3-0-3
MS-341	Leadership Skills			3-0-3
MS-359	Managerial Accounting II			3-0-3
MS-361	Marketing			3-0-3
MA-342	Business Statistics II			3-0-3
	TOTALS	**16-0-15**	**18-0-18**	**15-0-15**
SENIOR YEAR		**10**	**11**	**12**
MS-390	Quantitative Management	3-0-3		
MS-443	Labor Relations	3-0-3		
MS-441	Supervision	3-0-3		
HS-432	Ethics for Professional Managers & Engineers	3-0-3		
HS-494	Creative Thinking	3-0-3		
	Elective (Concentration)[4]	3-0-3		
MS-444	Business & Government Relations		3-0-3	
MS-445	Business Forecasting		3-0-3	
MS-448	Employment Law		3-0-3	
HS-453	American Government		3-0-3	
OR-402	Professional Guidance		1-0-1	
	Electives (Concentration)[4]		6-0-6	
MS-446	General Management Policies			3-0-3
MS-449	Human Resource Management			3-0-3
TC-452	Interpersonal Communication			3-0-3
	Elective (HU or HSS)[3]			3-0-3
	Elective (Concentration)[4]			3-0-3
	TOTALS	**18-0-18**	**19-0-19**	**15-0-15**

[1] The Bachelor of Science in Management Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301 Transfer Student Orientation.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] Concentration electives may be selected from the fields of Management Systems or Air Force. See suggested electives list.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - MANUFACTURING MANAGEMENT MAJOR[1]
Model Part-Time Track – V6.1

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-342	Management Principles	3-0-3		
EN-432	Business Communication	3-0-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
MS-341	Leadership Skills		3-0-3	
MS-354	Principles of Accounting		3-0-3	
MS-358	Managerial Accounting I			3-0-3
	Elective (HU or HSS)[3]			3-0-3
MS-340	Production Management	3-0-3		
HS-461	Organizational Psychology	3-0-3		
MS-356	Business Finance I		3-0-3	
MS-443	Labor Relations		3-0-3	
MS-357	Business Finance II			3-0-3
MS-441	Supervision			3-0-3
MS-359	Managerial Accounting II	3-0-3		
MA-341	Business Statistics I	3-0-3		
MA-342	Business Statistics II		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-361	Marketing			3-0-3
HS-432	Ethics for Professional Managers & Engineers			3-0-3
HS-453	American Government	3-0-3		
TC-452	Interpersonal Communication	3-0-3		
	Elective (Concentration)[4]	3-0-3		
	Elective (Concentration)[4]		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-327	International Business			3-0-3
	Elective (Concentration)[4]			3-0-3
MS-390	Quantitative Management	3-0-3		
HS-494	Creative Thinking	3-0-3		
MS-445	Business Forecasting		3-0-3	
MS-449	Human Resource Management		3-0-3	
OR-402	Professional Guidance		1-0-1	
MS-444	Business and Government Relations			3-0-3
MS-446	General Management Policies			3-0-3
MS-448	Employment Law	3-0-3		
	Elective (Concentration)[4]	3-0-3		
	TOTALS	**40-0-39**	**31-0-31**	**30-0-30**

[1] The Bachelor of Science Management in Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] Concentration electives may be selected from the fields of Management Systems or Air Force. See suggested electives list.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - MARKETING MANAGEMENT MAJOR[1]
Model Part-Time Track – V7.2

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MS-282	COBOL Programming I[5]	3-2-4		
MS-342	Management Principles	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-356	Business Finance I	3-0-3		
EN-432	Business Communication	3-0-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
MS-280	Intro to Management Info. Systems		3-0-3	
MS-327	International Business		3-0-3	
MS-357	Business Finance II		3-0-3	
MS-358	Managerial Accounting I		3-0-3	
MS-361	Marketing		3-0-3	
MA-341	Business Statistics I		3-0-3	
MS-340	Production Management			3-0-3
MS-341	Leadership Skills			3-0-3
MS-359	Managerial Accounting II			3-0-3
MS-462	Technical Selling			3-0-3
MA-342	Business Statistics II			3-0-3
	Elective (HU or HSS)[3]			3-0-3
	TOTALS	**16-2-16**	**18-0-18**	**18-0-18**
SENIOR YEAR		**10**	**11**	**12**
MS-483	Database Management	2-2-3		
EN-342	Group Discussion	3-0-3		
HS-432	Ethics for Professional Managers & Engineers	3-0-3		
HS-494	Creative Thinking	3-0-3		
TC-151	Theory of Communication	3-0-3		
	Elective (HU or HSS)[3]	3-0-3		
MS-444	Business & Government Relations		3-0-3	
MS-445	Business Forecasting		3-0-3	
MS-467	Marketing Research		3-0-3	
HS-453	American Government		3-0-3	
OR-402	Professional Guidance		1-0-1	
	Elective (Concentration)[4]		3-0-3	
MS-446	General Management Policies			3-0-3
MS-468	Advertising and Promotional Strategies			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
TC-452	Interpersonal Communication			3-0-3
	Elective (HU or HSS)[3]			3-0-3
	TOTALS	**17-2-18**	**16-0-16**	**14-2-15**

[1] The Bachelor of Science in Management Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301 Transfer Student Orientation.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] Concentration electives may be selected from the fields of Management Systems or Air Force. See suggested electives list.

[5] MS-3811 and MS-3831 may be substituted for MS-282 and MS-284.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - MARKETING MANAGEMENT MAJOR[1]
Model Part-Time Track – V7.0

		----------QUARTER----------		
JUNIOR AND SENIOR YEARS		**FA**	**WI**	**SP**
MS-342	Management Principles	3-0-3		
EN-432	Business Communication	3-0-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
MS-341	Leadership Skills		3-0-3	
MS-354	Principles of Accounting		3-0-3	
MS-358	Managerial Accounting I			3-0-3
MS-361	Marketing			3-0-3
MS-280	Intro to Management Info. Systems	3-0-3		
MS-282	COBOL Programming I[5]	3-2-4		
MS-356	Business Finance I		3-0-3	
	Elective (HU or HSS)[3]		3-0-3	
MS-357	Business Finance II			3-0-3
MS-462	Technical Selling			3-0-3
MS-359	Managerial Accounting II	3-0-3		
MA-341	Business Statistics I	3-0-3		
MS-444	Business & Government Relations		3-0-3	
MA-342	Business Statistics II		3-0-3	
HS-432	Ethics for Professional Managers & Engineers			3-0-3
	Elective (HU or HSS)[3]			3-0-3
EN-342	Group Discussion	3-0-3		
HS-453	American Government	3-0-3		
TC-151	Theory of Communication	3-0-3		
MS-445	Business Forecasting		3-0-3	
HS-494	Creative Thinking		3-0-3	
MS-327	International Business			3-0-3
MS-340	Production Management			3-0-3
MS-483	Database Management Systems	2-2-3		
TC-452	Interpersonal Communication	3-0-3		
MS-467	Marketing Research		3-0-3	
OR-402	Professional Guidance		1-0-1	
TC-342	Professional Presentation Techniques		2-2-3	
MS-446	General Management Policies			3-0-3
MS-468	Advertising & Promotional Strategies			3-0-3
	Elective (HU or HSS)[3]	3-0-3		
	Elective (Concentration)[4]	3-0-3		
	TOTALS	**39-4-40**	**30-2-31**	**30-0-30**

[1] The Bachelor of Science in Management Systems degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] Concentration electives may be selected from the fields of Management Systems or Air Force. See suggested electives list.

[5] MS-282 and MS-284 may be substituted for MS-3811 and MS-3831.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - NETWORK MANAGEMENT MAJOR[1]
Model Full-Time Track – V4.1

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MS-300	Principles of Operating Systems	3-0-3		
MS-342	Management Principles	3-0-3		
MS-354	Principles of Accounting	3-0-3		
MS-3811	Intro to C++ Programming[5]	3-2-4		
EN-432	Business Communication	3-0-3		
ET-351	Survey of Communication Circuits	2-2-3		
OR-301	Transfer Student Orientation[2]	1-0-0		
MS-358	Managerial Accounting I		3-0-3	
MS-3831	Advanced C++ Programming[5]		3-2-4	
MS-387	Systems Analysis and Design I		3-0-3	
MS-356	Business Finance I		3-0-3	
MA-341	Business Statistics I		3-0-3	
MS-485	Telecommunications			3-0-3
MS-388	Systems Analysis and Design II			3-0-3
MS-471X	Novell NetWare Administration			3-2-4
MA-342	Business Statistics II			3-0-3
	Elective (Concentration)[4]			3-0-3
	TOTALS	**18-4-19**	**15-2-16**	**15-2-16**
SENIOR YEAR		**10**	**11**	**12**
MS-371	Intro to Unix Operating Systems	3-0-3		
MS-412X	Administrating Microsoft Windows NT	2-2-3		
MS-483	Database Management Systems	2-2-3		
OR-402	Professional Guidance	1-0-1		
HS-494	Creative Thinking	3-0-3		
	Elective (Concentration)[4]	3-0-3		
MS-373	Advanced Unix and System Administration		2-2-3	
MS-484	Business Use and Management of Networks		3-0-3	
MS-444	Business and Government Relations		3-0-3	
	Elective (Concentration)[4]		3-0-3	
	Elective (HU or HSS)[3]		6-0-6	
MS-341	Leadership Skills			3-0-3
MS-361	Marketing			3-0-3
MS-389	Data Center Management			3-0-3
HS-432	Ethics for Professional Managers & Engineers			3-0-3
	Elective (Concentration)[4]			3-0-3
	Elective (HU or HSS)[3]			3-0-3
	TOTALS	**14-4-16**	**17-2-18**	**18-0-18**

[1] The Bachelor of Science in Network Management degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301 Transfer Student Orientation.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

BACHELOR OF SCIENCE
MANAGEMENT SYSTEMS - NETWORK MANAGEMENT MAJOR[1]
Model Part-Time Track – V4.0

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MS-300	Principles of Operating Systems	3-0-3		
MS-3811	Intro to C++ Programming[5]	3-2-4		
OR-301	Transfer Student Orientation[2]	1-0-0		
MS-3831	Advanced C++ Programming[5]		3-2-4	
MS-354	Principles of Accounting		3-0-3	
MS-358	Managerial Accounting I			3-0-3
	Elective (HU or HSS)[3]			3-0-3
EN-432	Business Communication	3-0-3		
ET-351	Survey of Communication Circuits	2-2-3		
MS-342	Management Principles		3-0-3	
MS-356	Business Finance I		3-0-3	
MS-341	Leadership Skills			3-0-3
MS-361	Marketing			3-0-3
MA-341	Business Statistics	3-0-3		
MS-387	Systems Analysis and Design I	3-0-3		
MA-342	Business Statistics II		3-0-3	
MS-388	Systems Analysis and Design II		3-0-3	
HS-494	Creative Thinking			3-0-3
	Elective (HU or HSS)[3]			3-0-3
MS-371	Intro to Unix Operating Systems	3-0-3		
MS-483	Database Management Systems	2-2-3		
MS-373	Advanced Unix and System Administration		2-2-3	
MS-485	Telecommunications		3-0-3	
MS-471X	Novell NetWare Administration			3-2-4
	Elective (Concentration)[4]			3-0-3
MS-412X	Microsoft NT NetWare Administration	3-0-3		
HS-432	Ethics for Professional Managers & Engineers	3-0-3		
	Elective (Concentration)[4]	3-0-3		
MS-484	Business Use and Management of Networks		3-0-3	
OR-402	Professional Guidance		1-0-1	
	Elective (Concentration)[4]		3-0-3	
MS-444	Business and Government Relations			3-0-3
MS-389	Data Center Management			3-0-3
	Elective (HU or HSS)[3]	3-0-3		
	Elective (Concentration)[4]	3-0-3		
	TOTALS	**38-6-40**	**30-4-32**	**33-2-31**

[1] The Bachelor of Science in Network Management degree is a junior-senior year only program. Admission into the program requires an associate degree or two years of college.

[2] Only students transferring into the BSMS program from other institutions are required to take OR-301 Transfer Student Orientation.

[3] There are 9 credits of humanities and social science electives (2 humanities and 1 social science). HS-461 will no longer be acceptable as an HSS elective.

[4] Concentration electives may be selected in consultation with your advisor. Courses chosen should complement your intended work environment.

[5] MS-282 and MS-284 may be substituted for MS-3811 and MS-3831.

MINOR IN MANAGEMENT

Program Director:
Dr. George P. Lephardt
Office: B-105
Phone: (414) 277-7352
Fax: (414) 277- 7479
E-mail: lephardt@msoe.edu

The minor in management is offered to those students majoring in nonbusiness areas who wish to expand their background and understanding of the managerial functions which will likely be required in their future job responsibilities. This option 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. The minor consists of seven core courses and two elective courses as follows:

Core Courses

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

Plus Two Electives From the Following

MS-322 Macroeconomics
MS-327 International Business
MS-333 Engineering Law
MS-340 Production Management
MS-341 Leadership Skills
MS-357 Business Finance II
MS-359 Managerial Cost Accounting II
MS-361 Marketing
MS-390 Quantitative Management
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-462 Technical Selling
MS-467 Marketing Research
MS-468 Promotion and Advertising Strategies
MS-475 Activity-Based Management

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

Novell Certification

MSOE's School of Business is a Novell Education Academic Partner (NEAP) and offers Novell authorized education courses. The courses are available for credit as technical electives in many degree programs. They are an integral part of the business and computer systems degree programs and the network management major available in the bachelor's degree program in management systems. Students not pursuing a degree at MSOE may participate in the courses as nondegree students.

In various combination, these courses will prepare students for certification as a Novell Certified NetWare Administrator (CNA) and a Novell Certified NetWare Engineer (CNE). Some MSOE NEAP courses are comprised of multiple Novell classes.

Certification exams must be arranged and paid for by the student through MSOE's Testing Center.

NetWare CNE5 Certification Track

MS-4715 Novell NetWare 5 System Management
MS-4745 Novell NetWare 5 Advanced Systems Management
MS-4732 Networking Technologies
MS-476 Novell Service and Support
MS-4733 Novell NetWare 5 NDS Design
MS-4765 Integrating NetWare and Microsoft Windows NT

By offering both certification programs (CNA & CNE), MSOE is preparing individuals to enter the work force with the skills necessary to begin a network support and management career. MSOE is committed to updating the course curriculum on a continual basis to meet Novell's changing requirements.

Microsoft Certified Systems Engineer Program

MSOE School of Business is proud to be part of the Microsoft Authorized Academic Training Program (AATP) and offers Microsoft-authorized training courses. As an AATP provider, MSOE is offering the entire series of courses necessary to obtain the Microsoft Certified Systems Engineer (MCSE) certification. The courses are available for credit as technical electives in many degree programs. They are an integral part of the business and computer systems degree programs and the network management major available in the bachelor's degree program in management systems. 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 Microsoft's changing requirements.

Microsoft Systems Engineer Track

MS-412 Administering Windows NT
MS-4732 Networking Essentials
MS-413 Microsoft Windows NT Core Technologies
MS-414 Microsoft Windows NT Server in the Enterprise
MS-415 Internetworking with Microsoft TCP/IP & NT Server
MS-416 Microsoft Internet Information Server 4.0

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE (EECS) 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 EECS Department is the oldest and largest academic department at MSOE. The department supports 11 engineering laboratories, plus the EECS Technical Support Center. Undergraduate degree granting responsibility includes the areas of electrical engineering, electrical engineering technology, computer engineering, software engineering and biomedical engineering. 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 Gassert

Department Secretaries:
Marilyn Searing, Susan Lennartson

Professors:
William Barnekow, Dr. Steven Barnicki, Dr. Richard C. Born, Dr. Vincent R. Canino, Dr. Edward W. Chandler, Dr. Michael T. Chier, Dr. John Gassert, Waldemar Gerassimoff, 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:
Jeffrey Blessing, Dr. Larry Fennigkoh, John Starr, Hue V. Tran, Matthew Treu, Dr. Charles Tritt, Dr. Glenn Wrate

Assistant Professors:
Dr. Ron Gerrits, Dr. Lisa Milkowski, Dr. Chris Taylor

Adjunct Professors:
Dr. Kishore Acharya, Dr. Robert Krueger

Adjunct Associate Professors:
Dr. Robert Bartfeld, John Lunz

Adjunct Assistant Professors:
Dr. Nighat Kokan, Lillian Witzke

Lecturers:

Dean Thomas Bray, N. Glenn Gratke, Kathy Lynch, David Sachs, Dr. George Stejic

Professors Emeriti:

Bernard Budny, James Eckl, Frank Evans, Dr. Donald Petzold, Hans Schroeder, Edwin Sherwood, 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

Biomedical engineering is that branch of engineering concerned with understanding and solving problems in life sciences and medicine using principles, methods and approaches drawn from engineering science and engineering design. Engineers, in general, use mathematics, physics, chemistry and social sciences to design products, systems or services in order to meet the needs of society. Biomedical engineers use mathematics, chemistry, physics, social sciences and the life sciences to design products, systems or services in order to meet the needs of society. The addition of the life sciences uniquely positions the biomedical engineer to deal with the rapid increase in knowledge predicted during the next 50 years.

Since the concepts, knowledge base and approaches of virtually all engineering disciplines can be employed to meet the needs of living systems, from research to medical care, the opportunities for interaction between biomedical engineers and other health professionals are many and varied. In order to meet the challenges, the MSOE biomedical engineering curriculum contains a core sequence of courses commonly found in all engineering curricula. In addition, the curriculum contains core courses in biology, human anatomy and human physiology. The biomedical engineering core courses include medical instrumentation, biomedical signal processing, biomaterials, biomechanics, medical imaging, rehabilitation engineering and clinical engineering.

The graduates of the biomedical engineering program are prepared to:

- design and evaluate medical products, systems or services using various government and industry standards
- serve the biomedical industry as a design, manufacturing, compliance, field service or sales engineer
- serve as a biomedical engineer in federal and military branches of government
- continue their education in graduate school in either biomedical engineering or life science or continue their education in law, medical or dental school
- serve as a clinical engineer in a health care facility

Program Goals

Students bear the responsibility for developing their skills in their chosen field of study. The biomedical engineering program at MSOE bears the responsibility for providing the environment in which the student can develop these skills. Therefore, in accordance with the mission of the university, MSOE will provide the student with the education necessary such that the students will:

develop general education skills which society commonly expects of persons holding a baccalaureate degree

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, medical imaging or rehabilitation engineering

possess the skills and understanding of common industrial practices that will allow them to excel in industrial and laboratory environments

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

develop personal and professional skills which allow them to function as productive members of an engineering design team

receive current information relative to the many career options open to engineering graduates. These options include professional schools, graduate schools (both full time and part time), continuing education and employment options in industry, health care, engineering consulting and government

recognize the need to serve society in their career plans, including service to the profession and to social, charitable and civic organizations

Combined Biomedical Engineering-Doctorate Basic Science Program

This program provides for overlapping course work to be performed while simultaneously working toward both an undergraduate degree in biomedical engineering and a doctorate in one of the basic science programs of the Medical College of Wisconsin (MCW). It is carried out in affiliation with MSOE and the Medical College of Wisconsin Graduate Division. The combined program requires both of the presently authorized programs at both institutions to be completed in full. The significance of the program is that it encourages individuals with backgrounds in the physical sciences to pursue an academic career in one of the basic science areas of the biomedical community.

The combined engineering-doctorate program is appropriate because of the rapidly increasing need for persons with engineering type backgrounds to participate in the complex high technology setting of biomedical research, an environment where people with strictly biological backgrounds are often limited.

Academic qualifications of students must meet MCW guidelines before formal acceptance is granted. Early entry of students into some of the basic courses is accomplished by provisionally accepting candidates until a sufficient number of undergraduate academic credits are accrued to be officially accepted into the graduate program at MCW. The type of students attracted to this program at MCW are those who wish to apply mathematical and engineering techniques to biomedically related problems within an academic setting.

The application process differs in that students apply for graduate courses following two years of undergraduate education at MSOE in the biomedical engineering program, provided they have an academic grade point average acceptable to the Graduate Division and the specific department with which the student wishes to be affiliated.

The academic prerequisites for conditional admission are successful completion of the first two years at MSOE with an acceptable grade point average and recommendations from the faculty of MSOE and MCW.

The major difference in the combined program is that the elective courses that the students at MSOE would take would be courses at MCW which could then be later applied toward the advanced basic science degree. The program utilizes three summer months of each year to involve the students in research projects to enable the development of techniques, and more rapidly direct the student toward a research project after completion of his or her undergraduate degree. It is anticipated that the combined degree could be completed within a period of seven to eight years from time of entry.

Further information on the combined engineering-doctorate basic science program can be obtained from the biomedical engineering program director at MSOE.

BACHELOR OF SCIENCE
BIOMEDICAL ENGINEERING
Model Full-Time Track – V2.3

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
MA-136	Calculus for Engineers I	4-0-4		
CH-200	Chemistry I	3-2-4		
BE-102	Biology	3-3-4		
EN-131	Composition	3-0-3		
OR-100	Freshman Orientation1	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 BE Design		1-3-2	
EN-132	Technical Composition		3-0-3	
MA-231	Calculus for Engineers III			4-0-4
CH-220	Organic Chemistry			3-0-3
PH-220	Physics of Heat, Wave Motion & Optics			3-3-4
BE-104	Computing in Biomedical Engineering			2-3-3
EN-241	Speech			2-2-3
	TOTALS	**17-5-18**	**14-7-17**	**14-8-17**

SOPHOMORE YEAR		4	5	6
MA-235	Differential Equations for Engineers	4-0-4		
CH-221	Biochemistry	3-3-4		
PH-230	Physics of Electricity & Magnetism	3-3-4		
ME-205	Engineering Statics	4-0-4		
MS-221	Microeconomics	3-0-3		
MA-232	Calculus for Engineers IV		3-0-3	
PH-250	Modern Physics		3-3-4	
EE-201	Linear Networks: Steady State Analysis		4-0-4	
ME-206	Engineering Dynamics		4-0-4	
EG-120	Engineering Graphics I		1-3-2	
MA-262	Probability and Statistics			3-0-3
EE-202	Linear Networks: Transient Analysis			3-3-4
EE-290	Combinational & Sequential Logic			3-3-4
ME-207	Strength of Materials I			4-0-4
	HSS Elective[2]			3-0-3
	TOTALS	**17-6-19**	**15-6-17**	**16-6-18**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
MA-330	Vector Analysis	3-0-3		
EE-291	Microprocessor Systems	3-3-4		
BE-305	Signal Analysis & Telemetry	4-0-4		
BE-381	Biophysical Phenomena: Thermo & Heat Transfer	4-0-4		
BE-372	Anatomy	2-0-2		
EE-310	Electronic Devices and Circuits		3-3-4	
EE-320	Electric & Magnetic Fields		4-0-4	
BE-373	Physiology I		3-3-4	
BE-382	Biophysical Phenomena: Fluid and Mass		4-0-4	
	HSS Elective[2]		3-0-3	
BE-306	Biomedical Instrumentation			3-3-4
BE-374	Physiology II			3-3-4
BE-400	BE Design Methodology			3-3-4
MS-331	Business Law			3-0-3
	HSS Elective[2]			3-0-3
	TOTALS	**16-3-17**	**17-6-19**	**15-9-18**

SENIOR YEAR		10	11	12
BE-401	Biomedical Engineering Design I	2-3-3		
BE-433	Biomedical Digital Signal Processing	3-3-4		
BE-417	Biomedical Electronics	3-3-4		
BE-410	Biomaterials	3-0-3		
	HSS Elective[2]	3-0-3		
BE-402	Biomedical Engineering Design II		2-3-3	
BE-460	Medical Imaging Systems		3-3-4	
BE-471	Biomedical Control Systems: Analog		4-0-4	
HS-461	Organizational Psychology		3-0-3	
	HSS Elective[2]		3-0-3	
BE-472	Biomedical Control Systems: Digital			3-3-4
BE-403	Biomedical Engineering Design III			2-3-3
HS-432	Ethics for Professional Managers and Engineers			3-0-3
	Technical Elective[3]			3-0-3
	HSS Elective[2]			3-0-3
	TOTALS	**14-9-17**	**15-6-17**	**14-6-16**

[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 18 credits of humanities and social sciences (HSS) electives in the biomedical engineering program, 6 of which must be from one HSS series.

[3] This technical elective must be from the following list:

MA-501	Linear Algebra	3-0-3
IE-423	Engineering Economy	3-0-3
BE-411	Biomechanics	3-0-3
BE-499	Clinical Internship	0-9-3
MS-327	International Business	3-0-3

Students in the Air Force ROTC may make the following substitutions in the biomedical engineering program: AF-401 for HS-455 and 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) 277-7465
E-mail: barnicks@msoe.edu

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 life-long 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

CS-481	Object-Oriented Programming	3-0-3
CS-484	Graphical User Interface Design	2-2-3
CS-486	Database System Design	3-0-3
CS-493	Computer Architecture II	2-2-3
CS-499	Independent Study	1-0-3
CS-4811	Java Programming	2-2-3
CS-4881	Artificial Intelligence (AI)	3-0-3

BACHELOR OF SCIENCE
COMPUTER ENGINEERING
Model Full-Time Track – V2.8

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
CH-200	Chemistry I	3-2-4		
EN-131	Composition	3-0-3		
GE-100	Intro to Engineering Concepts	3-2-4		
MA-136	Calculus for Engineers I	4-0-4		
OR-100	Freshman Orientation	1-0-0		
CH-201	Chemistry II		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
HU-100	Contemporary Issue			3-0-3
MA-231	Calculus for Engineers III			4-0-4
PH-110	Physics of Mechanic			3-2-4
	TOTALS	**14-4-15**	**13-5-15**	**15-7-18**
SOPHOMORE YEAR		**4**	**5**	**6**
EE-201	Linear Networks: Steady State Analysis	4-0-4		
HS-431A	Formal Logic	3-0-3		
MA-230	Discrete Mathematics	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-235	Differential Equations for Engineers		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	**17-3-18**	**15-8-18**	**15-8-18**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
CS-321	Computer Graphic	3-3-4		
CS-381	Engineering Systems Analysis w/Num. 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	
GE-300	Career & Professional Guidance		0-2-1	
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-370	Control Systems			4-0-4
EE-393	VLSI Design			3-3-4
HS-461	Organizational Psychology			3-0-3
MS-221	Microeconomics			3-0-3
	TOTALS	**15-8-18**	**12-9-16**	**16-6-18**

SENIOR YEAR		10	11	12
CS-489	Software Engineering Design	3-3-4		
CS-495	Computer Networking	3-3-4		
HS-494	Creative Thinking	3-0-3		
	Program Elective	3-0-3		
	HSS Elective	3-0-3		
CS-400	Senior Design Project I		3-0-3	
HS-464	Human Factors in Engineering and Design		2-2-3	
	Program Elective		3-0-3	
	Free Elective		3-0-3	
	HSS Elective		3-0-3	
CS-401	Senior Design Project II			3-0-3
CS-470	Computer Modeling and Simulation			3-2-4
HS-432	Ethics for Professional Managers and Engineers			3-0-3
MS-331	Business Law			3-0-3
	HSS Elective			3-0-3
	TOTALS	**15-6-17**	**14-2-15**	**15-2-16**

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.

There are 18 credits of elective subjects in the computer engineering program which must be taken as follows:

- 9 credits from the field of humanities and social sciences (HSS); 3 credits of humanities, 3 credits of social science, and 3 credits of humanities or social science
- 6 credits of of an approved program elective
- 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-201, 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, HS-455 (an HSS elective), the free elective, and the 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.

Electrical engineering (EE) is the broadest of the engineering disciplines. Students learn about general topics such as digital and analog circuits, programming, microcontrollers, wireless communications and electrical motors as well as special topics such as fuzzy logic, robotics and optical communications. EE 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.

To that end, 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 for 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 (BSEE) program 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 equally well for immediate entry into industry and for graduate school.

Design and laboratory projects grow in complexity throughout the four-year EE 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 or four on a major project for the entire academic year. Some recent projects were:

- NASA Space Shuttle payload project involving rapid prototyping
- airplane navigational "black box" finder
- functional two-person wet submarine (joint project with mechanical engineering students)
- robotic table tennis partner

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 foreign exchange program with the Fachhochschule Lübeck, University of Applied Sciences, in Lübeck, Germany. There are three key features to the program. First, all instruction is in English, although students are encouraged to learn some German while studying at Lübeck. Second, students receive both their MSOE degree and a degree from the Fachhochschule Lübeck. Third, 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 high frequency circuits for digital cellular phones
- Research engineer — Invents new optoelectronic devices to build optical computers
- 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 – V14.9X

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
GE-100	Intro to Engineering Concepts	3-2-4		
CS-150	Intro to Engineering Computing	2-2-3		
EN-131	Composition	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
HU-100	Contemporary Issues	3-0-3		
	HSS Elective[2]	3-0-3		
EG-120	Engineering Graphics I		1-3-2	
MA-136	Calculus for Engineers I		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
MS-221	Microeconomics		3-0-3	
MA-137	Calculus for Engineers II			4-0-4
PH-110	Physics of Mechanics			3-2-4
CH-201	Chemistry II			3-2-4
EN-241	Speech			2-2-3
	HSS Elective[2]			3-0-3
	TOTALS	**15-4-16**	**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-231	Calculus for Engineers III	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-235	Differential Equations for Engineers		4-0-4	
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-232	Calculus for Engineers IV			3-0-3
PH-250	Modern Physics			3-3-4
	TOTALS	**16-5-18**	**16-6-18**	**12-9-15**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
EE-310	Electronic Devices & Circuits	3-3-4		
EE-392	Digital System Design	3-2-4		
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-370	Control Systems			4-0-4
EE-383	Computer-Aided Design			3-3-4
EE-393	VLSI Design			3-3-4
MS-331	Business Law			3-0-3
MA-262	Probability and Statistics			3-0-3
	TOTALS	**15-8-18**	**14-8-17**	**16-6-18**
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 (one EE, one HSS)[2]	6-0-6		
EE-408	Senior Design Project II		2-3-3	
IE-423	Engineering Economy		3-0-3	
HS-461	Organizational Psychology		3-0-3	
	Electives (one EE, one HSS, one Free)[2]		9-0-9	
EE-409	Senior Design Project III			2-3-3
HS-432	Ethics for Professional Managers & Engineers			3-0-3
	Electives (one EE, one HSS, one Free)[2]			9-0-9
	TOTALS	**15-3-16**	**17-3-18**	**14-3-15**

[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 30 credits of elective subjects in the electrical engineering program which must be taken as follows:
- 15 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 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 be substituted for any electrical engineering courses, required or elective. Engineering technology courses may not be used as free electives.

Students in Air Force ROTC may make the following substitutions: AF-401 for HS-455 (an HSS elective); AF-402 for MS-331; and AF-300, AF-301, AF-302 and AF-400 for up to six credits of free electives. Other AF courses must be taken in addition to the above program and do not count as electives.

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-432	Transducers and Controllers	3	0	3
EE-441	Electric Machines	3	0	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-482	Pattern Recognition and Image Processing	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-497	System Design Using 16-bit Microprocessors	2	2	3
EE-499	Independent Study	1-4	0	1-4

GERMAN EXCHANGE PROGRAM

Foreign Study

Students in the electrical engineering program at MSOE have the opportunity to participate in foreign study through an agreement between MSOE and the Fachhochschule 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. And 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 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 first-hand 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, from MSOE and the Fachhochschule Lübeck.
- 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 Fachhochschule Lübeck, University of Applied Sciences, during their junior year. The school year runs September through June with a five-week break between semesters, providing an excellent opportunity for European travel. Students live in off-campus public housing provided by the university. They are in class with their German counterparts for 30 hours per week, 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 Fachhochschule 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 assistants 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.

L beck, 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 FACHHOCHSCHULE L BECK
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
EE-420/425	Microwaves I (EE Elective)	3	1
EE-303	Tutorial on Signal Analysis	2	
	Humanities/Social Sciences	4	
	German Language and Culture	4	2
	Total Hours	**31**	

SECOND SEMESTER

EE-479	Control Systems Laboratory		2
EE-474	Stored Program Control Systems	3	1
EE-424	Principles of Communication II	4	1
EE-429	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**	

MSOE STUDENTS BACK AT MSOE
Senior Year

FALL QUARTER

		Credit
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

		Lecture Hours
CEE-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 & Professional Guidance	1
	Total Credits	**16**

SPRING QUARTER

EE-409	Senior Design III	3
EE-393	VLSIDesign	4
HS-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.

1. Waive ME-354 for German exchange students in order to accommodate PH-250/360 sequence.
2. Waive HS-461 to make room for MS-331.

FACHHOCHSCHULE L BECK STUDENTS AT MSOE

WINTER QUARTER

		Lecture Hours	*Lab Hours*
EE-422	Digital Signal Processing	5	
EE-481	Fuzzy Logic Control	5	
EE-460	Quality Assurance in Electronic Systems	5	
CS-200	Object Oriented Programming	5	3
	HSS Elective	5	
EE-408	Supplemental	2	
	Total Hours	**30**	

SPRING QUARTER

EE-423	Applications of DSP	3	3
EE-393	VLSI Design	5	
PH-420	Optics, Photonics & Fiber Optic Communications	3	2
	HSS Elective	5	
	HSS Elective	5	
EE-409	Supplemental	2	
	Industry Seminar	2	
	Total Hours	**30**	

SUMMER QUARTER

NOTE: During the summer quarter and continuing into the fall quarter, the students from the Fachhochschule Lübeck will satisfy their diploma work, which generally will consist of an industrial internship. The diploma work culminates in a colloquium and formal report.

BACHELOR OF SCIENCE
ELECTRICAL ENGINEERING TECHNOLOGY

Program Director:
Dr. Robert A. Strangeway
Office: S-357
Phone: (414) 277-7311
Fax: (414) 277-7465
E-mail: strangew@msoe.edu
Web site: http://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.

The electrical engineering technology program provides a distinctive educational path into the electrical/electronic disciplines from two aspects: structure of the curriculum and typical careers of the graduates.

The Electrical Engineering Technology (EET) Curriculum

The EET curriculum is focused on an experience-building 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 the program typically begin at a trigonometric/algebra II mathematics level. The math is applied in concurrent DC and AC electrical courses. As students progress through the curriculum, the mathematics (through calculus and differential equations) 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-building 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 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 technical electives in the senior year. The technical electives are offered based on student voting in the previous year (in the course GE-300). In the technical electives, 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.

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 will be kept current through input from appropriate constituencies. This program will also be accessible on both a full- and part-time basis to traditional college students and 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, products 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

Careers in Electrical Engineering Technology

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

aerospace	electronics
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

Advice for Transfer Students

Students whose previous formal education has been gained through a technical, community or junior college are required to consult with the *director of transfer admission* at MSOE about credit transfer. Students may enter the electrical engineering technology program at MSOE at the beginning of any quarter. Consultation with an electrical engineering technology curriculum advisor 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 *director of transfer admission* 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 Track – V5.6

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
ET-103	DC Circuit Analysis[1]	3-3-4		
ET-107	Introduction to Engineering Technology[1]	1-2-2		
MA-126	Trigonometry	4-0-4		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
ET-104	AC Circuit Analysis[1]		3-3-4	
ET-190	Logic & Switching Circuits		3-2-4	
MA-127	College Algebra II		4-0-4	
MS-221	Microeconomics		3-0-3	
EN-132	Technical Composition		3-0-3	
ET-106	Advanced AC/Intro. to Semiconductors[1]			3-3-4
CS-150	Introduction to Computer Programming			2-2-3
EG-121	Computer-aided Graphics			2-2-3
MA-128	Analytic Geometry and Calculus I			4-0-4
EN-241	Speech			2-2-3
	TOTALS	**14-5-16**	**16-5-18**	**13-9-17**
SOPHOMORE YEAR		**4**	**5**	**6**
ET-210	Transistor Electronic Circuits[1]	3-2-4		
ET-295	Introduction to Microcontrollers	3-2-4		
MA-225	Calculus II for Technologists	4-0-4		
PT-110	Physics for Technologists I	3-3-4		
ET-213	Analog Electronic Circuits		3-2-4	
ET-224	Electronic Communications Concepts		3-2-4	
MA-226	Calculus III for Technologists		4-0-4	
PT-220	Physics for Technologists II		3-3-4	
ET-200	Electronic Construction and Packaging			3-2-4
ET-215	Microcontroller Applications			3-2-4
ET-240	Electric Machinery and Control			3-2-4
CH-100	Chemistry for Technologists I			3-3-4
	TOTALS	**13-7-16**	**13-7-16**	**12-9-16**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
ET-300	Linear Circuit Design	3-2-4		
ET-304	Advanced Topics in Circuit Analysis	3-0-3		
ET-323	Transmission Lines	3-2-4		
MA-227	Differential Equations for Technologists	3-0-3		
MT-353	Statics and Strength of Materials	4-0-4		
ET-301	Signals and Circuits		4-0-4	
ET-310	Electronic Circuit Design		3-3-4	
ET-381	Advanced Computer Programming		3-2-4	
MT-355	Thermodynamics & Heat Transfer		3-0-3	
GE-300	Career & Professional Guidance		0-2-1	
ET-324	Data Communications			4-0-4
ET-371	Feedback Control Systems and Circuits			3-2-4
PH-361	Engineering Materials			3-3-4
EN-332	Applied Technical Communications			3-2-4
	TOTALS	**16-4-18**	**13-7-16**	**13-7-16**

SENIOR YEAR		10	11	12
ET-420	Electromagnetic Field Concepts	3-0-3		
ET-4XX	Technical Elective[2]	3-2-4		
ET-460	Quality in Electronic Systems	3-0-3		
IE-423	Engineering Economy	3-0-3		
HS-494	Creative Thinking	3-0-3		
ET-424	Electromagnetic Field Applications		2-2-3	
ET-4XX	Technical Elective[2]		3-2-4	
HS-461	Organizational Psychology		3-0-3	
HS-4XX	Elective (HSS)[3]		3-0-3	
HS-4XX	Elective (HSS)[3]		3-0-3	
ET-4XX	Technical Elective[2]			3-2-4
HS-432	Ethics for Professional Managers & Engineers			3-0-3
MS-331	Business Law			3-0-3
MS-XXX	Elective (MS)[3]			3-0-3
HS-4XX	Elective (HSS)[3]			3-0-3
	TOTALS	**15-2-16**	**14-4-16**	**15-2-16**

[1] Transfer students may be eligible to take ET-104S, ET-107S and ET-210S. Consult with an ET-E curriculum advisor.

[2] Technical electives must be taken from the approved technical electives course list. This list also contains the technical electives guidelines and policies and is updated annually. Consult with an ET-E advisor before enrolling in technical electives.

[3] There are 12 credits of elective subjects in the ET-E program which must be taken as follows:
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 3 credits from the management systems (MS) area at the 300- or 400-level (computer programming courses do not qualify in general)

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 Track – V5.6

FRESHMAN AND SOPHOMORE YEARS		QUARTER FA	QUARTER WI	QUARTER SP
ET-107	Introduction to Engineering Technology[1]	1-2-2		
MA-126	Trigonometry	4-0-4		
ET-103	DC Circuit Analysis[1]		3-3-4	
MA-127	College Algebra II		4-0-4	
ET-104	AC Circuit Analysis[1]			3-3-4
EN-131	Composition			3-0-3
ET-190	Logic & Switching Circuits	3-2-4		
EN-132	Technical Composition	3-0-3		
ET-106	Advanced AC/Intro. to Semiconductors[1]		3-3-4	
MA-128	Analytic Geometry and Calculus I		4-0-4	
ET-210	Transistor Electronic Circuits1			3-2-4
EN-241	Speech			2-2-3
CS-150	Introduction to Computer Programming	2-2-3		
HU-100	Contemporary Issues	3-0-3		
MA-225	Calculus II for Technologists		4-0-4	
PT-110	Physics for Technologists I		3-3-4	
ET-213	Analog Electronic Circuits			3-2-4
MS-221	Microeconomics			3-0-3
CH-100	Chemistry for Technologists I	3-3-4		
EG-121	Computer-aided Graphics	2-2-3		
ET-200	Electronic Construction and Packaging		3-2-4	
ET-295	Introduction to Microcontrollers		3-2-4	
PT-220	Physics for Technologists II			3-3-4
MA-226	Calculus III for Technologists			4-0-4
ET-215	Microcontroller Applications	3-2-4		
ET-224	Electronic Communications Concepts	3-2-4		
ET-240	Electric Machinery and Control		3-2-4	
ET-304	Advanced Topics in Circuit Analysis[2]		3-0-3	
ET-381	Advanced Computer Programming[2]			3-2-4
MA-227	Differential Equations for Technologists[2]			3-0-3
	TOTALS	**27-15-34**	**33-15-39**	**24-14-36**

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
HS-494	Creative Thinking	3-0-3		
PH-361	Engineering Materials	3-3-4		
ET-300	Linear Circuit Design		3-2-4	
MT-353	Statics and Strength of Materials		4-0-4	
ET-310	Electronic Circuit Design			3-3-4
MT-355	Thermodynamics & Heat Transfer			3-0-3
ET-371	Feedback Control Systems and Circuits	3-2-4		
EN-332	Applied Technical Communications	3-2-4		
ET-323	Transmission Lines		3-2-4	
IE-423	Engineering Economy		3-0-3	
ET-301	Signals and Circuits			4-0-4
MS-331	Business Law			3-0-3
ET-324	Data Communications	4-0-4		
HS-461	Organizational Psychology	3-0-3		
ET-420	Electromagnetic Field Concepts		3-0-3	
ET-460	Quality in Electronic Systems		3-0-3	
GE-300	Career & Professional Guidance		0-2-1	
ET-424	Electromagnetic Field Applications			2-2-3
HS-432	Ethics for Professional Managers & Engineers			3-0-3
ET-4XX	Technical Elective[3]	3-2-4		
HS-4XX	Elective (HSS)[4]	3-0-3		
ET-4XX	Technical Elective[3]		3-2-4	
HS-4XX	Elective (HSS)[4]		3-0-3	
ET-4XX	Technical Elective[3]			3-2-4
HS-4XX	Elective (HSS)[4]			3-0-3
MS-XXX	Elective (MS)[4]	3-0-3		
	TOTALS	**28-9-32**	**25-8-29**	**24-7-27**

[1] Transfer students may be eligible to take ET-104S, ET-107S and ET-210S. Consult with an ET-E curriculum advisor.

[2] Credits apply toward junior/senior years of the program.

[3] Technical electives must be taken from the approved technical electives course list. This list also contains the technical electives guidelines and policies and is updated annually. Consult with an ET-E advisor before enrolling in technical electives.

[4] There are 12 credits of elective subjects in the ET-E program which must be taken as follows:
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 3 credits from the management systems (MS) area at the 300- or 400-level (computer programming courses do not qualify in general)

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).

Typical Technical Electives/Sequences (revised periodically)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
Computer Technical Elective Sequence				
ET-484	The UNIX Operating System	3	2	4
ET-489	Advanced C Language	3	2	4
Electronic Communications Technical Elective Sequence				
ET-421	Communication Circuits and Systems	3	2	4
ET-422	Digital Communication Systems	3	2	4
Industrial Electronics and Controls Technical Elective Sequence				
ET-442	Power Electronics	3	2	4
ET-441	Power Systems Analysis	3	2	4
ET-472	Analog and Digital Control Systems	3	2	4
Independent Study/Senior Project Technical Elective Sequence				
ET-499	Independent Study	1	0	4
ET-400	Senior Project	1	0	4
Other Technical Electives				
ET-395	Machine Vision Systems	3	2	4
ET-400	Senior Project	1	0	4
ET-412	Linear Integrated Circuits	3	2	4
ET-418	Electromagnetic Compatibility	3	2	4
ET-419	Optical Electronics	3	2	4
ET-423	Digital Signal Processing and Applications	3	2	4
ET-427	Microwave Components	3	2	4
ET-431	Sensors and Fiber Optic Technology	3	2	4
ET-432	Audio Systems	3	2	4
ET-476	Control of Automation Systems	3	2	4
ET-481	Numerical Methods for Technology	3	2	4
ET-488	Artificial Intelligence and Applications	3	2	4
ET-493	Design of Logic Systems	3	2	4
ET-499	Independent Study	1	0	4
MS-4744	Novell IntraNetWare 4.11 Advanced Administration	3	2	4
MS-476	Novell Service and Support	3	2	4
PH-250	Modern Physics	3	3	4
The following two courses must be taken to receive credit for one technical elective:				
MT-218	Fluid Mechanics	3	2	4
MT-303	Dynamics	3	0	3

BACHELOR OF SCIENCE
SOFTWARE ENGINEERING

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

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 that 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.

Program Goals

The software 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 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 engineering is often practiced in the context of a non-software application domain. An elective sequence provides each student with exposure to at least one application area (e.g., electrical engineering, industrial engineering, mechanical engineering, commercial applications).

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 – V1.0

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
CH-200	Chemistry I	3-2-4		
EN-131	Composition	3-0-3		
GE-100	Intro to Engineering Concepts	3-2-4		
MA-136	Calculus for Engineers I	4-0-4		
OR-100	Freshman Orientation	1-0-0		
CS-182	Computer Programming		3-3-4	
EN-132	Technical Composition		3-0-3	
HU-100	Contemporary Issues		3-0-3	
MA-137	Calculus for Engineers II		4-0-4	
MS-221	Microeconomics		3-0-3	
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	**14-4-15**	**16-3-17**	**12-7-15**
SOPHOMORE YEAR		**4**	**5**	**6**
CS-285	Data Structures	2-2-3		
EE-201	Linear Networks: Steady State Analysis	4-0-4		
MA-230	Discrete Mathematics	4-0-4		
PH-230	Physics of Electricity & Magnetism	3-3-4		
	HSS Elective	3-0-3		
EE-290	Combinational and Sequential Logic		3-3-4	
MA-235	Differential Equations for Engineers		4-0-4	
PH-220	Physics of Heat, Wave Motion & Optics		3-3-4	
SE-280	Software Engineering Process		2-2-3	
CS-280	Embedded Systems Software			3-2-4
CS-286	Algorithms			2-2-3
MA-232	Calculus for Engineers IV			3-0-3
MA-262	Probability and Statistics			3-0-3
SE-281	Software Component Design			3-2-4
	TOTALS	**16-5-18**	**12-8-15**	**14-6-17**

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
CS-321	Computer Graphics	3-3-4		
HS-464	Human Factors in Engineering and Design	2-2-3		
MA-343	Matrix Methods & Linear Programming	3-0-3		
SE-380	Principles of Software Architecture	3-2-4		
SE-381	Formal Methods	3-0-3		
CS-384	Design of Operating Systems		3-2-4	
GE-300	Career & Professional Guidance		0-2-1	
IE-423	Engineering Economy		3-0-3	
SE-3091	Software Development Laboratory I		1-3-3	
SE-382	Software Requirements and Specification		3-0-3	
	HSS Elective		3-0-3	
CS-391	Embedded Computer System Design			3-3-4
CS-393	Computer Architecture			3-2-4
HS-461	Organizational Psychology			3-0-3
SE-3092	Software Development Laboratory II			1-3-3
	Application Domain Elective			3-0-3
	TOTALS	**14-7-17**	**13-7-17**	**13-8-17**
SENIOR YEAR		**10**	**11**	**12**
CS-381	Engineering Systems Analysis with Numerical Methods	3-2-4		
SE-4093	Software Development Laboratory III	1-3-3		
SE-483	Software Verification and Validation	3-0-3		
	Program Elective	3-0-3		
	Application Domain Elective	3-0-3		
SE-400	Senior Design Project I		3-0-3	
	Program Elective		3-0-3	
	Free Elective		3-0-3	
	HSS Elective		3-0-3	
	Application Domain Elective		3-0-3	
HS-432	Ethics for Professional Managers and Engineers			3-0-3
MS-331	Business Law			3-0-3
SE-401	Senior Design Project II			3-0-3
	Program Elective			3-0-3
	HSS Elective			3-0-3
	TOTALS	**13-5-16**	**15-0-15**	**15-0-15**

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.

There are 33 credits of elective subjects in the software engineering program that must be taken as follows:

- 12 credits from the field of humanities and social sciences (HSS): 6 credits of humanities and 6 credits of social science
- 9 credits of approved program electives
- 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 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, HS-455 (an HSS elective), and the free elective.

GENERAL STUDIES DEPARTMENT

Main Office: Walter Schroeder Library, L-328
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 that they might become more sensitive to and more fully aware of themselves and others.

Faculty:

Chairman:
Dr. Roger J. Frankowski

Department Secretary:
Vickie Handy

Professors:
Marvin L. Bollman, Patrick J. Coffey, Joanne M. Dyskow, Dr. Roger J. Frankowski, Veronica S. Haggerty, Robert L. Kleppin, Susannah P. Locke, Leonard A. Vanden Boom

Associate Professors:
Dr. Donald Ashby, Gary C. Boelkins, Dr. Jon K. Borowicz, James W. Friauf, Dr. Richard G. Shrubb

Assistant Professors:
Brian E. Bennett, Connie R. Borowicz, Dr. R. David Kent, Dr. Katherine M. Wikoff

Adjunct Professors:
Howard L. Austin, Dr. James A. Green, Kenneth McAteer, Joseph P. Meloy

Adjunct Associate Professors:
Robert G. Cummisford, Perry D. Nigh, Virginia K. Reinmuller

Adjunct Assistant Professors:
Dale A. Darrow, Lyle N. Maryniak, Dianne L. Weber

Lecturers:
Elizabeth A. Albrecht, Jerome G. Bader, James Brierly, Sara L. Cissna, Susan K. Hoerchner, Sarah S. Kubly, Kathleen A. Rogers, Dana L. Root, Robert Scholz, Mary Spencer, Lucinda M. Staudacher, Pauli Taylor-Boyd, Dr. Portia Wright, Rebecca Wright

Professors Emeriti:
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 (HSS)				
Language Series				
HS-410	Foreign Language I	2	2	3
HS-411	Foreign Language II	2	2	3
HS-412	Foreign Language III	2	2	3
HS-413	Foreign Language IV	3	0	3
HS-414	Foreign Language V	3	0	3
Literature Series				
HS-420	Classical Derivatives	3	0	3
HS-421	Literary Genre	3	0	3
HS-422	British Literature	3	0	3
HS-423	American Literature	3	0	3
HS-424	European Literature	3	0	3
HS-425	Contemporary Literature	3	0	3
HS-426	Survey of Third World Literature	3	0	3
HS-428	Classics in Literature	3	0	3
HS-429	Literature of American Mennonites	3	0	3
Philosophy Series				
HS-431A	Formal Logic	3	0	3
HS-431B	Informal Logic	3	0	3
HS-433	Philosophy	3	0	3
HS-434	Existentialism	3	0	3
HS-435	Philosophy of Religion	3	0	3
HS-436	Metaphysics	3	0	3
HS-437	Praxiology	3	0	3
HS-438	Aesthetics	3	0	3
HS-439	Philosophy of Technology	3	0	3
History Series				
HS-440	Global History I-World to 1500	3	0	3
HS-441	Global History II-World Since 1500	3	0	3
HS-442	Modern European History	3	0	3
HS-443	Russian History	3	0	3
HS-444	United States History	3	0	3

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

Language Rules and HSS Credit 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.

Foreign Language Fulfilling HSS 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 HSS 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 HSS electives.

2) A student who is placed in "Foreign Language II" or "Foreign Language III" will receive three credits of HSS 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 HSS series obligations.

BACHELOR OF SCIENCE OR BACHELOR OF ARTS
TECHNICAL COMMUNICATION

Program Director:
Dr. Richard Shrubb
Office: L-322
Phone: (414) 277-7363
Fax: (414) 277-7462
E-mail: shrubb@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 department chairman, 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 – V2.1

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
PH-100	Intro to Physical Science I	3-2-4		
TC-151	Theory of Communication	3-0-3		
EN-131	Composition	3-0-3		
MA-125	College Algebra I	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
CH-100	Chemistry for Technologists I		3-3-4	
PH-101	Physical Science II		3-2-4	
TC-111	Intro to Technical Communication		2-0-2	
MA-126	Trigonometry		4-0-4	
MT-122	Intro to Materials Technology		3-2-4	
EG-103	Interpreting Engineering Drawings I			3-2-4
HS-431B	Informal Logic			3-0-3
TC-172	Information Processing			2-2-3
MA-127	College Algebra II			4-0-4
MS-221	Microeconomics			3-0-3
	TOTALS	**14-2-14**	**15-7-18**	**15-4-17**
SOPHOMORE YEAR		**4**	**5**	**6**
HS-440	Global History I	3-0-3		
HS-453	American Government	3-0-3		
MS-322	Macroeconomics	3-0-3		
GE-100	Intro to Engineering Concepts	3-2-4		
	Elective (HSS)[2]	3-0-3		
TC-233	Introduction to Report Writing/ Proposal Writing		4-0-4	
TC-261	Research Methods		3-0-3	
EN-241	Speech		2-2-3	
HS-441	Global History II		3-0-3	
MA-341	Business Statistics I		3-0-3	
	Elective (HSS)[2]		3-0-3	
TC-242	Persuasive Speech			3-0-3
MS-184	Intro. Comp. Methods and Applications			2-2-3
MA-342	Business Statistics II			3-0-3
ET-151	AC and DC Circuit Analysis			2-2-3
	Electives (HSS)[2]			6-0-6
	TOTALS	**15-2-16**	**18-2-19**	**16-4-18**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
TC-321	Visual Design Techniques	3-3-4		
MS-331	Business Law	3-0-3		
BE-352	Survey of Biomedical Engineering	3-0-3		
CS-100	Intro. to Engineering Computing	2-2-3		
	Technical Elective[2]	3-0-3		
TC-332	Advanced Technical Writing		3-0-3	
TC-351	Organizational Communication		3-0-3	
EN-342	Group Discussion		3-0-3	
HS-461	Organizational Psychology		3-0-3	
CS-182	Computer Programming		3-3-4	
	Technical Elective[2]		3-0-3	
TC-342	Professional Presentation Techniques			2-2-3
TC-452	Interpersonal Communication			3-0-3
ET-251	AC and DC Machines and Controls			3-2-4
MT-151	Applications of M.E. Technology			3-0-3
TC-381	Marketing Communications			3-0-3
	TOTALS	**14-5-16**	**18-3-19**	**16-4-16**
SENIOR YEAR		**10**	**11**	**12**
TC-432	Writing & Editing for Publication	3-0-3		
TC-451	Mass Communication	3-0-3		
TC-453	Intercultural Communication	3-0-3		
MS-354	Principles of Accounting	3-0-3		
	Technical Electives[2]	6-0-6		
TC-499	Internship		6-0-6	
HS-494	Creative Thinking		3-0-3	
IE-340	Project Management		3-0-3	
	Technical Elective[2]		3-0-3	
HS-432	Ethics for Professional Managers & Engineers			3-0-3
HS-415	Cultural Dimensions			3-0-3
OR-402	Professional Guidance			1-0-1
	Technical Electives[2]			6-0-6
	Business & Management Systems Elective[2]			3-0-3
	TOTALS	**18-0-18**	**15-0-15**	**16-0-16**

[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 Bachelor of Science in Technical Communication degree program, which must be taken as follows:

- 12 credits from the field of humanities and social sciences
- 3 credits from business and 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 business and management systems disciplines

BACHELOR OF ARTS
TECHNICAL COMMUNICATION
Model Full-Time Track – V2.1

		----------QUARTER----------		
FRESHMANYEAR		**1**	**2**	**3**
PH-100	Intro to Physical Science I	3-2-4		
TC-151	Theory of Communication	3-0-3		
EN-131	Composition	3-0-3		
HS-410	Foreign Language I[2]	2-2-3		
MA-125	College Algebra I	4-0-4		
OR-100	Freshman Orientation[1]	1-0-0		
TC-111	Intro to Technical Communication		2-0-2	
EN-241	Speech		2-2-3	
HS-411	Foreign Language II[2]		2-2-3	
MA-126	Trigonometry		4-0-4	
PH-101	Physical Science II		3-2-4	
TC-172	Information Processing			2-2-3
EG-103	Interpreting Engineering Drawings			3-2-4
HS-412	Foreign Language III[2]			2-2-3
MA-127	College Algebra II			4-0-4
MS-221	Microeconomics			3-0-3
	TOTALS	**16-4 -17**	**13-6-16**	**14-6-17**
SOPHOMORE YEAR		**4**	**5**	**6**
HS-413	Foreign Language IV[2]	3-0-3		
HS-440	Global History I	3-0-3		
MS-322	Macroeconomics	3-0-3		
GE-100	Intro to Engineering Concepts	3-2-4		
	Elective (HSS)[3]	3-0-3		
TC-233	Intro to Report Writing/Proposal Writing		4-0-4	
TC-261	Research Methods		3-0-3	
HS-414	Foreign Language V[2]		3-0-3	
HS-441	Global History II		3-0-3	
MA-341	Business Statistics I		3-0-3	
EN-342	Group Discussion		3-0-3	
TC-242	Persuasive Speech			3-0-3
HS-431B	Informal Logic			3-0-3
HS-461	Organizational Psychology			3-0-3
MS-184	Intro. Comp. Methods and Applications			2-2-3
MA-342	Business Statistics II			3-0-3
ET-151	AC and DC Circuit Analysis			2-2-3
	TOTALS	**15-2-16**	**19-0-19**	**16-4-18**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
TC-321	Visual Design Techniques	3-3-4		
MS-331	Business Law	3-0-3		
CH-100	Chemistry for Technologists I	3-3-4		
CS-100	Intro to Engineering Computing	2-2-3		
BE-352	Survey of Biomedical Engineering	3-0-3		
TC-332	Advanced Technical Writing		3-0-3	
TC-351	Organizational Communication		3-0-3	
MT-122	Intro to Materials Technology		3-2-4	
CS-182	Computer Programming		3-3-4	
	Technical Elective[3]		3-0-3	
TC-342	Professional Presentation Techniques			2-2-3
TC-452	Interpersonal Communication			3-0-3
ET-251	AC and DC Machines and Controls			3-2-4
MT-151	Applications of M.E. Technology			3-0-3
TC-381	Marketing Communication			3-0-3
	TOTALS	**14-8 -17**	**14-4-16**	**14-4-16**

SENIOR YEAR		10	11	12
TC-432	Writing & Editing for Publication	3-0-3		
TC-451	Mass Communication	3-0-3		
TC-453	Intercultural Communication	3-0-3		
HS-453	American Government	3-0-3		
MS-354	Principles of Accounting	3-0-3		
	Elective (HSS)[3]	3-0-3		
TC-499	Internship		6-0-6	
HS-494	Creative Thinking		3-0-3	
	Elective (HSS)[3]		3-0-3	
IE-340	Project Management		3-0-3	
HS-432	Ethics for Professional Managers & Engineers			3-0-3
HS-415	Cultural Dimensions			3-0-3
OR-402	Professional Guidance			1-0-1
	Elective (HSS)[3]			3-0-3
	Business and Management Systems Elective			3-0-3
	Technical Elective			3-0-3
	TOTALS	**18-0-18**	**15-0-15**	**16-0-16**

[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 bachelor of science degree by substituting 15 technical elective credits for the required foreign language.

[3] There are 21 credits of electives in the Bachelor of Arts in Technical Communication degree program, which must be taken as follows:
- 12 credits from the field of humanities and social sciences
- 3 credits from business and management systems
- 6 credits from mathematics, science, engineering, engineering technology or computer science

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 HS-467; AF-400 for HS-471; AF-401 for HS-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 or two years of college credits. 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 such a two-year associate degree or the equivalent in applied science, business or science may transfer with junior standing and expect a full two years of advanced credit. Prerequisite subjects, if needed, may be scheduled.

BACHELOR OF SCIENCE
TECHNICAL COMMUNICATION - 2 + 2 DEGREE[1]
Model Full-Time Track – V2.0

		----------QUARTER----------		
THIRD YEAR		**7**	**8**	**9**
EN-241	Speech	2-2-3		
HS-431B	Informal Logic	3-0-3		
HS-440	Global History I	3-0-3		
HS-453	American Government	3-0-3		
OR-301	Transfer Student Orientation	1-0-0		
TC-151	Theory of Communication	3-0-3		
MS-221	Microeconomics	3-0-3		
TC-351	Organizational Communication		3-0-3	
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	
HS-441	Global History II		3-0-3	
OR-402	Professional Guidance		1-0-1	
TC-171	Information Processing			2-2-3
TC-242	Persuasive Speech			3-0-3
TC-452	Interpersonal Communication			3-0-3
MS-331	Business Law			3-0-3
HS-415	Cultural Dimensions			3-0-3
	Elective (HSS)			3-0-3
	TOTALS	**18-2-18**	**16-0-16**	**17-2-18**
FOURTH YEAR		**10**	**11**	**12**
TC-321	Visual Design Techniques	3-3-4		
TC-432	Writing & Editing for Publication	3-0-3		
TC-451	Mass Communication	3-0-3		
TC-453	Intercultural Communication	3-0-3		
MS-354	Principles of Accounting	3-0-3		
	Elective (HSS)	3-0-3		
TC-332	Advanced Technical Writing		3-0-3	
EN-342	Group Discussion		3-0-3	
TC-499	Internship		6-0-6	
MS-322	Macroeconomics		3-0-3	
HS-432	Ethics for Professional Managers & Engineers		3-0-3	
TC-381	Marketing Communications			3-0-3
HS-494	Creative Thinking			3-0-3
HS-461	Organizational Psychology			3-0-3
TC-342	Professional Presentation Techniques			2-2-3
	Electives (HSS)			6-0-6
	TOTALS	**18-3-19**	**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.

MINOR IN TECHNICAL COMMUNICATION

A student enrolled in engineering, engineering technology or business/management programs at MSOE 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 graduates are sought by business, industry and government since they would possess two highly important talents.

The minor in technical communication is above and beyond the requirements established in the engineering, technology and business/management curricula.

The minor in technical communication requires 26 quarter credits in English or technical communication. In all instances, students in the various programs will have taken at least three courses (nine credits) of the minor requirement. The following courses 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-328
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.

Faculty:

Chairman:
Dr. Peter K.F. Kuhfittig

Department Secretary:
Vickie M. Handy

Professor:
George L. Edenharder

Associate Professors:
Dr. Karl H. David, Edward J. Griggs, Robert P. Schilleman

Assistant Professor:
James P. Carr

Senior Lecturer:
Dr. Robert R. Rice

Lecturers:
Carl C. Edmund, Harris L. Huenink, Jane R. Nichols, Dr. Terry A. Nyman, Nancy E. Olmsted, Dr. Badri Varma

Professors Emeriti:
Stanley J. Guberud, Dorothy Johnson, Janet Klein, Andrew B. Schmirler

Mathematics Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
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

MECHANICAL ENGINEERING (ME) DEPARTMENT

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

At MSOE, the Mechanical Engineering Department grants four-year baccalaureate degrees in mechanical engineering, industrial engineering and mechanical engineering technology.

Generally, the degree courses are involved in design, energy and/or production. Design includes mechanisms, material selection, and control of machines and systems. Energy includes energy conversion, and control and transmission, as well as analysis of power cycles, engines and other machines. Production includes planning, organization, materials processing, methods and equipment design, ergonomics, quality management and process optimization.

Departmental laboratories include the following: energy laboratories, fluid power/controls laboratory, the flexible manufacturing cell and center, Harley-Davidson Georgeson Computer Design Laboratory, engine test cells, the chassis laboratory, the Human Factors/Ergonomics Laboratory (operated in cooperation with the General Studies Department), the ME Service Machine Shop and Structures Laboratory, strength testing, heat treatment, hardness testing, foundry, materials laboratory and the Rapid Prototyping Laboratory.

Faculty:

Chairman:
Dr. Matthew A. Panhans

Secretary:
Gloria J. Schmid

Professors:
Dr. Cynthia W. Barnicki, John H. Farrow, Dr. Charles F. James Jr., Dr. Robert A. Kern, Lawrence B. Korta, Thomas J. Labus, Dr. Matthew A. Panhans, Dr. John G. Slater, Dr. Warren E. Snyder, Paul H. Unangst

Associate Professors:
Dr. Robert Y. Bodine, Lukie L. Christie, John L. Ficken, Harvey L. Hoy, Firouzeh Keshmiri, Dr. Subha F. Kumpaty, Michael J. Swedish

Assistant Professors:
Dr. Robert S. Crockett, William E. Howard, Dr. John H. Lumkes Jr., Dr. Joseph C. Musto, Lisa A. Zidek

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:
Robert D. Harenda, Stephen H. Rather

Distinguished Lecturer:
Dr. David A. Pilati

Senior Lecturer:
Jack L. Johnson

Lecturers:
Niranjan N. Desai, Timothy J. Devine, John A. Dudek, Dr. William Farrow, Dr. Gottfried F.J. Hoffmann, William F. Hren, Julianne Hunter, Dennis R. Joram, Dr. Richard H. Jungmann, Robin L Knoll, Carol Lomonaco, Richard Minch, Phillip S. Mueller, Rick S. Ottman, Thomas F. Sipla, Douglas V. Shuit, Craig Tallar, Thomas S. Wanke, Alan J. Zajac

Professors Emeriti:
Edward R. Allen, Joseph L. Deverse, Thomas R. Gaulke, Paul A. Gutting, Arthur B. Michael, Paul P. Perdue, Lloyd E. Vlies

BACHELOR OF SCIENCE
INDUSTRIAL ENGINEERING

Acting Program Director:
Professor Lawrence B. Korta
Office: S-112D
Phone: (414) 277-7390
Fax: (414) 277-2222
E-mail: korta@msoe.edu

Industrial engineers are directly involved in the effective integration of the critical resources of business and industry: the design of systems of materials, equipment and machines, methods and procedures, information, energy and, most importantly, people. Quality and productivity improvement are critical issues that must be successfully addressed by industrial engineers in both industry and in the institutional/service sector of today's economy.

Industrial engineering course work establishes a solid general foundation upon which are built the specialized technical and management knowledge and skills enabling graduates to make significant contributions in a variety of enterprises such as manufacturing, warehousing and distribution, banking, insurance and health care.

Program Goals

This program was developed in response to the needs of industry. The goals of the industrial engineering program are to produce 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

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

MSOE's industrial engineering program also actively collaborates 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 – V4.8

FRESHMAN YEAR		1	2	3
		----------QUARTER----------		
EG-120	Engineering Graphics I	1-3-2		
GE-100	Intro to Engineering Concepts	3-2-4		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
	HSS Elective[2]	3-0-3		
CS-150	Introduction to Computer Programming		2-2-3	
MA-136	Calculus for Engineers I		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
MS-221	Microeconomics		3-0-3	
HS-494	Creative Thinking			3-0-3
MA-137	Calculus for Engineers II			4-0-4
PH-110	Physics of Mechanics			3-2-4
CH-201	Chemistry II			3-2-4
ME-190	Computer Applications in Engineering			1-3-2
	TOTALS	**14-5-15**	**15-4-17**	**14-7-17**

SOPHOMORE YEAR		4	5	6
ME-255	Engineering Statics for Non-MEs	3-0-3		
MA-262	Probability & Statistics	3-0-3		
PH-230	Physics of Electricity & Magnetism	3-3-4		
MA-231	Calculus for Engineers III	4-0-4		
EN-241	Speech	2-2-3		
EE-252	DC & AC Circuit Analysis		4-0-4	
IE-201	Intro to Industrial Engineering		2-0-2	
ME-256	Engineering Dynamics for Non-MEs		3-0-3	
MA-235	Differential Equations for Engineers		4-0-4	
PH-220	Physics of Heat, Wave Motion & Optics		3-3-4	
ME-257	Strength of Materials IE			3-2-4
EE-253	Analysis & Control of Electromagnetic Devices			3-2-4
MA-232	Calculus for Engineers IV			3-0-3
PH-250	Modern Physics			3-3-4
	TOTALS	**15-5-17**	**16-3-17**	**12-7-15**

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
IE-345	Work Planning & Methods Development	2-2-3		
IE-381	Deterministic Modeling & Optimization	3-0-3		
EE-354	Digital Circuits & Microprocessor Apps.	3-2-4		
IE-379	Ergonomics	3-2-4		
MS-331	Business Law	3-0-3		
IE-348	Quality Assurance		3-0-3	
IE-382	Stochastic Processes		3-0-3	
IE-423	Engineering Economy		3-0-3	
ME-354	Thermodynamics		3-0-3	
MS-354	Principles of Accounting		3-0-3	
	HSS Elective[2]		3-0-3	
IE-347	Facilities Design			3-2-4
IE-383	Simulation			3-2-4
IE-426	Materials & Manufacturing Processes			3-2-4
HS-461	Organizational Psychology			3-0-3
	Technical Elective[2]			3-0-3
	TOTALS	**14-6-17**	**18-0-18**	**15-6-18**
SENIOR YEAR		**10**	**11**	**12**
IE-490	Industrial Engineering Design Process	2-0-2		
IE-370	Computer Numerical Control	3-2-4		
MS-358	Managerial Cost Accounting I	3-0-3		
	Technical Elective[2]	3-0-3		
	Management Systems Elective[3]	3-0-3		
	HSS Elective[2]	3-0-3		
IE-491	Industrial Engineering Design Project		1-0-3	
IE-476	Robotics Systems		3-2-4	
OR-402	Professional Guidance		1-0-1	
HS-432	Ethics for Professional Managers & Engineers		3-0-3	
	Technical Elective[2]		3-0-3	
	Science/Math Elective[2]		3-0-3	
IE-411	Compensation System Design			3-0-3
IE-477	Computer Integrated Manufacturing Systems			3-0-3
	Technical Elective[2]			3-0-3
MS-327	International Business			3-0-3
	Free Elective[2]			3-0-3
	HSS Elective[2]			3-0-3
	TOTALS	**17-2-18**	**14-2-17**	**18-0-18**

[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.

[2] There are 33 credits of elective subjects in the industrial engineering program. Students, in collaboration with their faculty advisors, 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 sciences (HSS), 6 of which must be from one HSS series
- 3 credits science electives (any upper-division math, physics, chemistry, biology or earth science course)
- 3 credits of an upper-division course (free elective)

[3] In order to obtain the minor in management, the industrial engineering student must take MS-342 and MS-356, and one course 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-340	Project Management	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

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 advisor.

Students in Air Force ROTC may make the following substitutions in the above program: AF-300 for MS-441, a management systems elective; AF-401 for HS-455, an HSS political science series elective; AF-402 for MS-431; 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: S258-D
Phone: (414) 277-7455
Fax: (414) 277-2222
E-mail: musto@msoe.edu

The broadest of all types of engineering, 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, materials 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 to 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 and the humanities

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/or 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 – V9.9

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
GE-100	Intro to Engineering Concepts	3-2-4		
EG-120	Engineering Graphics I	1-3-2		
CS-150	Intro to Computer Programming	2-2-3		
EN-131	Composition	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
	HSS Elective[2]	3-0-3		
HU-100	Contemporary Issues		3-0-3	
ME-190	Computer Applications in Engineering		1-3-2	
MA-136	Calculus for Engineers I		4-0-4	
CH-200	Chemistry I		3-2-4	
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-201	Chemistry II			3-2-4
EN-241	Speech			2-2-3
	TOTALS	**13-7-15**	**14-5-16**	**12-6-15**
SOPHOMORE YEAR		**4**	**5**	**6**
ME-205	Engineering Statics	4-0-4		
MA-231	Calculus for Engineers III	4-0-4		
MA-262	Probability and Statistics	3-0-3		
PH-230	Physics of Electricity & Magnetism	3-3-4		
MS-221	Microeconomics	3-0-3		
EE-201	Linear Networks: Steady-State Analysis		4-0-4	
ME-206	Engineering Dynamics		4-0-4	
MA-235	Differential Equations for Engineers		4-0-4	
PH-220	Physics of Heat, Wave Motion & Optics		3-3-4	
EE-253	Analysis & Control of Electromagnetic Devices			3-2-4
ME-207	Strength of Materials I			4-0-4
MA-232	Calculus for Engineers IV			3-0-3
PH-250	Modern Physics			3-3-4
	HSS Elective[2]			3-0-3
	TOTALS	**17-3-18**	**15-3-16**	**16-5-18**

JUNIOR YEAR		----------QUARTER---------- 7	8	9
ME-300	Modeling and Numerical Analysis	3-2-4		
ME-309	Strength of Materials II	3-2-4		
ME-311	Principles of Thermodynamics I	3-0-3		
ME-321	Science of Engineering Materials I	3-0-3		
	Elective[2]	3-0-3		
ME-314	Principles of Thermodynamics II		4-0-4	
ME-317	Fluid Mechanics		3-3-4	
ME-322	Science of Engineering Materials II		3-2-4	
ME-361	Dynamics of Machinery		2-2-3	
	Elective[2]		3-0-3	
ME-301	Computer-Aided Engineering			2-2-3
ME-316	Thermodynamics Applications			3-3-4
ME-323	Materials Processing			3-2-4
ME-463	Design of Machine Components			2-2-3
	Elective[2]			3-0-3
	TOTALS	**15-4-17**	**15-7-18**	**13-9-17**

SENIOR YEAR		10	11	12
EE-354	Digital Circuits & Microprocessor Apps.	3-2-4		
ME-413	Heat Transfer	3-2-4		
ME-460	Finite Element Methods	2-2-3		
ME-490	Senior Design Project I	1-0-1		
OR-402	Professional Guidance	1-0-1		
HS-461	Organizational Psychology	3-0-3		
	Elective (Design Project)[2]	1-3-3		
ME-401	Vibrations		3-0-3	
ME-431	Automatic Control Systems I		3-2-4	
ME-491	Senior Design Project II		1-0-3	
IE-423	Engineering Economy		3-0-3	
	Electives[2]		6-0-6	
ME-432	Automatic Control Systems II			3-2-4
MS-331	Business Law			3-0-3
HS-432	Ethics for Professional Managers and Engineers			3-0-3
	Electives[2]			6-0-6
	TOTALS	**14-9-19**	**16-2-19**	**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 30 credits of elective subjects in the mechanical engineering program that must be taken as follows:
- 12 credits from humanities and social sciences (HSS), 6 of which must be from one HSS series
- 3 credits from the fields of mathematics or science
- 12 credits from the engineering elective list to be divided as follows: 3 credits in engineering science; 3 credits in design project, and 6 credits in applications of design
- 3 credits from any upper-division (300- or 400-level) subject (free elective)

Engineering technology courses may not be substituted for any mechanical engineering course, required or elective.

Students in Air Force ROTC may make the following substitutions in the mechanical engineering program: AF-300 for the free elective, AF-401 for HSS-455 (an HSS elective), and AF-402 for MS-331.

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*
Engineering Science Electives				
GE-470	Robotics Fundamentals	3	0	3
ME-402	Vehicle Dynamics	3	0	3
ME-419	Internal Combustion Engines	3	0	3
ME-424	Engineering with Plastics	3	0	3
ME-428	Mechanics of Composite Materials and Structures	3	0	3
ME-444	Modern Rapid Prototyping Fundamentals	3	0	3
ME-471	Fluid Power Circuits	3	0	3
ME-472	Advanced Hydraulic Circuits	3	0	3
ME-481	Aerodynamics	3	0	3
ME-499	Independent Study	3	0	3
Design Project Electives				
ME-462	Vehicle Design Project	1	3	3
ME-464	Mechanical System Design Project	1	3	3
ME-466	Aero Design Project	2	2	3
ME-485	Energy System Design Project	2	2	3
Applications of Design Electives				
ME-362	Design of Machinery	3	0	3
ME-403	Design for Fatigue	3	0	3
ME-411	Fluid Mechanics Applications	3	0	3
ME-429	Design of Advanced Composite Structures	3	0	3
ME-423	Materials Selection	3	0	3
ME-445	Modern Rapid Prototyping Design Applications	3	0	3
ME-475	Design of Fluid Power Circuits	2	2	3
ME-480	HVAC System Design	3	0	3
ME-492	Senior Design Project III	1	0	3
ME-498	Topics in Application of Design	3	0	3

BACHELOR OF SCIENCE
MECHANICAL ENGINEERING TECHNOLOGY

Program Director:
Dr. Cynthia W. Barnicki
Office: S-112 E
Phone: (414) 277-7461
Fax: (414) 277-2222
E-mail: barnickc@msoe.edu

The mechanical engineering technology program emphasizes the application of sciences and technology in the areas of fluid power, mechanical design, thermal sciences and materials.

The program consists of a core curriculum for the first two years which provides a thorough grounding in mathematics, science and some technical subjects; the core is used as the base on which the technical specialty is built.

The student selects a technical specialty in design, energy or fluid power at the start of his/her third year. The technical specialty sequence consists of five courses (19 credits) cumulating in a project course. The third and fourth years continue with the technical subjects, advanced communications, humanities and the technical specialty.

Program Goals

The goals of the mechanical engineering technology program are:

to produce graduates who have a strong technical currency in areas relevant to industry

to produce graduates who have a strong background in technical science, math, general education, technical skills and technical specialties who can appreciate and have the ability to participate in continued learning

to provide an intimate learning environment that encourages interaction between students and faculty and is responsive to the needs of traditional and non traditional students

Completion of the four-year 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 Full-Time Track – V1.12

FRESHMAN YEAR		----------QUARTER---------- 1	2	3
MT-100	Intro to Mechanical Eng. Technology	3-3-4		
EG-122	Engineering Graphics I	1-3-2		
MS-183	Intro. To Computer Methods & Applications	2-0-2		
MA-126	Trigonometry[4]	4-0-4		
HU-100	Contemporary Issues	3-0-3		
EN-131	Composition	3-0-3		
OR-100	Freshman Orientation[1]	1-0-0		
MT-122	Intro. To Materials Technology		3-2-4	
EG-123	Engineering Graphics II		1-3-2	
CS-150	Intro to Computer Programming		2-2-3	
CH-100	Chemistry for Technologists		3-3-4	
MA-127	College Algebra II		4-0-4	
MT-123	Intro to Materials Processing			3-2-4
PT-110	Physics for Technologists I			3-3-4
MA-128	Analytic Geometry & Calculus I			4-0-4
MS-221	Microeconomics			3-0-3
EN-132	Technical Composition			3-0-3
	TOTALS	**17-6-18**	**13-10-17**	**16-5-18**

SOPHOMORE YEAR		4	5	6
MT-200	Statics	4-0-4		
MT-267	Dimensioning and Tolerancing	2-2-3		
PT-220	Physics for Technologists II	3-3-4		
MA-225	Calculus II for Technologists	4-0-4		
EN-241	Speech	2-2-3		
MT-205	Strength of Materials		4-0-4	
MT-228	Machining Processes		2-2-3	
MT-218	Fluid Mechanics		3-2-4	
ET-151	AC & DC Circuit Analysis		2-2-3	
MA-226	Calculus III for Technologists		4-0-4	
MT-262	Mechanical Components			3-3-4
MT-215	Thermodynamic Fundamentals			3-0-3
FP-272	Fluid Power Circuits			3-3-4
ET-190	Logic and Switching Circuits			3-2-4
MA-227	Differential Equations for Technologists			3-0-3
	TOTALS	**15-7-18**	**15-6-18**	**15-8-18**

[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.

NOTE: Students are required to declare a technical specialty in design, energy systems or fluid power prior to starting the junior year.

Design Specialty

JUNIOR YEAR		7	8	9
		----------QUARTER----------		
MT-314	Thermodynamic Cycles	3-3-4		
ET-298	Microprocessor Principles and Apps.	2-2-3		
IE-423	Engineering Economy	3-0-3		
MT-303	Dynamics	3-0-3		
MT-361	Applied Strength of Materials	3-3-4		
MT-316	Thermodynamic Applications		3-0-3	
MT-393	Applied Finite Element Analysis		2-2-3	
EN-332	Applied Technical Communication		3-2-4	
HS-494	Creative Thinking		3-0-3	
MT-362	Dynamics of Machinery		3-3-4	
MT-317	Heat Transfer			3-2-4
MT-331	Electric Motors			4-0-4
MT-342	Manufacturing Process Engineering			3-2-4
MT-302	Strength of Materials Laboratory			0-3-1
MT-363	Applied Mechanical Design			3-3-4
	TOTALS	**14-8-17**	**14-7-17**	**13-10-17**

SENIOR YEAR		10	11	12
MT-432	Power Transmission Control	2-2-3		
ET-355	Electronics and Instrumentation	3-2-4		
MT-490	Professional Orientation	2-0-0		
HS-461	Organizational Psychology	3-0-3		
	Free Elective[2]	3-0-3		
MT-466	Tool Design	2-2-3		
MT-412	Thermodynamics Laboratory		0-3-1	
MT-433	Feedback Control Systems		3-2-4	
MT-494	Senior Project Phase I[3]		1-0-1	
	Math-Science Elective[2]		3-0-3	
	HSS Elective[2]		3-0-3	
MT-468	Mechanical Design Projects		3-3-4	
MT-495	Senior Projects II[3]			1-0-2
MS-441	Supervision			3-0-3
HS-432	Ethics			3-0-3
	HSS Electives[2]			6-0-6
	Free Elective[2]			3-0-3
	TOTALS	**15-6-16**	**13-8-16**	**16-0-17**

[2] There are 18 credits of elective subjects in the MET program which must be taken as follows:
- 3 credits from mathematics or science courses.
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 6 credits free electives

[3] MT-400 Senior Project (1-0-3) is a one-term course which may be taken in place of MT-494 and MT-495. It runs every term in the evening.

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).

Energy Systems Specialty

JUNIOR YEAR		QUARTER 7	QUARTER 8	QUARTER 9
MT-314	Thermodynamic Cycles	3-3-4		
ET-298	Microprocessor Principles and Apps.	2-2-3		
IE-423	Engineering Economy	3-0-3		
MT-303	Dynamics	3-0-3		
MT-381	Energy Source Alternatives	3-3-4		
MT-316	Thermodynamic Applications		3-0-3	
MT-393	Applied Finite Element Analysis		2-2-3	
EN-332	Applied Technical Communication		3-2-4	
HS-494	Creative Thinking		3-0-3	
MT-382	Heating, Ventilating & Air Conditioning		3-3-4	
MT-317	Heat Transfer			3-2-4
MT-331	Electric Motors			4-0-4
MT-342	Manufacturing Process Engineering			3-2-4
MT-302	Strength of Materials Laboratory			0-3-1
MT-383	Internal Combustion Engines			3-3-4
	TOTALS	**14-8-17**	**14-7-17**	**13-10-17**

SENIOR YEAR		QUARTER 10	QUARTER 11	QUARTER 12
MT-432	Power Transmission Control	2-2-3		
ET-355	Electronics and Instrumentation	3-2-4		
MT-490	Professional Orientation	2-0-0		
HS-461	Organizational Psychology	3-0-3		
	Free Elective[2]	3-0-3		
MT-484	Power System Design	2-2-3		
MT-412	Thermodynamics Laboratory		0-3-1	
MT-433	Feedback Control Systems		3-2-4	
MT-494	Senior Project Phase I[3]		1-0-1	
	Math-Science Elective[2]		3-0-3	
	HSS Elective[2]		3-0-3	
MT-488	Energy System Design		3-3-4	
MT-495	Senior Projects II[3]			1-0-2
MS-441	Supervision			3-0-3
HS-432	Ethics			3-0-3
	HSS Electives[2]			6-0-6
	Free Elective[2]			3-0-3
	TOTALS	**15-6-16**	**13-8-16**	**16-0-17**

The energy systems specialty courses are offered during evening hours only, with sufficient enrollment.

[2] There are 18 credits of elective subjects in the MET program which must be taken as follows:
- 3 credits from mathematics or science courses
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 6 credits free electives

[3] MT-400 Senior Project (1-0-3) is a one-term course which may be taken in place of MT-494 and MT-495. It runs every term in the evening.

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).

Fluid Power Specialty

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
MT-314	Thermodynamic Cycles	3-3-4		
ET-298	Microprocessor Principles and Apps.	2-2-3		
IE-423	Engineering Economy	3-0-3		
MT-303	Dynamics	3-0-3		
FP-373	Industrial Pneumatics	3-2-4		
MT-316	Thermodynamic Applications		3-0-3	
MT-393	Applied Finite Element Analysis		2-2-3	
EN-332	Applied Technical Communication		3-2-4	
HS-494	Creative Thinking		3-0-3	
FP-374	Hydraulic Maintenance		3-2-4	
MT-317	Heat Transfer			3-2-4
MT-331	Electric Motors			4-0-4
MT-342	Manufacturing Process Engineering			3-2-4
MT-302	Strength of Materials Laboratory			0-3-1
FP-375	Mobile Hydraulics			3-2-4
	TOTALS	**14-7-17**	**14-6-17**	**13-9-17**
SENIOR YEAR		**10**	**11**	**12**
MT-432	Power Transmission Control	2-2-3		
ET-355	Electronics and Instrumentation	3-2-4		
MT-490	Professional Orientation	2-0-0		
HS-461	Organizational Psychology	3-0-3		
	Free Elective [2]	3-0-3		
FP-473	Electrohydraulic Components	3-2-4		
MT-412	Thermodynamics Laboratory		0-3-1	
MT-433	Feedback Control Systems		3-2-4	
MT-494	Senior Project Phase I[3]		1-0-1	
	Math-Science Elective[2]		3-0-3	
	HSS Elective[2]		3-0-3	
FP-475	Fluid Power Design Projects		2-2-3	
MT-495	Senior Projects II[3]			1-0-2
MS-441	Supervision			3-0-3
HS-432	Ethics			3-0-3
	HSS Electives[2]			6-0-6
	Free Elective[2]			3-0-3
	TOTALS	**16-6-17**	**12-7-15**	**16-0-17**

The fluid power specialty courses are offered during evening hours only. with sufficient enrollment.

[2] There are 18 credits of elective subjects in the MET program which must be taken as follows:
- 3 credits from mathematics or science courses
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 6 credits free electives

[3] MT-400 Senior Project (1-0-3) is a one-term course which may be taken in place of MT-494 and MT-495. It runs every term in the evening.

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
MECHANICAL ENGINEERING TECHNOLOGY
DESIGN SPECIALTY[1]
Model Part-Time Track – V1.14

FRESHMAN AND SOPHOMORE YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MT-100	Intro. To Mechanical Engineering Technology	3-3-4		
MS-183	Intro. To Computer Methods & Applications	2-0-2		
MA-126	Trigonometry		4-0-4	
EN-131	Composition		3-0-3	
MA-127	College Algebra II			4-0-4
CS-150	Introduction to Computer Programming			2-2-3
CH-100	Chemistry for Technologists	3-3-4		
EG-122	Engineering Graphics I	1-3-2		
MA-128	Analytic Geometry and Calculus I		4-0-4	
EN-132	Technical Composition		3-0-3	
MT-122	Intro. To Materials Technology			3-2-4
MA-225	Calculus II for Technologists			4-0-4
MT-123	Intro. To Materials Processing	3-2-4		
PT-110	Physics for Technologists I	3-3-4		
MT-200	Statics		4-0-4	
PT-220	Physics for Technologists II		3-3-4	
MT-205	Strength of Materials			4-0-4
EG-123	Engineering Graphics II			1-3-2
MT-218	Fluid Mechanics	3-2-4		
MA-226	Calculus III for Technologists	4-0-4		
FP-272	Fluid Power Circuits		3-3-4	
MT-267	Dimensioning and Tolerancing		2-2-3	
MT-228	Machining Processes			2-2-3
MA-227	Differential Equations for Technologists			3-0-3
MS-221	Microeconomics			3-0-3
ET-151	AC & DC Circuit Analysis	2-2-3		
MT-215	Thermodynamic Fundamentals	3-0-3		
ET-190	Logic and Switching Circuits		3-2-4	
MT-262	Mechanical Components		3-3-4	
HU-100	Contemporary Issues			3-0-3
EN-241	Speech			2-2-3

JUNIOR AND SENIOR YEARS		QUARTER FA	QUARTER WI	QUARTER SP
EN-332	Applied Technical Communication	3-2-4		
IE-423	Engineering Economy	3-0-3		
MT-314	Thermodynamic Cycles		3-3-4	
MT-303	Dynamics		3-0-3	
MT-316	Thermodynamic Applications			3-0-3
MT-393	Applied Finite Element Analysis			2-2-3
HS-494	Creative Thinking			3-0-3
MT-317	Heat Transfer	3-2-4		
MT-302	Strength of Materials Laboratory	0-3-1		
HS-461	Organizational Psychology		3-0-3	
ET-355	Electronics and Instrumentation		3-2-4	
MT-412	Thermodynamics Laboratory			0-3-1
	Math-Science Elective[2]			3-0-3
MT-342	Manufacturing Process Engineering	3-2-4		
MS-441	Supervision	3-0-3		
MT-361	Applied Strength of Materials		3-3-4	
ET-298	Microprocessor Principles and Applications		2-2-3	
MT-362	Dynamics of Machines			3-3-4
HS-432	Ethics			3-0-3
MT-363	Applied Mechanical Design	3-3-4		
	HS Elective[2]	3-0-3		
MT-466	Tool Design		2-2-3	
	HS Elective[2]		3-0-3	
MT-468	Mechanical Design Projects			3-2-4
	Free Elective[2]			3-0-3
MT-331	Electric Motors	4-0-4		
MT-490	Professional Orientation	2-0-0		
MT-432	Power Transmission Control		2-2-3	
MT-400	Senior Project		1-0-3	
	Free Elective[2]		3-0-3	
MT-433	Feedback Control Systems			3-2-4
	HS Elective[2]			3-0-3

[1]Students are required to declare a major in the design, energy or fluid power technical specialty prior to starting the junior year.

[2]There are 18 credits of elective subjects in the MET program which must be taken as follows:
- 3 credits from mathematics or science courses
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 6 credits of free 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).

BACHELOR OF SCIENCE
MECHANICAL ENGINEERING TECHNOLOGY
ENERGY SYSTEMS SPECIALTY[1]
Model Part-Time Track – √1.14

FRESHMAN AND SOPHOMORE YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MT-100	Intro. To Mechanical Engineering Technology	3-3-4		
MS-183	Intro. To Computer Methods & Applications	2-0-2		
MA-126	Trigonometry		4-0-4	
EN-131	Composition		3-0-3	
MA-127	College Algebra II			4-0-4
CS-150	Introduction to Computer Programming			2-2-3
CH-100	Chemistry for Technologists	3-3-4		
EG-122	Engineering Graphics I	1-3-2		
MA-128	Analytic Geometry and Calculus I		4-0-4	
EN-132	Technical Composition		3-0-3	
MT-122	Intro. To Materials Technology			3-2-4
MA-225	Calculus II for Technologists			4-0-4
MT-123	Intro. To Materials Processing	3-2-4		
PT-110	Physics for Technologists I	3-3-4		
MT-200	Statics		4-0-4	
PT-220	Physics for Technologists II		3-3-4	
MT-205	Strength of Materials			4-0-4
EG-123	Engineering Graphics II			1-3-2
MT-218	Fluid Mechanics	3-2-4		
MA-226	Calculus III for Technologists	4-0-4		
FP-272	Fluid Power Circuits		3-3-4	
MT-267	Metrology and Tolerancing		2-2-3	
MT-228	Machining Processes			2-2-3
MA-227	Differential Equations for Technologists			3-0-3
MS-221	Microeconomics			3-0-3
ET-151	AC & DC Circuit Analysis	2-2-3		
MT-215	Thermodynamic Fundamentals	3-0-3		
ET-190	Logic and Switching Circuits		3-2-4	
MT-262	Mechanical Components		3-3-4	
HU-100	Contemporary Issues			3-0-3
EN-241	Speech			2-2-3

JUNIOR AND SENIOR YEARS		QUARTER FA	WI	SP
EN-332	Applied Technical Communication	3-2-4		
IE-423	Engineering Economy	3-0-3		
MT-314	Thermodynamic Cycles		3-3-4	
MT-303	Dynamics		3-0-3	
MT-316	Thermodynamic Applications			3-0-3
MT-393	Applied Finite Element Analysis			2-2-3
HS-494	Creative Thinking			3-0-3
MT-317	Heat Transfer	3-2-4		
MT-302	Strength of Materials Laboratory	0-3-1		
HS-461	Organizational Psychology		3-0-3	
ET-355	Electronics and Instrumentation		3-2-4	
MT-412	Thermodynamics Laboratory			0-3-1
	Math-Science Elective[2]			3-0-3
MT-381	Energy Source Alternatives	3-3-4		
	HS Elective[2]	3-0-3		
MT-382	Heating, Ventilating & Air Conditioning		3-3-4	
ET-298	Microprocessor Principles and Apps.		2-2-3	
MT-383	Internal Combustion Engines			3-3-4
HS-432	Ethics			3-0-3
MT-484	Power System Design	2-2-3		
MT-342	Manufacturing Process Engineering	3-2-4		
MT-488	Energy System Design		3-2-4	
	HS Elective[2]		3-0-3	
MS-441	Supervision			3-0-3
	Free Elective[2]			3-0-3
MT-331	Electric Motors	4-0-4		
MT-490	Professional Orientation	2-0-0		
MT-432	Power Transmission Control		2-2-3	
MT-400	Senior Project		1-0-3	
	Free Elective[2]		3-0-3	
MT-433	Feedback Control Systems			3-2-4
	HS Elective[2]			3-0-3

[1]Students are required to declare a major in the design, energy or fluid power technical specialty prior to starting the junior year.

[2] There are 18 credits of elective subjects in the MET program which must be taken as follows:
- 3 credits from mathematics or science courses
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 6 credits of free 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).

BACHELOR OF SCIENCE
MECHANICAL ENGINEERING TECHNOLOGY
FLUID POWER SPECIALTY[1]
Model Part-Time Track – V1.14

FRESHMAN AND SOPHOMORE YEARS		QUARTER FA	QUARTER WI	QUARTER SP
MT-100	Intro. To Mechanical Engineering Technology	3-3-4		
MS-183	Intro. To Computer Methods & App.	2-0-2		
MA-126	Trigonometry		4-0-4	
EN-131	Composition		3-0-3	
MA-127	College Algebra II			4-0-4
CS-150	Introduction to Computer Programming			2-2-3
CH-100	Chemistry for Technologists	3-3-4		
EG-122	Engineering Graphics I	1-3-2		
MA-128	Analytic Geometry and Calculus I		4-0-4	
EN-132	Technical Composition		3-0-3	
MT-122	Intro. To Materials Technology			3-2-4
MA-225	Calculus II for Technologists			4-0-4
MT-123	Intro. To Materials Processing	3-2-4		
PT-110	Physics for Technologists I	3-3-4		
MT-200	Statics		4-0-4	
PT-220	Physics for Technologists II		3-3-4	
MT-205	Strength of Materials			4-0-4
EG-123	Engineering Graphics II			1-3-2
MT-218	Fluid Mechanics	3-2-4		
MA-226	Calculus III for Technologists	4-0-4		
FP-272	Fluid Power Circuits		3-3-4	
MT-267	Dimensioning and Tolerancing		2-2-3	
MT-228	Machining Processes			2-2-3
MA-227	Differential Equations for Technologists			3-0-3
MS-221	Microeconomics			3-0-3
ET-151	AC & DC Circuit Analysis	2-2-3		
MT-215	Thermodynamic Fundamentals	3-0-3		
ET-190	Logic and Switching Circuits		3-2-4	
MT-262	Mechanical Components		3-3-4	
HU-100	Contemporary Issues			3-0-3
EN-241	Speech			2-2-3

JUNIOR AND SENIOR YEARS		QUARTER FA	WI	SP
EN-132	Applied Technical Communication	3-2-4		
IE-423	Engineering Economy	3-0-3		
MT-314	Thermodynamic Cycles		3-3-4	
MT-303	Dynamics		3-0-3	
MT-316	Thermodynamic Applications			3-0-3
MT-393	Applied Finite Element Analysis			2-2-3
HS-494	Creative Thinking			3-0-3
MT-317	Heat Transfer	3-2-4		
MT-302	Strength of Materials Laboratory	0-3-1		
HS-461	Organizational Psychology		3-0-3	
ET-355	Electronics and Instrumentation		3-2-4	
MT-412	Thermodynamics Laboratory			0-3-1
	Math-Science Elective			3-0-3
FP-373	Industrial Pneumatics	3-2-4		
	HS Elective[2]	3-0-3		
FP-374	Hydraulic Maintenance		3-2-4	
ET-298	Microprocessor Principles and Apps.		2-2-3	
FP-375	Mobile Hydraulics			3-2-4
HS-432	Ethics			3-0-3
FP-473	Electro-Hydraulic Components	3-2-4		
MT-342	Manufacturing Process Engineering	3-2-4		
FP-475	Fluid Power Design Projects		2-2-3	
	HS Elective[2]		3-0-3	
MS-441	Supervision			3-0-3
	Free Elective[2]			3-0-3
MT-331	Electric Motors	4-0-4		
MT-490	Professional Orientation	2-0-0		
MT-432	Power Transmission Control		2-2-3	
MT-400	Senior Project		1-0-3	
	Free Elective[2]		3-0-3	
MT-433	Feedback Control Systems			3-2-4
	HS Elective[22]			3-0-3

[1]Students are required to declare a major in the design, energy or fluid power technical specialty prior to starting the junior year.

[2]There are 18 credits of elective subjects in the MET program which must be taken as follows:
- 3 credits from mathematics or science courses
- 9 credits from the field of humanities and social sciences (HSS), 6 of which must be from one HSS series
- 6 credits of free 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).

Mechanical Engineering Technology
Technical Specialty Courses

		Term	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
Design Technical Specialty					
MT-361	Applied Strength of Materials	7	3	3	4
MT-362	Dynamics of Machinery	8	3	3	4
MT-363	Applied Mechanical Design	9	3	3	4
MT-466	Tool Design	12	2	2	3
MT-468	Mechanical Design Projects	10	3	3	4
	TOTALS		**14**	**14**	**19**
Energy Systems Technical Specialty					
MT-381	Energy Source Alternatives	7	3	3	4
MT-382	Heating, Ventilating and Air Conditioning Design	8	3	3	4
MT-383	Internal Combustion Engines	9	3	3	4
MT-484	Power System Design	10	2	2	3
MT-488	Energy Management and System Design Projects	11	3	3	4
	TOTALS		**14**	**14**	**19**
Fluid Power Technical Specialty					
FP-373	Industrial Pneumatics	7	3	2	4
FP-374	Hydraulic Maintenance, Troubleshooting, Filtration and Contamination Control	8	3	2	4
FP-375	Mobile Hydraulics	9	3	2	4
FP-473	Electrohydraulic Components/ Systems	10	3	2	4
FP-475	Fluid Power Design Projects	11	2	0	3
	TOTALS		**14**	**11**	**19**

NOTE: The energy systems and fluid power technical specialty courses will be offered only in the evening during the terms listed, when enrollment is sufficient.

SCHOOL OF NURSING

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

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 which promotes the integration of technology with the diagnosis and treatment of human responses to health states.

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 (B.S.N.) degree and are eligible to sit for the national licensing examination (NCLEX-RN).

Faculty:

Chairperson and Professor:
Dr. Mary Louise Brown

Associate Professors:
Sandra K. Plach, Dr. Ruth M. Waite, Linda K. Young

Assistant Professors:
Cecilia E. Diaz, Dawn M. Frederickson, Jerri Hoehn, Sherrill Leifer, Mary-Lynn Robinson

BACHELOR OF SCIENCE
NURSING

Program Director:
Professor Linda Young, MSN, RN
Office: S-204
Phone: (414) 277-4531
Fax: (414) 277-4540
E-mail: young@msoe.edu

Program Objectives

Upon successful completion of the program, the graduate is expected to:

provide competent, caring, holistic nursing care to clients

integrate relevant research findings and knowledge based on the humanities, sciences and nursing into nursing practice

provide leadership when collaborating with other health care team members and communities in assuming accountability for nursing care outcomes

employ appropriate technology when providing professional nursing care

consistently employ appropriate and effective communication skills in nursing practice

demonstrate critical thinking skills in diverse situations

incorporate principles of health promotion, health maintenance and health 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

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

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 and 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.

Immunization requirements, which must be satisfied by September 1 of the sophomore year, are listed below:

Students born after 1956 are required to show evidence of measles immunity or to have had two doses of live measles vaccine since 1980. Documentation of immunity includes a physician diagnosed measles disease or laboratory evidence of measles immunity. Persons born prior to 1956 are generally considered immune to measles and mumps and do not need to produce evidence of immunity.

Documentation and dates are required for a series (three injections) of hepatitis B vaccine; evidence of tetanus/diphtheria booster within the past 10 years; evidence of vaccination (including dates) or confirmed immunity against rubella; and evidence (including dates) of mumps and polio vaccination.

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) on 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 $1,000,000/$3,000,000. Participation in a group policy at cost is available 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. Uniforms may be purchased at Goldfish Uniforms at 8330 West Bluemound Road, Milwaukee. In order to ensure that uniforms will be available by the start of the winter quarter, students must order their uniforms no later than September 30.

Clinical name badges will be available through the School of Nursing.

Laboratory Supplies

Students are expected to procure the following supplies for the off-campus and on-campus laboratory experiences:

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. 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", "F" or "D" 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 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 advisor 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 (B.S.N.) degree is awarded. Graduates from the MSOE School of Nursing are eligible to sit for the National Council Licensing Exam for RNs (NCLEX-RN).

The School of Nursing is accredited by the Commission on Collegiate Nursing Education and has continued approval from the Wisconsin Board of Regulation and Licensing to admit and prepare students to sit for the NCLEX-RN.

BACHELOR OF SCIENCE
NURSING
Model Full-Time Track – V2.23

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
OR-102	Orientation to Nursing at MSOE	0-2-1		
EN-131	Composition	3-0-3		
PH-100	Intro. to Physical Science	3-2-4		
MA-125	College Algebra I	4-0-4		
MS-184	Intro. to Computer Methods and Appl.	2-2-3		
HS-161	General Psychology	3-0-3		
BE-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	
HS-471	Sociology		3-0-3	
BE-172	Human Anatomy & Physiology I			3-0-3
HS-431B	Informal Logic			3-0-3
CH-220	Organic Chemistry			3-0-3
BE-256	Microbiology			3-3-4
TC-452	Interpersonal Communication			3-0-3
	TOTALS	**15-6-18**	**14-7-17**	**15-3-16**
SOPHOMORE YEAR		**4**	**5**	**6**
NU-200	History & Theories of Nursing	3-0-3		
BE-273	Human Anatomy & Physiology II	3-3-4		
CH-221	Biochemistry	3-3-4		
HS-433	Philosophy	3-0-3		
HS-462	Developmental Psychology	3-0-3		
BE-274	Human Anatomy & Physiology III		3-3-4	
NU-201	Health Assessment of Individual		3-3-4	
NU-202	Health Assessment of Family & Community		3-3-4	
HS-466	Abnormal Psychology		3-0-3	
HS-473	World Societies		3-0-3	
BE-290	Pathophysiology I			4-0-4
BE-281	Pharmacology			4-0-4
NU-252	Primary Dynamics of Professional Nursing Care			3-12-7
BE-260	Nutrition			2-0-2
	TOTALS	**15-6-17**	**15-9-18**	**13-12-17**

		----------QUARTER----------		
JUNIOR YEAR		**7**	**8**	**9**
NU-330	Nursing Care Of Clients with Episodic Health Challenges I	3-12-7		
HS-332	Bioethics	3-0-3		
BE-391	Pathophysiology II	4-0-4		
MA-315	Introductory Applied Statistics	3-0-3		
NU-331	Nursing Care of Clients with Episodic Health Challenges II		3-12-7	
NU-390	Nursing Research		3-0-3	
	Humanities Elective[1]		3-0-3	
HS-461	Organizational Psychology		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
	Humanities Elective[1]			3-0-3
	TOTALS	**13-12-17**	**12-12-16**	**9-15-14**
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		
	Humanities Elective	3-0-3		
NU-471	Nursing Care of Clients with Complex Episodic Health Challenges		3-15-8	
	Free Elective[2]		3-0-3	
	Humanities Elective[1]		3-0-3	
MS-221	Microeconomics		3-0-3	
NU-485	Nursing Clinical Elective			2-12-6
NU-486	Synthesis of Nursing Care			4-0-4
NU-490	Nursing Leadership & Professional Orientation			3-6-5
	TOTALS	**9-18-15**	**12-15-17**	**9-18-15**

Total Credits: Program - 197, NU - 84, Electives - 15

[1] Nursing students must take 12 credits of humanities electives: 3 in the HS-420 series; 3 in the HS-440 series; 3 in the HS-480 series; and 3 in HS-420, 430, 440 or 480 series.

[2] These 3 credits may be taken from any field.

Accredited by the Commission on Collegiate Nursing Education (CCNE, One Dupont Circle, NW, Suite 530, Washington, DC 20036; telephone: (202) 463-6930).

RN TO BACHELOR OF SCIENCE IN NURSING

Program Director:
Dr. Mary Louise Brown
Office: S-201B
Phone: (414) 277-4516
Fax: (414) 277-4540
E-mail: brown@msoe.edu

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 155.

Prerequisite courses for NU-200

EN-131 Composition
EN-241 Speech

Pre or Corequisite courses for NU-202

HS-471 Sociology
HS-473 World Societies
NU-105 Concepts of Health
TC-452 Interpersonal Communication
NU-200 History & Theories of Nursing

Prerequisite courses for NU-252 or to qualify for the exemption exam

BE-102 Biology
BE-256 Microbiology
BE-260 Nutrition
BE-274 Anatomy & Physiology III
CH-200 General Chemistry
CH-220 Organic Chemistry
CH-221 Biochemistry
HS-161 General Psychology
HS-462 Developmental Psychology
HS-431B Informal Logic
MA-125 College Algebra I
MS-184 Intro to Computer Methods and Applications
NU-201 Health Assessment of Individual
PH-100 Intro to Physical Science
OR-301 Transfer Orientation

Prerequisite for NU-330 or NU-340 or to qualify for the exemption exam

BE-281 Pharmacology
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

BE-391 Pathophysiology
HS-332 Bioethics
NU-330 Nursing Care of Clients with Episodic Health Challenges I or successful completion of the exemption exam

Prerequisite for NU-470 or to qualify for the exemption exam

BE-391 Pathophysiology
HS-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
HS-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

HS-433 Philosophy
HS-420 Literature Elective
HS-440 History Elective
HS-480 Fine Arts Elective
HS-420, 430, 440 480, Elective
Free Elective
NU-495 Role Transition (May not be taken until successful completion of NU-202, Assessment of Family & Community, has been demonstrated.)

NOTE: A minimum of 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 MSOE's Student Accounts Office for current fee information.

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 2.4

		----------QUARTER----------		
FRESHMAN YEAR		**1**	**2**	**3**
OR-102	Orientation to Nursing or OR-301 Transfer Orientation	0-2-1		
EN-131	Composition	3-0-3		
PH-100	Introduction to Physical Science	3-2-4		
MA-125	College Algebra I	4-0-4		
MS-184	Introduction to Computer Methods and Appl.	2-2-3		
HS-161	General Psychology	3-0-3		
BE-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	
HS-471	Sociology		3-0-3	
BE-172	Human Anatomy & Physiology I			3-0-3
HS-431B	Informal Logic			3-0-3
CH-220	Organic Chemistry			3-0-3
BE-256	Microbiology			3-3-4
TC-452	Interpersonal Communication			3-0-3
	TOTALS	**15-6-18**	**14-7-17**	**15-3-16**

SOPHOMORE YEAR		**4**	**5**	**6**
NU-200	History & Theories of Nursing	3-0-3		
BE-273	Human Anatomy & Physiology II	3-3-4		
CH-221	Biochemistry	3-3-4		
HS-433	Philosophy	3-0-3		
HS-462	Developmental Psychology (must be lifespan development)	3-0-3		
BE-274	Human Anatomy & Physiology III		3-3-4	
NU-201	Health Assessment of Individual (must include more than PA)		3-3-4	
NU-202	Health Assessment of Family & Community		3-3-4	
HS-466	Abnormal Psychology		3-0-3	
HS-473	World Societies (may substitute study of cultural diversity)		3-0-3	
BE-290	Pathophysiology I (may also be exempted by exam)			4-0-4
BE-281	Pharmacology (may also be exempted by exam)			4-0-4
NU-252	Primary Dynamics of Professional Nursing Care			3-12-7
BE-260	Nutrition			2-0-2
	TOTALS	**15-6-17**	**15-9-18**	**13-12-17**

		----------QUARTER----------		
JUNIOR YEAR		**1**	**2**	**3**
NU-330	Nursing Care of Clients with Episodic Health Challenges I	3-12-7		
HS-332	Bioethics	3-0-3		
BE-391	Pathophysiology II (may also be exempted by exam)	4-0-4		
MA-315	Introductory Applied Statistics	3-0-3		
NU-331	Nursing Care of Clients with Episodic Health Challenges II		3-12-7	
NU-390	Nursing Research		3-0-3	
HS-420	Humanities Literature Elective[1]		3-0-3	
HS-461	Organizational Psychology		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
HS-440	Humanities History Elective[1]			3-0-3
	TOTALS	**13-12-17**	**12-12-16**	**9-15-14**
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		
HS-480	Humanities Fine Arts Elective[1]	3-0-3		
NU-471	Nursing Care of Clients with Complex Episodic Health Challenges		3-15-8	
	Free Elective[2]		3-0-3	
	HS-420, 440, 470, 480 Humanities Elective[1]		3-0-3	
MS-221	Microeconomics		3-0-3	
NU-485	Nursing Clinical Elective (prelicensure students only) or NU-495 Role Transition (RN students only)			2-12-6 (4-6-6)
NU-486	Synthesis of Nursing Care			4-0-4
NU-490	Nursing Leadership & Professional Orientation			3-6-5
	TOTALS	**9-18-15**	**12-15-17**	**9-18-15 (11-12-15)**

Total Credits: Program - 197, NU - 84, Electives - 15

[1] Nursing students must take 12 credits of humanities electives: 3 in the HS 420 series, 3 in the HS 440 series, 3 in the HS 480 series, and 3 in HS 420, 430, 440, or 480 series.

[2] These 3 credits may be taken from any field.

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 courses in physics and chemistry to support the various academic program offerings of MSOE.

Faculty:

Chairman:
Dr. Anders Schenstrom

Department Secretary:
Julie au Buchon

Technical Support Staff:
Carl Hick, Richard Wolter

Professors:
Dr. J. William Dawicke, Dr. Carol B. Diggelman, Brigita E. Kore, Jeffrey B. Korn, Dr. Eugene R. Magnuson, Dr. A. James Mallmann, Dr. Steve P. Mayer, Dr. Anders Schenstrom, Darrell L. Seeley, Dr. Melvin J. Stavn

Associate Professors:
James Dieball, Dr. Richard Greengard

Assistant Professor:
Dr. Richard Mett

Instructors:
Ruth A. Schwartz, Kevin J. Seward, Joyce M. Solochek

Lecturers:
Steve Augustine, Fengchi Chen, Carl Edmund, Glenn Gratke, Wendell Kumlien, Rosemary Wehnes

Professor Emeritus:
Dr. Ronald A. Kobiske, Harry A. Schopler

Physics and Chemistry Electives

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*
CH-352	Introduction to Environmental Chemistry	3	0	3
CH-461	Advanced Topics in Chemistry	3	0	3
CH-499	Independent Study	3	0	3
PH-320	Lasers and Applications	2	2	3
PH-408	Environmental Issues	3	0	3
PH-420	Optics	2	2	3
PH-441	Intro. to Astronomy and Astrophysics	3	0	3
PH-454	Nuclear Power, Applications and Safety	3	0	3
PH-455	Acoustics and Illumination	3	0	3
PH-470	Intro. to Geology and Geophysics	3	0	3
PH-471	Oceanography	3	0	3
PH-499	Independent Study	3	0	3

TWO-DEGREE PROGRAMS

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 Construction Management	Bachelor of Science Management Systems	Bachelor of Science Technical Communication	Master of Science Environmental Engineering	Master of Science Architectural Engineering
Bachelor of Science Architectural Engineering	X	X	X	X	X
Bachelor of Science Business and Computer Systems			X		
Bachelor of Science Computer Engineering		X	X		
Bachelor of Science Electrical Engineering		X	X		
Bachelor of Science Industrial Engineering		X	X	X	
Bachelor of Science Mechanical Engineering		X	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, building electrical or building environmental systems.

Approximately 14 courses in the construction management emphasis are taken in the junior, senior and fifth years along with the architectural engineering courses.

When preregistering for both of these degrees, students must see the chairman of the Architectural Engineering and Building Construction Department.

Bachelor of Science in Management Systems

MSOE's business programs were established with the understanding that business is driven by rapidly changing technology. Since computers are the most important tools in business, MSOE's business and management curricula are centered around the latest technological developments in computers.

MSOE's School of Business offers a Bachelor of Science in Management Systems degree along with an engineering degree through MSOE's two-degree program. By taking business and 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, production management, management policies, leadership skills, business communications

When preregistering for a two-degree program in engineering and management systems, students should see the chairman of the 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, 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 including technical communication, students should meet with the chairman of the General Studies Department.

Master of Science in Architectural Engineering

The Master of Science in Architectural Engineering (MSAE) building structural design specialty degree program is designed to meet the needs of architectural, civil or structural engineers who need advanced course work to better analyze and design contemporary building structural systems.

The MSAE has course topics that include applied finite element analysis, structural dynamics, structural stability and structural system design. Other topics include design courses in structural steel, reinforced concrete, wood, masonry and foundations. All courses emphasize the ability to present and communicate design ideas to the client and other engineers.

The dual program allows a student in the building structural design specialty to begin taking graduate classes in the senior year. The student can take three specific graduate-level classes, one in each quarter, in place of three related undergraduate-level classes. The student can then complete the MSAE in one additional year of full-time study.

This program is also designed as a five-year, two-degree program.

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.

Students who intend to pursue the Bachelor of Science in Architectural Engineering and the Master of Science in Environmental Engineering degree programs should meet with the chairman of the Architectural Engineering and Building Construction Department before the end of their sophomore year.

GRADUATE STUDIES PROGRAMS

For a *Graduate Studies Catalog* and more information on any of these programs, please call (800) 332-6763 toll free, or (414) 277-6763 in the Milwaukee area.

Master of Science in Architectural Engineering

The Master of Science in Architectural Engineering (MSAE) building structural design speciality degree program is designed to meet the needs of architectural, civil or structural engineers who need advanced course work to better analyze and design contemporary building structural systems.

The MSAE assumes that you have completed an undergraduate curriculum that included indeterminate structural analysis, structural steel and reinforced concrete design, and soil mechanics. The MSAE expands on these fundamentals with course topics that include applied finite element analysis, structural dynamics, structural stability and structural system design. Other topics include design courses in structural steel, reinforced concrete, wood, masonry and foundations. All courses emphasize the ability to present and communicate design ideas to the client and other engineers.

This program is also designed as a five-year, two-degree program.

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: computer, electrical, fluid power (by petition) and mechanical.

Master of Science in Engineering Management

One of the largest programs of its kind in the country, the engineering management program is best described as a master's degree in the overall management of organizations with an orientation to manufacturing, engineering, technology or production.

Master of Science in Environmental Engineering

The 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, soil and groundwater remediation are presented.

This program is also designed as a five-year, two-degree program.

Master of Science in Medical Informatics

This program, offered jointly by Milwaukee School of Engineering and the Medical College of Wisconsin, is the study of computer applications for the form and function of medical information. This innovative program explores the technological, logistical, financial and organizational issues shaping the field of medical informatics.

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.

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 and 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 dual degrees; career paths in architectural engineering and construction management; and the constructor's role and the design process in architecture, structural engineering, building environmental systems engineering and building electrical systems engineering. The student's conceptual design of a building uses the above process. 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 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. (prereq: none)

AE-103 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. (prereq: none)

AE-123 Building Construction Materials and Methods I	**4**	**0**	**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. (prereq: none)

AE-130 Architectural 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. Drawings are created using manual and CAD techniques. (prereq: AE-103)

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-3001 Dynamics	**3**	**0**	**3**

Dynamics presents the motion of particles and rigid bodies. Kinematics topics include absolute and relative motion of plane, rectilinear and curvilinear systems. Kinetic topics of force, mass, acceleration, work, energy, impulse and momentum are covered. The class introduces the concepts of motion and vibration as related to structural members. (prereq: AE-200, MA-137)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
AE-213	**Applied Fluid Mechanics for Architectural Engineers and Construction Managers**	**4**	**0**	**4**

This course covers the basic principles of fluid dynamics 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: ME-252)

AE-220	**Building Construction Materials and Methods II**	**3**	**2**	**4**

This course continues the study of building construction terminology and design considerations. Building systems are arranged into three basic categories: structure, enclosure of envelope, and interior systems. Each is studied in terms of function, materials and construction methods. Exercises in drawing and sketching are used to help the student visualize and develop architectural details. (prereq: AE-123, AE-130)

AE-222	**Construction Materials Laboratory**	**1**	**2**	**1**

This laboratory reinforces the topics presented in AE-123. Tests are conducted to develop an understanding of the physical and mechanical properties of materials used in construction. ASTM test procedures are followed where applicable. (prereq: AE-123)

AE-225	**Specifications and Contracts**	**3**	**0**	**3**

This course starts with a brief overview of the different contractual relationships within the building industry. Then, the focus is placed on a study of the fundamentals of contracts and specifications for building construction. Contract document standards, as related to the CSI Master format, are studied. The student is acquainted with the basics of why construction methods and materials are specified. Contract documents normally encountered in a construction project are included. (prereq: AE-220)

AE-301	**Basic Steel Design**	**3**	**0**	**3**

Students study the fundamentals of the elements of steel design, beams, columns, tension members, bolts, welds and the properties of structural steel materials. This course is an extension of the study of strength of materials concepts. The theoretical and allowable stresses are evaluated and compared for compliance with AISC LRFD Code. (prereq: AE-201)

AE-303	**Soil Mechanics and Foundations**	**4**	**0**	**4**

This course provides a basic understanding of the effects of soil conditions on the construction process. Methods of soil testing are described, and analysis of data is performed. Topics include soil types and classifications, physical properties and parameters, subsoil stresses, shear strength, bearing capacity, settlement, consolidation and lateral earth pressure. Design topics include shallow and deep foundations, along with retaining walls. Design is based on criteria of the latest American Concrete Institute Code. (prereq: AE-201, AE-308)

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-301, AE-306)

		Lecture Hours Per Week	*Lab Hours Per Week*	*Credit In Quarter Hours*

AE-305 Structural Analysis I **3** **0** **3**

This course emphasizes statically indeterminate structural members and systems. Topics covered include continuous beams with hinges, influence lines, moment distribution and virtual work. Manual solutions are verified with computer applications. (prereq: AE-201)

AE-306 Structural Analysis II **3** **0** **3**

Matrix analysis is introduced in this course. Matrix methods enable the evaluation of simultaneous equations and provide the basic concepts for finite element analysis. Stiffness matrices are derived and used to explain the theory of structural analysis computer programs. Three-dimensional structures and other complex structural systems are evaluated. (prereq: AE-305)

AE-308 Basic Concrete Design **3** **0** **3**

The basic concepts of reinforced concrete design, based on the latest edition of the American Concrete Institute Code, are presented. Topics include analysis and design of moment and shear reinforcement for beams, one-way slabs and short columns. (prereq: AE-201, AE-222)

AE-309 Strength of Materials Laboratory **1** **2** **1**

This laboratory course allows a student to study structural components analytically and then physically verify their behavior by test. Physical examinations include deflections, column buckling, tension and compression members, and torsion. The student is also introduced to experimental stress analysis. (prereq: AE-201)

AE-310 Basic Principles of HVAC Systems **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: (1) introduction to comfort parameters, (2) building heat loss calculation methods, (3) building heat gain calculation methods, (3) basic heating and cooling processes, and (4) heating and cooling equipment. (prereq: AE-213)

AE-311 Building Energy Systems I **4** **0** **4**

This course introduces the student to the development of the basic design of a heating, ventilating and air conditioning system. Students are required to perform manual calculations and selection of HVAC equipment. Emphasis is on code requirements and equipment performance. Design emphasizes procedures and guidelines as used by industry. The project begun in this course is continued in AE-313. (prereq: AE-310)

AE-313 Building Energy Systems II **3** **2** **4**

This course continues the development of the 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 used are those currently used in the industry for system design. (prereq: AE-311)

AE-315 Plumbing Systems Design **3** **0** **3**

The architectural engineering design requirements of plumbing systems are the primary considerations of this course. Emphasis is on hydraulic design methods, including Hazen-Williams, Darcy-Weisbach, Manning and Hunter theories and design formulae. Complete layout and design of plumbing waste and water systems for a nonresidential building are accomplished. (prereq: AE-213)

AE-316 Fire Suppression Systems Design **3** **0** **3**

The architectural engineering design requirements of fire protection systems are the primary consideration of this course. Insurance and authoritative agency requirements and fire department concerns and needs are discussed. An introduction to chemical suppression methods is included. Complete layout and hydraulic design of a sprinkler system for a commercial building are accomplished. (prereq: AE-213)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AE-318 Building Environmental Systems I for CM 3 0 3
The purpose of this course is to introduce the student to industry practices and requirements for mechanical systems design principles and concepts. The course also familiarizes the student with system types, along with design and selection procedures for equipment. (prereq: AE-310)

AE-342 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)

AE-345 Integrated Engineering Concepts 1 1 1
This course is a review of basic engineering science, mathematics and science focusing towards the Fundamentals of Engineering (FE) exam. The Wisconsin FE exam may be taken for a course grade. (prereq: eighth term standing)

AE-357 Illumination for Buildings 3 0 3
Design and specification of interior and exterior building illumination systems, including lighting loads, branch circuits and switching, are covered. Study of applicable NFPA 70 (NEC) and related codes pertaining to buildings is an integral part of the course. (prereq: PH-220)

AE-358 Communication Systems 4 0 4
Design and specification of communication systems in buildings, including fire alarm, security, sound, telephone, integrated telecommunication, telemedia, clock and program, television, data and nurse call, are covered. Students study applicable sections of electrical code. Sound, as it applies to communication systems and noise, is also covered. (prereq: EE-250)

AE-359 National Electrical Code 2 0 2
This course focuses on the study of the National Electrical Code as amended by ILHR Chapter 16 of the Wisconsin Administrative Code. NEC handbook is required. (prereq: EE-250)

AE-401 Advanced Concrete Design 3 2 4
This course is a continuation of AE-204. 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-308, AE-306)

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-306)

AE-411 Building Systems Control 3 2 4
This course familiarizes the student with a basic knowledge of HVAC system controls and control theory. Topics covered include pneumatic, electric and electronic control systems and components. Building energy management and its connection to control systems are introduced. In addition, basic motors, starters and power sources are reviewed. Reinforcement of the various topics is provided through laboratory tests and observations using the various HVAC equipment located in the Johnson Controls Building Environmental Systems Laboratory. (prereq: AE-313, EE-250)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AE-412 Energy Management Techniques 3 0 3

Using the information from the previous energy systems courses, the student studies basic energy management from an energy conservation perspective. This includes various methods of energy conservation and the savings afforded by them, and evaluation of equipment and system performance, along with calculation procedures required for system economic evaluations. The course emphasizes the retrofit of existing systems for energy conservation. As part of the course, the student is required to use an energy analysis computer program and spreadsheet analysis to calculate equipment performance. In addition, actual methods in management of a building for energy conservation are discussed. (prereq: AE-411)

AE-413 Building Energy Systems III 3 0 3

The last of the HVAC design series, this course begins with a study of the various systems currently applied. Coverage continues to system control and theory, and then introduces building automation. Ample design work gives the student the opportunity to apply the concepts learned. (prereq: AE-412)

AE-414 Urban Planning and Municipal Engineering 2 2 3

This is a study of the principles of urban planning and development. Concepts of urban renewal; relationship of industrial, commercial and residential areas; and utilization of zoning, mapping, division control and budgeting in planning are discussed. Transportation systems, utilities, sewage and water distribution are also considered. Case studies of planned and unplanned city growth are examined in conjunction with problems and procedures in planning. (prereq: senior 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, hospital and medical gas systems, commercial and industrial buildings, institutional facilities and penal facilities. Coordination with other building trades including electrical, fire protection and HVAC systems are included to aid the engineer in designing a compatible plumbing system. (prereq: AE-315)

AE-419 Building Environmental Systems II for CM 4 0 4

The purpose of this course is to familiarize the student with HVAC system types, control schemes and operating characteristics. The course also provides the student with a basic ability to analyze an HVAC system's first cost and associated operating costs which will assist in the overall evaluation of the most cost-effective selection. (prereq: AE-318)

AE-431 Architectural Design 2 4 4

This course offers the student an opportunity to understand and demonstrate skills in problem solving (or design) of building projects. Areas stressed in this course include problem analysis, project design, and graphic and oral presentation techniques (prereq: senior standing)

AE-432 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 AE-450, which allows the fullest development, to the finest detail, of the students' ideas. (coreq: AE-451)

AE-440 Office Management 3 0 3

The organization and management of a construction company and/or architectural engineering office are studied. Employee wages and benefit costs are discussed. Financial management is presented, including accounting procedures, cash flow, budget formulation and financial statements evaluation. Current topics on professional liability, ethics, partnering and total quality management (TQM) also are presented. (prereq: CM-323)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AE-441 Building Investment Economics 3 0 3

This course is based on the principle that in order to properly meet a client's needs on a building design, the designer must understand the economic factors that motivate the client to build. The student is taught the basic principles of real estate investment, cash flow, equity, appreciation and tax shelter. Also covered are zoning, tax laws, investment finance and appraisal techniques. (prereq: IE-423)

AE-450 Architectural Engineering Design I 1 3 3
AE-451 Architectural Engineering Design II 1 3 4

These team-taught courses emphasize the total design concept for each team of students using their previous subjects as they design a building. The student teams complete these phases of design: site analysis; preliminary drawings and presentation; design development drawings; analysis and calculations of the structure; and HVAC, plumbing, lighting and other mechanical systems. Final presentation includes an estimated cost of the project. Students must take this series only in consecutive terms. (AE-450 prereq: term 11 standing or consent of department chairman) (AE-451 prereq: AE-450; AE-451 coreq: AE-432)

AE-461 Advanced CAD with AE Applications I 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)

AE-472 Electrical Power Quality for Buildings 3 2 4

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: EE-355)

AE-476 Electrical System Cost Estimating and Specifications 3 0 3

This course covers the study of cost estimating software and systems, case studies and value engineering. This course also includes coverage of CSI electrical specifications for general conditions, equipment and installation of work. (prereq: AE-472, senior standing)

AE-490 Independent Study 3 0 3

This subject provides the student with an opportunity to develop an in-depth understanding of an area within the construction industry not offered within the program. Completed projects require a formal technical communication, written and/or verbal, as prescribed by the advisor. (prereq: consent of department chairman)

AF-100 The Air Force Today 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 The Air Force Today II 1 2 1

This is a continuation of AF-100. (prereq: AF-100)

AF-102 The Air Force Today III 1 2 1

This is a continuation of AF-101 (prereq: AF-101)

AF-105 Air Force Health and Fitness I 1 1 1

This is a survey course designed to promote self responsibility and a holistic approach to health and fitness. This course provides the knowledge needed to make informed decisions about nutrition, stress management and alcohol and tobacco use. Proper warm-up and exercise techniques are taught, and the framework for improved physical conditioning is built. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AF-106 Air Force Health and Fitness II 1 1 1

This course is a continuation of Air Force Health and Fitness I. It builds upon previously taught health and fitness principles and focuses on their application. All aspects of physical conditioning are practiced including cardiorespiratory endurance, strength development and flexibility. Nutrition and conditioning are measured, individual goals are established, and progress is monitored. (prereq: AF-105 or consent of the department chairman)

AF-107 Air Force Health and Fitness III 1 1 1

This course is a continuation of Air Force Health and Fitness II. Progress towards the goals established in the previous course are monitored, and supplemental nutrition and fitness techniques are taught based upon individual development. (prereq: AF-106 or consent of the department chairman)

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.

Air Force Fitness Laboratory

Air Force Fitness Laboratory is the practical application of the concepts and theories presented in the AFAS Air Force Health and Fitness series. Students improve physical conditioning through group fitness activities.

AF-200 The Development of Air 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 The Development of Air Power II 1 2 1

This is a continuation of AF-200. (prereq: AF-200)

AF-202 The Development of Air Power III 1 2 1

This is a continuation of AF-201. (prereq: AF-201)

AF-205 Air Force Health and Fitness I 1 1 1

See AF-105.

AF-206 Air Force Health and Fitness II 1 1 1

See AF-106.

AF-207 Air Force Health and Fitness III 1 1 1

See AF-107.

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

AF-300 Air Force Leadership and Management 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 and Management II 3 2 3

This is a continuation of AF-300. (prereq: AF-300)

AF-302 Air Force Leadership and Management III 3 2 3

This is a continuation of AF-301. (prereq: AF-301)

AF-305 Air Force Health and Fitness I 1 1 1

See AF-105.

AF-306 Air Force Health and Fitness II 1 1 1

See AF-106.

AF-307 Air Force Health and Fitness III 1 1 1

See AF-107.

AF-400 National Security Forces in Contemporary Society 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 Forces in Contemporary Society II 3 2 3

This is a continuation of AF-400. (prereq: AF-400)

AF-402 National Security Forces in Contemporary Society III 3 2 3

This is a continuation of AF-401. (prereq: AF-401)

AF-405 Air Force Health and Fitness I 1 1 1

See AF-105.

AF-406 Air Force Health and Fitness II 1 1 1

See AF-106.

AF-407 Air Force Health and Fitness III 1 1 1

See AF-107.

BE-102 Biology 3 3 4

The objective of this course is to introduce students to various areas of biology. Topics include cell structure and function, cellular reproduction, genetics and distinguishing features of each of the five kingdoms. In the laboratory, students must demonstrate proficiency in experimental design, basic laboratory techniques, data recording and scientific report writing using computer tools. (coreq: CH-200)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

BE-103 Freshman BE Design 1 3 2

The objective of this course is to develop an engineering design methodology applicable to biomedical engineering design problems. This course is the first of a five-course sequence terminating in a senior design project. The student is assigned a design project and a faculty advisor. Each student is required to develop a plan covering the next 10 quarters of work on the design project. In the laboratory, the students are required to demonstrate proficiency in using an engineering log book, performing calculations using a scientific calculator, and using more advanced features of the computer tools introduced in BE-102. This course contains two credits of engineering design. (prereq: BE-102, MA-136)

BE-104 Computing in Biomedical Engineering 2 3 3

The objective of this course is to familiarize each student with the computer systems available at MSOE and to present the basics of computer programming using CC++. Each student is required to demonstrate proficiency using various software packages deemed necessary and 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 her/his senior project. (prereq: BE-103, MA-137)

BE-172 Human Anatomy and Physiology I 3 0 3

The objective of this course is to begin the student's study of many aspects of human anatomy and physiology. Topics include the skin, skeleton, muscles, joints, the nervous system and the senses. Credit for BE-172 is granted after the student has successfully completed BE-273 and BE-274. (prereq: BE-102; coreq: CH-220)

BE-256 Microbiology 3 3 4

This course introduces the student to the basics of microbiology. Topics include the scope and history of microbiology, microscopy, staining techniques, characteristics of prokaryotic and eukaryotic cells and an introduction to viruses. Elements of microbial nutrition, growth, microbial metabolism, microbial genetics and genetic engineering are also introduced along with the control of microbial growth by physical and chemical means. Further topics include microbe human interaction, immunology and immune assays. Medical microbiology is introduced with emphasis on cocci, bacilli and other miscellaneous agents of disease that are of medical importance. Viral diseases including DNA and RNA viruses are also discussed. Finally, the students are introduced to some aspects of environmental and applied microbiology. (prereq: BE-102)

BE-260 Nutrition 2 0 2

This two-credit 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 the changing nutritional needs of infants, children, adolescents and adults. (prereq: BE-102, CH 200)

BE-273 Human Anatomy and Physiology II 3 3 4

The objective of this course is to present the basic principles of functional human physiology that apply to homeostasis, respiration, digestion, reproduction and elimination. (prereq: BE-172)

BE-274 Human Anatomy and Physiology III 3 3 4

This is the third course in the human physiology sequence for the nursing students. The principles of functional human physiology that apply to homeostasis, respiration, reproduction, digestion and elimination are presented. The laboratory exercises include computer simulation and physical examination of fellow students to demonstrate physiological principles. (prereq: BE-273)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
BE-281	**Pharmacology**	**4**	**0**	**4**

This course introduces the students to the effects of drugs on biologic systems. Topics include general principles of pharmacology, drugs affecting the neuroeffector systems, drugs for the prevention and treatment of pain, pain syndromes and inflammation, pharmacotherapeutics for inappropriate muscle activity, and drug treatment for psychiatric disorders. Further topics include cardiovascular system pharmacology, organ system pharmacology, chemotherapeutic agents, toxicology and endocrine pharmacology. (prereq: BE-274)

BE-290	**Pathophysiology I**	**4**	**0**	**4**

This course provides the students with an understanding of the etiology of disease processes, manifestations, diagnoses and treatment modalities. Topics include central concepts of pathophysiology, alterations in cellular function, alterations in host defense mechanisms, hemodynamic alterations, cardiovascular alterations, and alterations in respiratory functions. Further topics include alterations in fluid, electrolyte and acid base homeostasis and diabetes mellitus. (prereq: BE-274)

BE-305	**Signal Analysis and Telemetry**	**4**	**0**	**4**

The objective of this course is to apply Fourier series and Fourier transforms to the analysis of physiological signals, and to apply amplitude, frequency and pulse modulation techniques to the transmission and reception of physiological signals. This course contains one credit of engineering design. (prereq: BE-104, EE-202, MA-262)

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 operational amplifiers and other integrated circuits such as 555 timers and multipliers. Biological data are converted to electrical signals using displacement, force, pressure and temperature transducers. Circuits are designed to amplify, filter and detect events in the biological signals. Systems for blood pressure, flow and volume measurements are developed. Basic circuits for waveform generation and amplitude and frequency modulation are discussed. (prereq: BE-305, BE-373, EE-310; coreq: BE-400)

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: term 7 standing)

BE-372	**Anatomy**	**2**	**0**	**2**

The objective of this course is to give the student a working knowledge of human anatomy. The following structures are studied: cell, muscle, heart, vascular system, skeleton, lungs, kidney and bladder, GI system, eye and ear, and skin. (prereq: BE-102, CH-221)

BE-373	**Physiology I**	**3**	**3**	**4**

The objective of this course is to present the basic principles of human physiology that apply to homeostasis, cell membrane potentials and transport mechanisms, nerve and muscle, and the heart and circulatory system. The laboratories are scheduled at the Medical College of Wisconsin facilities. Students may be required to attend the laboratory during the final examination week and during the quarter break. Credit for BE-373 is granted after the student has also successfully completed all of the requirements for BE-374. (prereq: BE-372)

BE-374	**Physiology II**	**3**	**3**	**4**

The objective of this course is to present the basic principles of human physiology that apply to the microcirculation and the lymphatic system, the blood, the respiratory system, the renal system, the gastrointestinal system and the regulation of plasma glucose concentration by hormones of the pancreatic islets. The laboratories are scheduled at the Medical College of Wisconsin facilities. (prereq: BE-373)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
BE-381	**Biophysical Phenomena: Thermodynamics and Heat Transfer**	**4**	**0**	**4**

The objective of this course is to present topics in 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 topics in classical fluid mechanics and mass transport, and to apply these principles to the solution of both classical and biomedical problems. (prereq: BE-381, MA-330)

BE-391	**Pathophysiology II**	**4**	**0**	**4**

This course provides a continuation of knowledge in the understanding of the etiology of disease processes, manifestations, diagnoses and treatment modalities. Topics include alterations in the 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: BE-290)

BE-400	**Biomedical Engineering Design Methodology**	**3**	**3**	**4**

There are two major objectives for this course, the first being the development of the final design requirements for the biomedical engineering design project. The second objective is the introduction of computer software in the design process. This course integrates the application of computer software with the decision-making process necessary in biomedical engineering design and project documentation. Spreadsheets, equation solvers, and analog and digital circuit analysis/design software are used for the iterative process necessary to achieve optimal solutions to design problems. (prereq: BE-382, EE-291, EG-120, EN-241; coreq: BE-306, BE-374)

BE-401	**Biomedical Engineering Design I**	**2**	**3**	**3**

This course is a continuation of BE-400. The objective of this course is to have the student loop through the design process along with completing the construction and testing of all subsystems. Written and oral presentations are required of each student. This course contains three credits of engineering design. (prereq: BE-400; coreq: BE-410, BE-417, BE 433)

BE-402	**Biomedical Engineering Design II**	**2**	**3**	**3**

This course is a continuation of BE-401. The objective of this course is to have the student integrate all subsystems into the final product and to begin product testing. Written and oral presentations are required of each student. This course contains three credits of engineering design. (prereq: BE-401, MS-331; coreq: BE-460, BE-471)

BE-403	**Biomedical Engineering Design III**	**2**	**3**	**3**

This course is a continuation of BE-402 and is the last course in the engineering design sequence. The objective of this course is a completed working prototype of the design along with a formal engineering design report and an operator's manual. Each student must give an oral presentation during the Biomedical Engineering Design Show. This course contains four credits of engineering design. (prereq: BE-402; coreq: BE-472, HS-432)

BE-410	**Introduction to Biomaterials**	**3**	**0**	**3**

The objective of this course is to present the principles that apply to the properties and selection of materials used in medical applications. Topics include metals, ceramics, polymers, composites, biological tissues, and the interaction between biological tissues and artificial materials. (prereq: BE-371, BE-380, EE-320, ME-206)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

BE-411 Biomechanics 3 0 3

This course is an introduction to the biomechanics of human movement, with applications to occupational and sports biomechanics. Topics include kinematics; anthropometry; kinetics; mechanical work, energy and power; synthesis of human movement; muscle mechanics; and kinesiological electromyography. (prereq: BE-374, BE-410, BE-433, ME-206, ME-207)

BE-417 Biomedical Electronics and Systems II 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 total measurement systems. Of particular interest are the production and distribution of biological signals, such as the ECG, EMG and EEG, and the electrodes and sensitive amplifiers needed to record them. Methods for reducing electrical noise and interference in the signals and digitizing them are included. General feedback principles are applied to the system performance. (prereq: BE-306; coreq: BE-433)

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 the student apply these methods to the analysis of biological signals such as EEG, ECG, evoked potentials, etc. Topics include correlation, signal averaging, Z-transform, discrete-time system analysis, discrete and fast Fourier transform, and digital filtering. In the laboratory, the student is required to design hardware and software to perform the analysis on various biopotential signals. This course contains two credits of engineering design. (prereq: BE-305, BE-306, BE-374, BE 380, EE-291)

BE-460 Medical Imaging Systems 3 3 4

The objective of this course is to present an overview of the modalities used in medical imaging. Topics include image formation, computer tomography, X-rays, ultrasound, magnetic resonance, image processing and displays. (prereq: BE-374, BE-417, BE-433, PH-250)

BE-471 Biomedical Control Systems: Analog 4 0 4

The objective of this course is to present topics in classical feedback control theory and to apply these topics to the solution of both classical and physiological feedback control problems. This course contains one credit of engineering design. (prereq: BE-305, BE-374, BE-382, BE-400, BE-417)

BE-472 Biomedical Control Systems: Digital 3 3 4

The objective of this course is to present topics in classical digital feedback control theory and to apply these topics to the solution of both classical and physiological digital feedback control problems. In the laboratory, the student is required to design, construct and test both analog and digital feedback control systems. This course contains two credits of engineering design. (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 the student. 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 at the end of the internship. (prereq: senior standing, written consent of the BE program director and the EECS Department chairman)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CH-100 Chemistry for Technologists 3 3 4

This is a general chemistry course for students **not** majoring in engineering or nursing degree programs. The course includes classification and properties of matter, atomic structure, chemical bonding, chemical equations, physical states of matter, chemical and physical properties of matter, and solutions. Laboratory experiments support lecture topics. (prereq: one year high school algebra or MA-125; one year high school physics or chemistry, PH-100 or PH-102)

CH-102 Pretechnology 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 of B or better. This course includes classification and properties of matter, atomic structure, chemical bonding, chemical equations, physical states of matter, chemical and physical properties of matter, and solutions. Laboratory experiments support lecture topics. (prereq: MA-125 or one year high school algebra)

CH-200 Chemistry I 3 2 4

A general chemistry course for students in engineering and nursing degree programs, which provides a review of basic chemical calculations; concepts and nomenclature; atomic structure; chemical bonding; bonding theories; introduction to organic chemistry; kinetic molecular theory applied to gases; and properties of gases, liquids and solutions. Laboratory experiments are integrated with lecture topics. (prereq: CH-102 or one year high school chemistry with a grade of B or better)

CH-201 Chemistry II 3 2 4

This is a continuation of CH-200. Energy in chemical reactions, chemical change, rates of reactions, acid-base theory, chemical equilibria, oxidation-reduction, electrochemistry and organic chemistry are covered. Laboratory experiments support lectures. (prereq: CH-200)

CH-220 Organic Chemistry 3 0 3

This course covers principles of organic chemistry and includes a study of properties, preparations and interrelationships of important classes of organic compounds, as well as a study of their role in living systems. (prereq: CH-200)

CH-221 Biochemistry 3 3 4

This course provides the student with a basic understanding of the essentials of biochemistry and a knowledge of the interrelationships of the biochemistry reactions of the body and metabolic processes essential to body function. (prereq: CH-220)

CH-350 Chemistry of Building Materials 3 0 3

For architectural engineering and construction management B.S. students, an introduction to the chemistry of the production, preservation and deterioration of building materials and how chemical bonding at the microscopic level explains macroscopic properties of common construction materials, including ferrous and nonferrous metals, aggregate, cementitious materials, bituminous materials, polymers, wood and coolants. (prereq: CH-200)

CH-352 Introduction to Environmental Chemistry 3 0 3

This course will 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 time scales. Such an understanding provides baseline information against which the effects of human perturbations of chemical processes can be quantified. Another theme is the importance of understanding how engineering choices of input materials impact environmental chemistry. (prereq: CH-200 and junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CH-461 Advanced Topics in Chemistry 3 0 3

This elective will consist of a number of mini-courses that will cover chemical topics that are of specific interest to students in various engineering disciplines. Possible topics will vary, depending on the desires of the students, and may include chemistry of natural and synthetic polymers, chemical sensor technology, fuel cell chemistry, corrosion chemistry, battery technology, organic conductors and switches, and chemistry of composite materials. The course will involve a good deal of independent research and the major portion of the grade will be based on a technical research paper. (prereq: CH-201 and junior standing)

CH-499 Independent Study 3 0 3

Students are given the opportunity to pursue an approved subject not covered in regularly scheduled course work. Weekly meetings with the course advisor and a final report to be filed in the Physics and Chemistry Department are required. This course fulfills the science elective requirement in many programs. (prereq: junior standing and consent of the Physics and Chemistry Department chair)

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)

CM-224 Construction Estimating I 3 0 3

This course provides an overview of the different types of construction estimating. The basic skills concerning conceptional and budget-type estimating are taught. The whole bidding process is covered, from the point of view of the architect/engineer to that of the contractor. The use of computers in budget estimating is examined. (prereq: AE-225, AE-123)

CM-301 Construction Law 3 0 3

Material presented covers construction law, contracts, and labor relations. Topics include the 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)

CM-310 Construction Issues 3 2 4

This course deals with detailed construction site activities and conditions, including multiple-story construction, forming and shoring, site use and inspection, testing, safety and accident prevention, cold weather construction, organizing a job site, and working in an occupied building. (prereq: AE-220)

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-323 Construction Practices and Management 3 0 3

This course introduces some of the basic elements of a construction project to the student. Topics covered include elements of a construction project, the role of a project manager, project delivery types, scheduling, record keeping, value engineering, total quality, partnering, dispute resolution and contract enforcement. (prereq: AE-225)

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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
CM-420 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: CM-323)

CM-421 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: CM-420)

CM-432 Construction Project I w/AE-450	**1**	**3**	**3**

Team-building and leadership skills are developed with fellow students through the design process of an actual construction project. Progress reporting techniques are covered for the various phases of design. Budgeting and scheduling tools are utilized. The various potential career roles of the project manager are discussed. The CM term project work evolves utilizing the AE-450 design project. (coreq: AE-450, CM-421)

CM-433 Construction Project II w/AE-451	**1**	**3**	**4**

As a continuation of CM-432, this course develops analysis techniques used throughout the design process to ensure project constructability and maximum project value. Principles of value engineering, life cycle cost analysis, and quality control systems are covered in detail. Preparation for construction through development of the construction schedule and project start-up procedures are addressed. (prereq: CM-432; coreq: AE-451)

CS-100 Introduction to Engineering Computing	**2**	**2**	**3**

This course introduces computer programming as a tool for solving engineering problems, using the C++ programming language. Topics include basic data types and statements, control structures, input/output programming, functions, and the use of existing libraries. Laboratory assignments help the students to understand and apply programming concepts and techniques. (coreq: MA-127 or equivalent)

CS-150 Introduction to Computer Programming	**2**	**2**	**3**

This course provides students with a working knowledge of design and implementation of computer programs to solve problems encountered in engineering practice. Structured programming techniques will be introduced in this course. Particular emphasis is placed on the discussion of problem investigation, algorithm development, use of flowcharts and pseudocode, coding, execution, debugging, and documentation. Topics include data types, assignment statements, I/O statements, files, control constructs, looping techniques, arrays and vectors, user-defined functions, library functions,and modules. Data visualization will also be discussed. Problems related to engineering applications are emphasized. The computer language C++ is used to illustrate and implement the course topics.
(prereq: MA-126; 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: high-school programming course or equivalent.
(coreq: MA-127 or equivalent)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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-200 Engineering Software Design 2 2 3

This course provides a foundation in the design and implementation of computer programs using an object-oriented approach and the C++ programming language. Particular emphasis is placed on the design, documentation, and testing of programs. Topics include data types, control constructs, and the Standard Template Library. (prereq: CS-100 or equivalent)

CS-280 Embedded Systems Software 3 2 4

This course presents assembly language programming concepts. Topics include addressing modes, low-level architecture, use of library functions, and interrupts. Software control of hardware is stressed. In the laboratory, the students apply learned principles to real systems. (prereq: CS-183)

CS-285 Data Structures 3 0 3

The course covers fundamentals of data organization and basic algorithms for data manipulation. Topics include arrays, lists, stacks, queues, trees, sets, and hash tables. Fundamentals of algorithm performance are introduced, with an emphasis placed on time complexity analysis. Special emphasis is placed on appropriate use of containers, iterators, and algorithms defined in the C++ standard library. Laboratory assignments involve both the use and implementation of common data structures. (prereq: CS-183)

CS-286 Algorithms 2 2 3

This course extends the study of algorithms introduced in CS-285. Topics 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)

CS-321 Computer Graphics 3 3 4

This course introduces the student 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)

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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

CS-384 Design of Operating Systems 3 2 4

The design and implementation of modern operating systems are studied. An historical perspective is provided prior to investigating the following topics: process synchronization and scheduling, deadlock detection and avoidance, memory management,file system structures, protection and security, networks, and distributed computing. 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-391 Embedded Computer System Design 3 3 4

In this course, the student applies a design methodology to the implementation of a single board microcomputer system to be used in the control of an electromechanical device. Topics 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. The students' design experience reinforces the lecture material. (prereq: CS-280, CS-384, EE-201, EE-290)

CS-393 Computer Architecture 3 2 4

In this course, students learn about computer architecture and performance trade-offs that must be made in the design of computer systems. Topics include reduced instruction set computers, instruction set design, processor implementation, pipelining and memory hierarchy. The lectures are reinforced through projects in which the 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 CS-400/401, 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)

CS-401 Senior Design Project II 3 0 3

This is the second course in the two-course senior design sequence CS-400/401. 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-470 Computer Modeling and Simulation 3 2 4

This course introduces the student 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, the student develops computer models for engineering systems. (prereq: CS-381,MA-262)

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-486 Database System Design	**3**	**0**	**3**

This course introduces the theory and practice of database design and application, with emphasis on relational and object-oriented models. Topics include the 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-4881 Artificial Intelligence (AI)	**3**	**0**	**3**

The objective of the course is to introduce the basic concepts of artificially intelligent systems. Topics include knowledge representation, search strategies, control, and pattern recognition. Formal logic, natural language understanding, and "expert" systems are 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 small team projects 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 the student 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-393)

CS-495 Computer Networking	**3**	**3**	**4**

This course presents principles of data communications and computer networks. Topics include network topology, the principles of signaling on physical links, modulation, error control, flow control, LANs, packets, protocols, and network applications. Laboratory projects involve both hardware and software aspects of network systems.(prereq: CS-384, CS-391, CS-393)

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 advisor are required. A final report, the format of which is left to the discretion of the advisor, is required at the end of the term. (prereq: senior standing, consent of program director)

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 language SPICE will also be introduced for computer analysis of steady-state DC and AC circuits. (prereq: MA-137)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

EE-202 Linear Networks: Transient Analysis 3 3 4

This course introduces the student 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 response. (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 complete a number of design projects. The designs are prototyped and tested in the laboratory and each student submits a formal bound design report. Design content will account for 40 percent of the course grade. (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

Electrical Systems 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, transformers, motors, and motor controllers are analyzed focusing on application, mathematical 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 will be introduced. (prereq: MA-231) (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 solution 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 non-electrical engineer to DC and AC motors and transformers, as well as control of these devices using programmable logic controllers and variable speed drives. Electronics will include rectifiers and SCRs. Laboratory work emphasizes motors and their control. (prereq: EE-201, 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 ASM chart. SSI, MSI, and programmable logic devices will be used to implement the design circuits. Commercially available software will be used as CAD. Experiments, design problems and projects in lecture and laboratory sessions support material discussed in the course. (prereq: CS-100, EE-201)

		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 to be 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. The 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 will design at least two microcomputer subsystem interfaces entailing both hardware and software. (prereq: EE-290)

EE-353	**Electrical Power Distribution Systems II**	**3**	**2**	**4**

Topics 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, unit substations, 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. NEC handbook is required. (prereq: EE-351)

EE-354	**Digital Circuits and Microprocessor Applications**	**3**	**2**	**4**

This course amplifies electronic concepts previously introduced to non-electrical 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 will exemplify how various chips can be utilized to control mechanical and other systems. Laboratory experiments support the theory. (prereq: EE-253, CS-150, not an EE elective.)

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-370	**Control Systems**	**4**	**0**	**4**

The student is introduced to the fundamentals of automatic control systems including the analysis and design of control systems for various engineering applications. Topics include steady state errors, sensitivity analysis, transient response, Routh-Hurwitz criteria, root locus, frequency response, and state space variables. MATLAB is used to aid in the analysis and design of 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 will be used for the iterative process necessary to achieve optimal solutions to design problems. (prereq: EE-290, EE-310, CS-200 or equivalent)

EE-392	**Digital Systems Design**	**3**	**3**	**4**

The objective of this course is to give the student 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 the student with the opportunity to apply the theory. Designs will be 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 the student to the design and fabrication of custom-made integrated circuits. The course will draw on the student's knowledge of electronic circuit theory, semi-conductor device physics and digital logic design to perform the design of an integrated circuit. Topics covered include review of semi-conductor 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. SILOS logic simulation and SPICE will be used to aid the student in the design of a custom integrated circuit. (prereq: EE-290, EE-310, PH-360)

EE-401 Principles of Communications 3 0 3

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 the student to the design of low frequency active filters. The student learns 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 senior design sequence EE-407/408/409, which is required for the BSEE degree. Students form into 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 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 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 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 1 4

This subject covers the terminal behavior of linear operational amplifiers, and nonlinear active circuit analysis and design. Topics 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, the scattering parameters are introduced as the two-port parameters used in high frequency circuits. NOTE: This course is a prerequisite for EE-425, 426, 429, 462, 464, and 492, and is offered only during the fall quarter each year. (prereq: EE-320)

EE-421 Digital Communication Systems **3** **0** **3**

This course covers important concerns involved in the design of digital communication systems. Methods including PAM, PWM, PPM, and PCM are studied. Other topics include the matched filter, correlation, and modem protocols. (prereq: MA-262, EE-401)

EE-422 Digital Signal Processing (DSP) **3** **0** **3**

This introduction to the digital processing of signals includes the topics of impulse sampling, 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. (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 the student to implement powerful algorithms on actual DSP hardware utilizing the assembly language of the DSP chip. Such algorithms as FIR and IIR digital filters, adaptive and multirate filters (interpolator) 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-422, EE-291 or equivalent)

EE-424 Data Communications **3** **0** **3**

This course is designed to provide the student with the technical aspects of data communication. It extends the concepts of communication system theory, applying them to data communications situations. Topics 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 and impedance matching are covered. This is followed by the design of filters, amplifiers, mixers, and oscillators in the RF region. Computer-aided engineering software is utilized in the laboratory to help realize actual RF circuit designs. (prereq: EE-401, 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, non-reciprocal 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, the student is 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-230, and EE-310)

EE-447 Power System Analysis I 3 0 3

This course is designed to give the students a solid foundation in classical methods and modern techniques in power system engineering. Methods of power system analysis and design, particularly with the aid of a personal computer, are presented. Topics 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 include: symmetrical three-phase faults, symmetrical components, unsymmetrical faults, technical treatment of the general problem of power system stability and its relevance, introduction to relaying principles and practice, and power system protection. (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: EE-310 and senior standing)

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

The 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-420)

EE-474 Programmable Controllers 2 2 3

This course provides the theory and hands-on experience necessary to enable the student 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 proceed 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 which 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 will be developed. The material is reinforced by laboratory sessions which 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 the student the basic concepts of modeling uncertainty in systems through the use of fuzzy sets. The underlying concepts of fuzzy sets will be introduced and their role in such applications as semantic interpreters, control systems, and reasoning systems will be presented. Students will gain first hand experience of fuzzy sets through programming assignments and a short research project. (prereq: EE-290 and senior standing)

EE-482 Pattern Recognition and Image Processing 3 0 3

This course introduces the students to the concepts of image processing. Topics include image display, image processing in real time domain, image processing in frequency domain, geometric transformations and segmentation. Design of non-recursive filters, as well as project and programming sessions are also included. (prereq: EE-290, EE-303, and senior standing)

EE-484/584 Neural Networks 3 0 3

This course introduces the student to the basic concepts of modeling and simulating adaptive and learning systems using neural networks. The underlying concepts of neural networks will be introduced, as well as a number of common topologies and learning rules used in neural networks. Students will gain first hand experience of neural networks through computer assignments and a short research project. (prereq: EE-290, MA-330 or MA-343, CS-200 (or equivalent) and 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 will be demonstrated. (prereq: CS-200 and 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 either electrical engineering or computer engineering)

EE-488 Introduction to Artificial Intelligence and Expert Systems 3 0 3

The objective of this course is to provide the student with an overview of topics in the field of artificial intelligence(AI). The course also provides the student 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 will be discussed. Fuzzy logic systems, neural network systems and computer vision systems will be 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 will be devoted to the design of expert systems. Applications of expert system in engineering system design and analysis will be stressed throughout. Case studies will be discussed. Students are encouraged to design expert systems for his/her own engineering applications, and an expert shell will be used to implement the design. (prereq: CS-200, 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 will cover 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 IBM-PC BIOS routines. Students will learn to write and debug assembly language programs using a powerful Macro Assembler and Debugger. The course will also introduce students to interfacing memory and I/O devices to the 8086 CPU, and how to build a basic minimum mode system. In particular, students will learn how to use the 8086 timing diagrams to determine the speed requirements for memory and I/O devices. (prereq: EE-291)

EE-497 System Design Using 16-Bit Microprocessors	**2**	**2**	**3**

The course continues with the memory and I/O interfacing techniques discussed in EE-493. Students learn how to interface to both dynamic and static random access memory, and master a variety of I/O techniques, including polled, interrupt driven and DMA (direct memory access). Parallel and serial I/O interface ICs, timer/counter ICs, a programmable interrupt controller, a DMA controller and the 8087 family of arithmetic coprocessors are also studied. System design in both the minimum and maximum modes of the Intel 8086 family is considered. An introduction is given to some of the more advanced features of the 80286/80386/80486 microprocessors such as multitasking, memory management and virtual memory. (prereq: EE-493)

EE-499 Independent Study	**1**	**0**	**3**

Students enrolled in this course are 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 advisor are required. A final report, the format of which is left to the discretion of the advisor, is required at the end of the term. (prereq: senior standing in electrical engineering and consent of department chairman)

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**

This is a core course for engineering technologists and engineers. Topics include linear measurement systems, orthographic and axonometric sketching, projection theories, visualization, auxiliary views, sectioning, dimensioning and tolerances, and introduction to 3-D CADD. (prereq: none)

EG-121 Engineering Graphics for EET	**2**	**2**	**3**

This is a core course for electrical engineering technology students. Topics include 3-D sketching and visualization, orthographic views, projection theories, auxiliary views, true length, true size, rotation, sectioning, dimensioning, tolerances and 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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)

EG-130 Engineering Graphics II 1 3 2

This is a study of applications and various aspects of projective geometry. Topics include true length of lines, true size of planes, true angles, parallelism, perpendicularity, connectors, rotation, force systems and computer graphics. (prereq: EG-120)

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 semester 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 purpose of this course is to acquaint students with the principles of effective, audience centered public speaking, help them develop poise and confidence when speaking in front of an audience, and give them practice in preparing and delivering speeches. Students learn the steps in the speech-making process as well as effective techniques for analyzing their audience to ensure that speeches are appropriate for and effective for their audience. A variety of assignments in expository and persuasive speeches as well as group discussion provide students with several challenging public speaking experiences. A speech banquet is held at the end of the course during which each student gives a speech for a larger audience than is normal during class periods. (prereq: EN-131)

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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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. Working in pairs, students prepare a formal report dealing with a real business problem, culminating in an oral presentation that includes appropriate visual aids. (prereq: EN-241)

EN-441 Professional Presentation Techniques 2 2 3

The purpose of this course is to develop effective persuasive presentation skills, to learn to incorporate graphics into presentations, to understand the basics 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-103 DC Circuit Analysis 3 3 4

This course is an introduction to the fundamental laws and properties of electrical circuits and their application to DC circuit analysis. Topics covered include resistance, Ohm's law, Kirchhoff's laws, series-parallel circuits, mesh and nodal analysis, network theorems, capacitance and inductance. The laboratory experiments are designed to illustrate the principles presented in this course and the use of computer software in report preparation. The student is also introduced to DC steady state computer simulation. (prereq: freshman standing; MA-125 or equivalent; coreq: ET-107)

ET-104 AC Circuit Analysis 3 3 4

ET-104 is a continuation of the study of electric circuit theory begun in ET-103. It covers the analysis of electrical networks with sinusoidal excitation. Topics covered include the sine wave, complex numbers, phasors, series-parallel circuits, mesh and nodal analysis, network theorems, complex power, and ideal transformers. The laboratory experiments are designed to illustrate the principles presented. The student is also introduced to AC steady state computer simulation and expands the software utilized in report preparation. (prereq: ET-103, MA-126)

ET-104S DC and AC Electric Circuit Analysis (supplemental) 3 3 4

This course is a bridge course designed especially for transfer students. The student is assumed to have a knowledge of DC and AC circuit concepts and analysis through series-parallel circuits. This course covers the advanced circuit analysis concepts and techniques normally covered in ET-103 and ET-104. Kirchhoff's laws, series-parallel circuits, phasors, and impedance are briefly reviewed. Then superposition, mesh and nodal analysis, Thevenin's and Norton's theorems, complex power, and ideal transformers are covered. The laboratory experiments are designed to illustrate the principles presented in this course and the use of computer software in report preparation. The student is also introduced to DC and AC steady state computer simulation. (prereq: ET-E curriculum advisor written approval)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
ET-106	**Advanced AC Circuit Analysis and Introduction to Semiconductor Diodes**	**3**	**3**	**4**

ET-106 is a continuation of the study of electric circuit theory begun in the previous course sequence ET-103 and ET-104. The new concepts to be introduced include frequency as a variable in the analysis of electric circuits and semiconductor diodes. Topics covered include circuit analysis with frequency as a variable, Bode plots of circuit responses, resonant circuits, an introduction to semiconductors, various pn junction diodes, and diode circuit applications. The laboratory experiments illustrate the principles presented in this course. Computer simulations are extended to include swept frequency AC circuit analysis and diodes circuits. The utilization of software for report preparation is continued. (prereq: ET-104, MA-127; coreq: EN-132)

ET-107	**Introduction to Engineering Technology**	**1**	**2**	**2**

This course serves as an introduction to the college experience, resources and engineering technology. The electrical engineering technology profession is examined in order to establish a sound perspective. Development of academic, personal, and interpersonal skills that will help the student succeed in college is covered. Practice and feedback are given to enhance skills in oral presentation, written expression, and class participation. (prereq: none)

ET-107S	**Introduction to Engineering Technology Seminar**	**1**	**0**	**0**

This course serves as an introduction to MSOE and the electrical engineering technology program for transfer students who have 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. Transfer credit for ET-107 is awarded for the student's previous college experience and the successful completion of the requirements in ET-107S. Topics that are typically covered include: the electrical engineering technology program, the MSOE computer system, the library, MSOE policies and procedures, campus resources, critical thinking, and multicultural diversity. (prereq: consent of an ET-E curriculum advisor)

ET-151	**AC and DC Circuit Analysis**	**2**	**2**	**3**

The purpose of this subject is to introduce the student to the fundamental laws of electrical engineering and their application to AC and DC circuit analysis. Topics covered include Ohm's law, Kirchhoff's laws, batteries, magnetism, induction, series-parallel circuits, single-phase AC circuits, power factor and phasors. (prereq: MA-126; coreq: PT-220)

ET-190	**Logic and Switching Circuits**	**3**	**2**	**4**

This course is taken by both electrical and mechanical engineering technology students. The student initially learns how to implement basic logic functions. The fundamental concepts of Boolean algebra, postulates, reduction techniques, and number systems are covered. The electronic devices that are used to implement basic combinational and sequential logic functions are examined, and the use of integrated circuits is stressed. Laboratory work reinforces material presented in lectures. (prereq: ET-103 or ET-151)

ET-200	**Electronic Construction and Packaging**	**3**	**2**	**4**

This course is an introduction to the packaging of electronic systems. It covers mechanical design aspects of these products, packaging considerations of electronic components, practical circuit analysis involved in packaging, reliable design factors, thermal analysis and vibration considerations. All three levels of packaging will be discussed. This study will progress from chip carrier, on to printed circuit boards and finish with a usable product. The printed circuit board will be a focal point with applications of CAD techniques used in design. The manufacturing process of printed circuit boards is studied. SMT technology is introduced. All topics are augmented with tours of local manufacturing facilities. (prereq: EG-121, ET-190, ET-210)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
ET-210	**Transistor Electronic Circuits**	**3**	**2**	**4**

The bipolar junction transistor (BJT) and the field effect transistor (FET) are introduced in this class. The semiconductor operation and important parameters of these devices are thoroughly discussed. The DC and AC analysis techniques are used to derive the DC bias and the small signal gain, frequency response, and input and output impedance expressions of several amplifier circuits. Laboratory experiments are used to augment and illustrate the lecture material. (prereq: ET-106)

ET-210S	**Electronic Circuit Analysis (supplemental)**	**3**	**3**	**4**

This course is a bridge course designed especially for transfer students. The student is assumed to have a knowledge of resonant circuit, circuits containing diodes, and the DC analysis of bipolar junction transistor (BJT) and field effect transistor (JFET and MOSFET) circuits. New concepts introduced include frequency as a variable in the analysis of electric circuits with sinusoidal excitation. Topics include circuit analysis with frequency as a variable, Bode plots of circuit responses, and detailed analysis of resonant circuits. The student is then introduced to small signal analysis of transistor amplifier circuits and examines gain and phase frequency response. The laboratory experiments illustrate the principles presented in this course. The student is also introduced to swept frequency AC circuit analysis using computer simulation and will continue to utilize software for report preparation. (prereq: ET-104S, MA-127, and ET-E advisor written approval)

ET-213	**Analog Electronic Circuits**	**3**	**2**	**4**

This course builds upon the foundation established in ET-210 in order to provide the student with the background needed to work effectively with linear integrated circuits. The basic internal structure of the operational amplifier (op-amp) is first studied to obtain an understanding of its terminal characteristics. Applications of the op-amp are then studied, noting how the terminal characteristics of that device affect the performance of the circuits. Oral presentations are scheduled in this course. (prereq: ET-210, MA-128; coreq: EN-241)

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, ET-104, PT-220)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
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, ET-190)

ET-298	**Microprocessor Principles and Applications**	**2**	**2**	**3**

Mechanical Engineering Technology students are introduced to the microprocessor, microcontroller and microcontroller system. In the laboratory, the student is required to analyze and design programs 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 microprocessor and microcontroller, programming model, assembly language, addressing mode, instruction set, looping, polling and handshaking techniques, stacks and stack operations, subroutines, parallel I/O, interrupts, and interfacing circuits. Special attention is given to microprocessor applications related to mechanical systems. (prereq: CS-150, ET-190)

ET-300	**Linear Circuit Design**	**3**	**2**	**4**

This course will provide an opportunity for the student to gain knowledge of both time domain and frequency domain analysis techniques for electric networks. A variety of waveforms, including ramp, sinusoid, switched, exponential, and impulse functions, are discussed. 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 the lectures. (prereq: ET-213 and CS-150; coreq: ET-304 and MA-227)

ET-301	**Signals and Circuits**	**4**	**0**	**4**

In this course, the student examines electronic signals and noise, especially in the frequency domain, and determines various circuit and system responses to them. Major topics include Fourier series, Fourier transforms, electronic noise, and circuit/system specifications and performance. This course concludes with an examination of discrete time signals and applications. Computer software is utilized for significant computations. (prereq: ET-300; coreq: ET-323)

ET-304	**Advanced Topics in Circuit Analysis**	**3**	**0**	**3**

This course consists of four main topics: an overview of traditional electric circuit analysis techniques, Bode plots of transfer functions containing second order terms, development of two-port parameters and models, and applications of two-ports to electric and electronic circuit analysis. The overview of traditional electric circuit analysis techniques sets the foundation for this course. The Bode plot coverage of transfer functions containing first order terms is extended to terms with complex conjugate roots. The determination of the two-port parameters of circuits and the derivation of various gain and impedance expressions is emphasized in the two-port parameters coverage. The two-port parameters are then utilized in the context of transistor amplifiers and passive networks. (prereq: ET-213)

ET-310	**Electronic Circuit Design**	**3**	**3**	**4**

This course provides an introduction to the fundamentals of electronic circuit design. Building on earlier topics, the student applies fundamental concepts to laboratory design projects utilizing bipolar and field effect transistors, and operational amplifiers. Design activity focuses on power supplies, power amplifiers, switched mode power supplies, oscillators, and active filters. The use of circuit simulation software is an integral part of the design process. (prereq: ET-300)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
ET-323	**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 concludes with a brief examination of antenna fundamentals and basic link calculations. In the laboratory sessions, high frequency measurement techniques and topics are covered. (prereq: ET-224, PT-220; coreq: ET-304 and 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)

ET-351	**Survey of Communication Circuits**	**2**	**2**	**3**

Data communications is very significant in today's world. It is used in all 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: one 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; coreq: MA-226)

ET-371	**Feedback Control Systems and Circuits**	**3**	**2**	**4**

In this course, the student is introduced to the analysis, design and applications of feedback control systems. Topics include the concept of open and closed loop systems, transient response, steady state analysis, closed loop system stability, and the design of simple controllers. Modeling and simulation of control systems are covered using commercially available simulation languages. Typical applications of feedback control systems are discussed in the laboratory sessions. (prereq: ET-310)

ET-380	**C Programming Language**	**3**	**2**	**4**

The C programming language is the most popular industrial language for applications program development. It is highly structured and easily transportable from mainframes to microcomputers. The C language permits programming in all areas from games to graphics, from operating systems to applications programs, and from business programs to industrial controls programs. The student learns the variety of data types and ventures into all areas of C programming. C language program design will be in the development of functions and their modular usage in large and small programs. (prereq: ET-295)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
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 and 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, PT-220)

ET-400 Senior Project (1-4 credits)

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 advisor, the ET-E program director, and the department chairman) (1-4 credits, but 4 credits to count as a technical elective)

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 and EN-332; coreq: ET-424)

ET-419	**Optical Electronics Technical Elective**	**3**	**2**	**4**

The objective of this course is to equip the student with both theory and laboratory experience to apply optical electronics 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 evaluation 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, gradients, 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, GE-300)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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, GE-300)

ET-424 Electromagnetic Field Applications 2 2 3

This course is a continuation of ET420 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)

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 output are considered. (prereq: PT-220; ET-E students: ET-310, ET-323; Mfg. ET students: ET-395)

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, GE-300, PT-220)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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, GE-300)

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-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-200, ET-310, MS-221, PH-361)

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: Mfg. ET students: ET-298; ET-E students: 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 on all 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, and numerical differentiation and integration. (prereq: EN-332, ET-380, GE-300, MA-227)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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 capability, 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, 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, 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, pulsemode, and levelmode 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, GE-300)

ET-499 Independent Study **1-4 credits**

Independent investigation into a topic is encouraged under the direction of a MSOE faculty member. The independent study must conform to MSOE ET-499 guidelines. (prereq: EN-332, GE-300, courses appropriate to the selected topic, senior standing and consent of an independent study advisor, the ET-E Program Director, and the Department Chairman) (1-4 credits, but 4 credits to count as a technical elective)

FP-272 Fluid Power Circuits 3 3 4

This course defines fluid power, its advantages and limitations, the prevailing standards, and graphic symbols. It ties in the many applications of fluid mechanics. The various types of loads are studied and related to the hydraulic performance required. Positive-displacement pumps, motors and actuators are described, and then supported by laboratory sessions in which students inspect the components and operate some of them in hydraulic circuits. Also included are valves for pressure control, direction control and flow control; they are incorporated into hydraulic circuits for specific purposes. Finally, the subject of overall circuit design and optimization is treated. (prereq: MT-218)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

FP-373 Industrial Pneumatics 3 2 4

In this course, pneumatic on-off motion control is considered and compared to various alternative methods. The gas laws are applied to analyze the compression, flow, pipe friction loss and valve coefficients for air. Compressors, receivers and air treatment accessories are described. Air motors, cylinders and valves are studied. ANSI graphic symbols are introduced in order to recognize and draw the components. Complete pneumatic circuits are designed for single and multiple actuators using valves shifted by the choice of various operators. The course is supported by a progression of laboratory exercises. (prereq: MT-215 or MT-216, junior standing)

FP-374 Hydraulic Maintenance, Troubleshooting, Filtration and Contamination Control 3 2 4

Proper maintenance and troubleshooting of hydraulic components and systems are covered in this course. Causes of component and system failure are discussed along with methods of reducing and preventing failures. A systematic approach to contamination control is presented by determining the target cleanliness level of different types of hydraulic circuits; discussing filter performance characteristics; and selecting, sizing and locating a filter in a circuit for optimum performance. A systematic approach to troubleshooting hydraulic systems is also presented using portable diagnostic equipment including pressure transducers, flow meters and temperature indicators. Laboratory sessions include failure analysis of various types of hydraulic components, fluid sample analysis and troubleshooting hydraulic industrial and mobile circuits using portable diagnostic equipment. (prereq: FP-272)

FP-375 Mobile Hydraulics 3 2 4

This course covers the application of hydraulic fluid power and motion control technology to mobile applications. Stack, sectional and cartridge valves are analyzed along with multiposition spool valves for steering and brake control. Hydrostatic transmission design for single and multiple drive points is investigated. Power plant management in conjunction with multifunction operations is covered in the context of load sensing, constant power, constant flow and pressure compensation for direct pump control. Reservoir design criteria, hose standards and performance are included. Environmental issues related to fluids and noise control are also addressed. (prereq: FP-272)

FP-472 Modeling and Simulation in Design of Hydraulic Components and 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 electro-hydraulic 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; pre/coreq: ME-431/432 or MT-433)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

FP-475 Fluid Power Design Projects 2 3 3

A specific design project(s) having a substantial hydraulic content is undertaken. A set of specifications are developed, and teams are formed to address specific issues of the design. Issues include component sizing; systems/sub-systems design; and interfacing with electronic, pneumatic and mechanical systems/components. Hardware fabrication and testing are completed if the project scope and manpower allow. The open-ended projects are judged based on originality, functionality, performance, satisfaction of good engineering practice, safety and presentation of results. (prereq: FP-373, FP-374, FP-375, FP-473)

GE-100 Introduction to Engineering Concepts 3 2 4

This course introduces concepts common to all branches of engineering. It includes engineering technology, methodology, tools, experimentation and the scope of the profession. Basic principles, devices, processes and systems of particular interest to industrial, electrical, computer and mechanical engineers are discussed in lecture and demonstrated in laboratory. (prereq: term 1 standing)

GE-205, GE-305, GE-405 Professional Growth 1 0 0

This series of courses is directed towards the overall growth of the student. The student is required to attain 20 hours of combined professional and community outreach from sophomore through senior year. (prereq: none)

GE-300 Career and Professional Guidance 0 2 1

This course is designed to give guidance to students in the computer engineering, electrical engineering, electrical engineering technology and software engineering majors for their senior year and for their professional career immediately following graduation. Guest speakers from several discipline areas help provide insight into industrial careers. The instructors and guest speakers together 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 discusses how to prepare a good resume, placement office procedures, interviewing skills and use of the Internet for employment opportunities. Students prepare a resume, do research on a company that they are interested in and then submit their resume with an appropriate cover letter seeking employment. Finally, the process of professional engineering registration is presented. (prereq: junior standing)

GE-470 Robotics Fundamentals 3 0 3

This course covers the basics of robot operation and applications. Topics include the following: robot arm motion and degrees of freedom; mechanical, pneumatic and electrical end-effectors; mechanical, optical, proximity and tactile sensors; robotic drives; robot programming; industrial applications; and commercial robots that are used today. Students have the opportunity to operate and program life-size robots, and to see robots in action on industrial field trips. (prereq: none)

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)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
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)

GT/NM-330	**Fundamentals of Quality Methods**	**3**	**0**	**3 or 3.3 CEUs**

This course examines the real meaning of quality, quality-cost relationship goals and quality management systems. In relation to these, the following are discussed: basic concepts of quality control; policy objectives and management; organizing the quality function, economics of quality control; quality costs; the inspection function; quality control systems; customer relations; vendor relations; and quality motivation. Concepts in attributes and variable sampling, probability determination and problem-solving techniques are utilized. (prereq: none)

GT/NM-333	**Inspection, Sampling and Statistical Process Control**	**3**	**0**	**3 or 3.3 CEUs**

This course is designed for production supervisors and managers and is concerned with applying techniques of quality for operator self inspection. SPC and sampling are covered from an application aspect rather than a development and design focus. Statistical basis is briefly covered to give confidence that the methods are sound. (prereq: GT/NM-330)

GT/NM-334	**ISO-9000 and the Quality Audit**	**3**	**0**	**3 or 3.3 CEUs**

This course covers an introduction to ISO-9000 and its potential impact on doing 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: GT/NM-330)

GT/NM-340	**Advanced Statistical Process Control**	**3**	**0**	**3 or 3.3 CEUs**

This course provides students with advanced tools needed to create solutions to process problems. Advanced techniques include analysis of means for both variable and attributes. This course also includes a review of general statistics needed for problem solving. (prereq: GT/NM-333)

GT/NM-346	**Production Systems**	**3**	**0**	**3 or 3.3 CEUs**

This course evaluates the performance of production systems and investigates how quality and productivity are affected when using different production systems in meeting varying market demands. Students learn how to continuously improve production systems; identify, quantify and reduce waste and inefficiency; and reduce or eliminate activities that add no value. Actual data from students' work environments are used to reinforce material presented. The production systems reviewed include order point, MRP/MRP II (manufacturing resource planning), JIT (just in time), OPT (optimized product technology), and ABC (activity-based costing). (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
GT/NM-444 Design of Experiments	**3**	**0**	**3**
			or 3.3 CEUs

Systematic, structured approaches to experimentation are essential to an effective quality-assurance effort that focuses on designing quality into the product or process. This course develops the fundamentals of experimental design, considering the Taguchi approach, and maximizes information obtained at minimal resource expenditure. Experimentation strategies, analyses of means and variance (ANOM, ANOVA), and a variety of experiment designs, including factorial and fractional factorial designs, are covered. (prereq: GT/NM-445)

GT/NM-445 Applied Statistics for Quality	**3**	**0**	**3**
			3.3 CEUs

This course provides the basic statistical tools applied to quality assurance/improvement. Topics include data collection, probability distribution analysis, design and application of process control charts, process capability analysis, statistical tolerancing, acceptance sampling, correlation and regression analysis. (prereq: college algebra)

GT/NM-447 Advanced Applied Statistics for Quality	**3**	**0**	**3**
			3.3 CEUs

This is a continuation of GT/NM-445. Topics covered include hypothesis testing, acceptance sampling, correlation and regressing analysis, and an introduction to analysis of variance. All topics are treated in relation to the quality improvement process. (prereq: GT/NM-445)

HS-161 General 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 and stress management; an overview of developmental stages; values; interpersonal relationships; and marriage and divorce. A discussion of the theories is presented with an emphasis on personal and professional applications. (prereq: none)

HS-332 Bioethics

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 practice of the various health care professions. This course emphasizes 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 will be a recurring theme of the course.

HS-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, the 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)

HS-411 Foreign Language II	**2**	**2**	**3**

This course is a continuation of HS-410. (prereq: HS-410 or two years of high school foreign language)

HS-412 Foreign Language III	**2**	**2**	**3**

This course is a continuation of HS-411. (prereq: HS-411 or three years of high school foreign language)

HS-413 Foreign Language IV	**3**	**0**	**3**

Grammar is reviewed as needed, especially in more difficult points. Vocabulary expansion is stressed. Extensive reading is done in original texts, and related cultural issues are discussed. (prereq: HS-412 or four years of high school foreign language)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HS-414 Foreign Language V **3** **0** **3**

This course is a continuation of HS-413. (prereq: HS-413 or five years of high school foreign language)

HS-415 Cultural Dimensions **3** **0** **3**

This course is designed to provide insight into a particular foreign culture. It includes such topics as the geography, natural resources, historical background, society, politics and current affairs, art, religion, business, literature, and other cultural traditions. (prereq: none)

HS-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)

HS-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. It also considers major approaches to literary criticism. (prereq: none)

HS-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)

HS-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 (pre-colonization) 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 status of a world-class literature. 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HS-425 Contemporary Literature **3** **0** **3**

This course focuses on the best of literature published within the past five 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. Film may also be used to give students visual reference to what has been studied. (prereq: none)

HS-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)

HS-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, Virgin, etc.); Middles Ages Literature (Beowulf, Dante, Chaucer, etc.); and Renaissance Literature (Petrarch, Erasmus, Machiavelli, Cervantes, Shakespeare, Mikton, etc.). In addition to the reading that we do as a group, students are required to conduct and individual research project. The individual projects will demonstrate a thorough investigation (secondary research and personal insight) of a specific piece of pre-Renaissance literature (preferably something that we have not discussed as a class). (prereq: none)

HS-429 American Minority Literature **3** **0** **3**

This course acquaints students with a broad range of literature by American writers from minority ethnic backgrounds, from colonial American poetry to contemporary poetry, novels, plays, short stories, and essays. The works read are placed into historical and cultural perspectives, and film may be used to give students visual reference to what has been studied. (prereq: none)

HS-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 and semantics and syntax is stressed as elements of formal systems for sentential and quatificational deduction are introduced. Activities emphasize acquiring skill in the translation of English expressions into symbolic notation and proof construction. (prereq: none)

HS-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, recognizing and evaluating arguments. The second part of the course covers recognition of fallacies, the role and importance of language used in the media, science, business and other areas of contemporary concern. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HS-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 our daily life 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)

HS-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)

HS-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 "existentialist." 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 literature drama and philosophy. Students will be encouraged to explore and develop their own personal and philosophical positions. (prereq: none)

HS-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, 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)

HS-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)

HS-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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HS-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)

HS 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)

HS-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)

HS-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. (Global History I is NOT a prerequisite.) (prereq: none)

HS-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 twentieth 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)

HS-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)

HS-444 United States History 3 0 3

This course presents a synopsis of American history highlighting the significant events that have shaped our 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HS-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, 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)

HS-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)

HS-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)

HS-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 twentieth 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)

HS-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 (both through individual classroom contributions and through formal panels) and in writing. (prereq: none)

HS-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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HS-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)

HS-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 bio-mechanical 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)

HS-466 Abnormal Psychology 3 0 3

This course is designed to assist students in gaining an understanding of abnormal psychology and its place in contemporary society. In addition to exploring the major categories of mental disorders, students also focus on those patterns that seem most relevant to a broad, basic understanding of maladaptive behavior. Students examine four aspects of each major pattern of abnormal behavior: the clinical picture; causal factors (biological, psychosocial and sociocultural); treatments; and outcomes. Students gain both a better understanding of their own human experience and behavior and that of others. (prereq: none)

HS-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)

HS-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)

HS-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)

HS-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)

HS-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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

HS-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)

HS-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, art film, and 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 an art object. Analytical written reports are required. (prereq: none)

HS-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)

HS-487 Visual Arts 3 0 3

What pleases the eye? Why? This subject 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)

HS-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)

HS-494 Creative Thinking 3 0 3

The subject 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)

HS-495 Humanities Selected Studies 3 0 3

This course covers timely topics in the humanities and 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)

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 theses 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.

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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-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 analysis algorithms also are examined. (prereq: MA-136 or equivalent)

IE-340 Project Management 3 0 3

This course enables 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. Computer applications are used to better understand the decision-making tools, PERT and CPM. (prereq: MA-262 or equivalent)

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 manpower facilities. This course emphasizes the techniques and procedures for planning the effective use of these facilities 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 of a design origin. The subjects presented here move from traditional plant layout and facilities planning to comprehensive design requirements of modern integrated, computer-assisted manufacturing, storage and materials handling. (prereq: junior standing)

IE-348 Quality Assurance 3 0 3

Quality has become a watchword of American industry as it moves into the world market. This course deals with the problems and solutions of how to achieve better quality at lower costs. The course covers the techniques of quality measurement and control, and relates these techniques to the required income, costs, management role, and support operations factors as related to both manufacturing and service industries. (prereq: MA-262)

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-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)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
IE-379	**Ergonomics**	**3**	**2**	**4**

Ergonomics is the study of the optimum 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 and 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 (nonrandom). 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)

IE-383	**Simulation**	**3**	**2**	**4**

Focusing on discrete-event systems, this course uses FORTRAN and SLAMSYSTEM 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: CS-185, IE-382)

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; the design to attract, maintain and motivate good people; and the design 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. It deals with cost, value and worth concepts, and emphasizes the applications of funds invested in capital assets and facilities, as well as the return on such investments. (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 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 course covers the fundamental properties of materials and their relation to manufacturing processes. Emphasis is on the principles upon which manufacturing processes are based. Topics covered include material testing, solidification, deformation and materials removal processes, and economic analysis of alternate processes. (prereq: IE-345, ME-257)

		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 the orthogonal array techniques of Taguchi, and Box/Hunter, especially as applied to design. (prereq: MA-262)

IE-470 Topics in Industrial Engineering 3 0 3

This course contains subject matter in some of the newer areas of industrial engineering and management. Thus, the content changes regularly. (prereq: senior standing and consent of the instructor)

IE-476 Robotics Systems 3 2 4

The 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-control 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 Systems 3 0 3

Computer control of manufacturing systems is a fact of life. The planning, use, expansion and updating of computerized 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-479 Plant Engineering 3 0 3

This course covers the varied topics that are part of the responsibilities of a modern plant engineer. The course covers the selection and utilization of industrial power systems, motors and other devices necessary for a safe and reliable plant operation. Units of measurements for liquid, solid and gases; material balance; and steady-state conservation and nonconservative systems, with emphasis to pollutants and environmental concerns are also covered. The course also covers heating and ventilation topics, selection of blowers and motors, as pertaining to the normal responsibilities of a plant engineer. Topics of maintenance for plant equipment are also touched upon. (prereq: EE-253, ME-354)

IE-483 Advanced Simulation 3 0 3

This course continues the material presented in IE-383 and focuses on statistical concerns and advanced network modeling techniques. Probability distributions are examined for appropriateness and data fit. Concentrated effort in the analysis of case studies or an industrial project is included. (prereq: IE-383)

IE-490 Industrial Engineering Design Process 2 0 2

This course introduces the student to the design process used to develop an acceptable solution to a broadly defined problem or opportunity. Evaluation of user needs and development of technical specifications and design evaluation criteria, as well as techniques for design optimization in the presence of sometimes conflicting design constraints (quality, safety, productivity, etc.) are reviewed. The course culminates in the selection of a senior design project, usually by a team of students, and a technical design proposal submitted to their “client.” (prereq: senior standing and consent of the instructor)

IE-491 Industrial Engineering Design Project 1 0 3

This course includes the actual implementation of the design proposal developed in phase one (IE-490). The design is documented in a written team report and orally defended before a faculty review panel. (prereq: IE-490)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
IE-499	**Independent Study**	**0**	**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 survey, analysis, design or laboratory study. (prereq: senior standing and approval of a faculty advisor and the program director)

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)

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)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
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)

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 present future failures, hydraulic system troubleshooting, and control systems. (prereq: Basic Fluid Power Technology Certificate or equivalent)

MA-105	**Geometry**	**4**	**0**	**4**

This course introduces concepts of plane geometry with emphasis on geometry as a deductive system using postulates and theorems. Topics include points, lines, angles, polygons, parallel lines, perpendicular lines, congruence of segments, angles and triangles, and special angle relationships. (prereq: none)

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)

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: 1-1/2 units of high school algebra; coreq: MA-126)

MA-128	**Analytic Geometry and Calculus I**	**4**	**0**	**4**

This subject 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-127)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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, differentiation of algebraic and trigonometric functions, and applications of the derivative to maximum, minimum and time rate problems. (prereq: MA-127)

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; integration of algebraic and transcendental functions; integration of powers of certain trigonometric functions; integration by parts; and applications of integration to areas, volumes of solids of revolution and work. (prereq: MA-136)

MA-225 Calculus II for Technologists 4 0 4

This subject 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)

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 subject 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 offers an introductory discussion of topics fundamental to computer science. These topics include sets, logic and logic circuits, binary relations, combinatorics, and an introduction to graph theory. (prereq: MA-127)

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; improper integrals; L'Hospital's rule; applications of integration to fluid pressure, centroids, and arc length; partial derivatives and 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 solution of first-order differential equations and linear differential equations with constant coefficients, including applications. The course also introduces the method of Laplace transforms. (prereq: MA-231)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MA-262 Probability and Statistics 3 0 3

This subject 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 subject 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. (Not open to students who have credit for MA-262 or MA-341.) (prereq: MA-125)

MA-330 Vector Analysis 3 0 3

This subject provides a brief study of vector algebra and 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 Stoke's theorem. (prereq: MA-232 and MA-235, or MA-227)

MA-341 Business Statistics I 3 0 3

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, and tests of hypotheses. (Not open to students who have credit for MA-262 or MA-315.) (prereq: MA-127)

MA-342 Business Statistics II 3 0 3

This course presents more of the statistical methods available to help make managerial decisions in the face of uncertainty. Topics covered include more hypotheses testing, modern decision theory, quality control, regression and correlation. (prereq: MA-262 or MA-315 or MA-341)

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; convex sets; and linear programming, including 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, MA-235)

MA-381 Complex Variables 3 0 3

This subject 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; it includes transforms of special functions, properties, operations, 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-190 Computer Applications in Engineering **1** **3** **2**
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: CS-150, GE-100)

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 for forces in trusses, frames and machine components; additional topics are friction, location of centroids, and evaluation of area moments of inertia. (prereq: MA-137, PH-110)

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 Strength of Materials I 4 0 4
This is the first course in mechanics of deformable bodies. Topics include normal and shearing stresses produced by axial loading, torsion, and bending, elastic deflections, and buckling of slender columns. (prereq: MA-137, PH-110)

ME-252 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 & 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)

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 an introduction to numerical analysis and its application to various engineering problems. Numerical methods include the following: numerical differentiation, finding roots of equations, iteration, regression, interpolation, numerical integration, and numerical solution of ordinary differential equations. Numerical error is estimated by Taylor Series. The student is introduced to the concept of modeling by first formulating, and then numerically solving, the relevant equations to describe various real-world engineering problems. (prereq: ME-190, MA-235)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-301 Computer-Aided Engineering 2 2 3
This course is a continuation of ME-300. Numerical methods and the digital computer are applied to various design problems in engineering. (prereq: ME-300)

ME-309 Strength of Materials II 3 2 4
This course continues the study of the mechanics of elastic bodies. Topics include statically indeterminate structures, theories of failure, design of columns, and stresses in various members, including thin-walled and hollow cross-section members subjected to torsion and transverse shear, curved beams, and pressure vessels. Analytical techniques are verified by laboratory experiments. (prereq: ME-207)

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 thermodynamic-oriented 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: CH-200, 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. Subject material includes unsteady flows, second law, irreversibility, availability, and Rankine and Brayton cycles. (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)

ME-317 Fluid Mechanics 3 3 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, drag and fluid power applications. The laboratory stresses instrumentation, error analysis and independent thought, culminating in the students designing their own experiment. (prereq: MA-232, ME-206)

ME-321 Science of Engineering Materials I 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 Science of Engineering Materials II 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 Materials Processing 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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, CH-210, 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)

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-401 Vibrations 3 0 3

This is an introduction to mechanical vibrations, to free and forced vibrations of single-degree 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, MA-235, ME-206, ME-207)

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-206 or equivalent)

ME-403 Design for Fatigue 3 0 3

This course applies the theory of fatigue to the design of structures and machine elements. Topics include repeated stresses, theories of failure and factors influencing fatigue properties. Students are required to design and evaluate various structures when subjected to different conditions of loading or thermal/environmental conditions. (prereq: ME-309, ME-463 or equivalent)

ME-411 Fluid Mechanics Applications 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; coreq: ME-317)

ME-419 Internal Combustion Engines 3 0 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
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)

ME-428 Mechanics of Composite Materials and Structures	**3**	**0**	**3**

This course introduces the student to the mechanical behavior of fiber-reinforced composite materials. Topics to be covered include micromechanics, anisotropic stress-strain relationships, failure theories, stress analysis of laminated plates and shells, and characterizations methods. (coreq: ME-309)

ME-429 Design of Advanced Composite Structures	**3**	**0**	**3**

This course will allow the student to formulate solutions to design problems using fiber-reinforced composite structures. Manufacturing processes and their effects on mechanical properties will be considered. Computerized methods will be integrated into the solution of design problems. Specific areas to be considered are pressure vessels, power transmission shafts, sporting goods, civil engineering (infrastructure) applications, and buckling-critical applications. (prereq: ME-428)

ME-431 Automatic Control Systems I	**3**	**2**	**4**

This course uses previous mathematical and electrical instrumentation background to provide an introduction to automatic controls used in mechanical engineering applications, including fluid power. The course includes an orientation to automatic controls with feedback and basic hydraulic system elements. Laboratory experiments are conducted using fluid power and electronic equipment. (prereq: MA-235, ME-317)

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-444 Modern Rapid Prototyping Fundamentals	**3**	**0**	**3**

This course covers the fundamentals of the dynamic new technology of rapid prototyping that has evolved during the past few years. Emphasis is on the application of rapid prototyping in modern engineering and explores the different methods of rapid prototyping today, their relative advantages and disadvantages, technical differences, their scientific method of operation, their applications, and the future of rapid prototyping. Other topics studied include imaging, intercommunications, computer involvement and the materials utilized in rapid prototyping. (prereq: CH-100 or CH-201 or equivalent, and ME-207 or MT-205 or equivalent)

ME-445 Modern Rapid Prototyping Design Applications	3	0	3

The purpose of this course is to provide the students with experience in the application of rapid prototyping in industrial situations. Students carry out two or three applications of rapid prototyping in the area of molding, aerodynamics, medical, composites, investment casting, lost foam casting, or "V" process casting. Students are involved in the design plan, modeling, design of fabrication method, and processing, and they give a final presentation of each project. (prereq: ME-444)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-460 Finite Element Methods 2 2 3

This is an introduction to the finite element method of structural analysis. Topics covered include modeling structures with finite elements; development of stiffness matrices for typical elements; forming structure matrix from element matrices; and solution of equations for displacements, forces and stresses. Use of general-purpose, finite element computer programs also is included. (prereq: ME-309 or equivalent)

ME-462 Vehicle Design Project 1 3 3

This project course gives students the experience and techniques that allow them to organize and complete a multidisciplinary engineering problem by applying the principles of system design to the design of vehicles that comply with one of the Society of Automotive Engineers' Vehicle Design Competitions. Included are the design process, team management and organization, safety, manufacturability, serviceability and cost. The student teams are required to give formal presentations and written reports after the conceptualization and design phases. (prereq: ME-207 and ME-402 or equivalents, and consent of instructor)

ME-463 Design of Machine Components 2 2 3

This subject covers the principles of engineering applied to the design of machine elements. Topics include theories of failure, stress-life fatigue design, shafting, geartrain design and anti-friction bearings, threaded fasteners, and springs. Students are required to complete open-ended projects involving the design and integration of various machine elements. (prereq: ME-309 and ME-361)

ME-464 Mechanical System Design Project 1 3 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-463 or equivalent)

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)

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. Prevailing industrial standards are identified and integrated with sound engineering practice. (prereq: ME-317 or equivalent)

ME-472 Advanced Hydraulic Circuits 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

ME-475 Fluid Power Design Projects **2** **2** **3**

A specific design project(s), having a substantial hydraulic content, is undertaken. A set of specifications is developed, and teams are formed to address specific issues of the design. Issues include component sizing; systems/sub-systems design; and interfacing with electronic, pneumatic and mechanical systems/components. Hardware fabrication and testing are completed if the project scope and manpower allow. The open-ended projects are judged based on originality, functionality, performance, satisfaction of good engineering practice, safety and presentation of results. (prereq: ME-431, ME-471)

ME-480 HVAC System Design **3** **0** **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-316, ME-317 or equivalent)

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 or equivalent)

ME-485 Energy System Design Project **2** **2** **3**

This course is an application of design methodology to an energy systems project, involving the principles of thermodynamics, heat transfer and fluid mechanics. Students form project teams of 3-4 members to carry the project from problem statement to final design recommendations. Project teams are required to submit oral or written progress reports, as well as a final design report and an oral presentation, defending their design. (prereq: ME-314 or equivalent; coreq: ME-413 or equivalent)

ME-490 Senior Design Project I **1** **0** **1**

This course allows the student, with faculty guidance, to initiate a multidisciplinary engineering design project. Students are required to organize the project and to present status reports. The end result must be a formal, written project proposal based on investigations conducted during the term. (prereq: term 10 standing and consent of program director)

ME-491 Senior Design Project II **1** **0** **3**

This course is a continuation of ME-490. Students are required to complete the engineering design project chosen by them, and to prepare a final design report. Students must then present and defend their design. (prereq: ME-490)

ME-492 Senior Design Project III **1** **0** **3**

This course is a continuation of ME-491 for those projects deemed long enough to be spread over a full academic year. (prereq: ME-491 with consent of both project faculty advisor and the program director)

ME-498 Topics in Applications of Design **3** **0** **3**

This course involves the application of design principles in areas that are normally not part of the curriculum. It allows students to work in new and developing areas. (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 advisor and the program director)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MS-183	**Introduction to Computer Methods and Applications**	**2**	**0**	**2**
MS-184	**Introduction to Computer Methods and Applications**	**3**	**0**	**3**

These courses introduce the student to the fundamental concepts of popular application software including operating systems (Windows); word processing (WordPerfect); spreadsheets (Quattro Pro); and presentation packages (PowerPoint and/or Corel Draw). The courses also explore communication technologies, including e-mail and the Internet. These are hands-on, skill building courses that prepare students to use these tools in various other courses. Based on previous experience, students can test out of all, or portions, of these courses. (MS-183 is designed for students who are not pursuing a business degree.) (prereq:none)

MS-211 Principles of Organization **3** **0** **3**

From the view of American capitalism, this course examines the forms of business ownership and how these forms are changing through interaction with other economic and social institutions. The course introduces the basic principles of the organizing process and social responsibility, and emphasizes the dynamic functions of a business. Outside readings, company tours and other activities may be included. (prereq: none)

MS-221 Microeconomics **3** **0** **3**

This course provides an introduction to the central concepts of microeconomic analysis, 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 include analysis of labor markets, governmental policy making and international economics. (prereq: none)

MS-280 Introduction to Management Information Systems **3** **0** **3**

This course introduces the general concepts applicable to management information systems (MIS). Each area of specialty is discussed conceptually in terms of how it fits in with the rest. (prereq: none)

MS-282 COBOL Programming I **3** **2** **4**

The concepts of business data processing and of the COBOL programming language are presented to the student to help build a framework for understanding computer applications in the business world. The beginning student is introduced to the computer, program design, structured programming techniques and formal test procedures. Sequential file processing, data manipulation, arithmetic calculations and report field editing are used to create various programs. No prior knowledge of computer programming is required. (prereq: MA-127)

MS-284 COBOL Programming II **3** **2** **4**

The advanced COBOL topics of conditional processing, data validation, input and inquiry screens, control breaks, and table handling are covered in this course. Students gain an understanding of various business applications by utilizing these techniques to write programs. A programming project is done using a team approach. (prereq: MS-282)

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 files systems) are examined in detail along with how various hardware components of a computer system work together. (prereq: MS-282 or MS-3811)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-313 Business Environments and Change **3** **0** **3**

The student is introduced to the evolution of business behavior, decision-making and organizational design as they adapt to changing environmental forces. The student evaluates and critiques how modern organizations respond to rapid changes in information technology, globalization, law and regulation, diversity and the growing phenomenon of boundaryless organizations from a systems paradigm. Topics also include learning organizations, network organizations, contingency work force and virtual business structures. (prereq: MS-221, MS-331)

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 supplyside. Monetary and fiscal policy efforts to promote employment, price stability and economic growth are reviewed. (prereq: MS-221)

MS-327 International Business **3** **0** **3**

This course is designed to develop an understanding of the expanding role of international business and factors that are important for a firm that is dealing in world markets. The focus is on terminology, alternative methods of doing business, entry strategies, factors important in initiating or expanding overseas operations, and international financial considerations. (prereq: MS-221, MS-331, MS-342)

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: foundations of American law; contract law; agency; debtor-creditor relations; real and personal property; and computers and the law. The course includes practical legal cases of interest and importance to engineering, technology, business, medical and technical communication industries. (prereq: none)

MS-333 Engineering Law **3** **0** **3**

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 other technical professionals who want to review the aspects of business law that they are most likely to encounter in their jobs. 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: MS-331)

MS-340 Production Management **3** **0** **3**

The student is introduced to the advantages and constraints of the various production processes for both manufacturing and service industries. The effective management of production planning, inventory control and quality control is studied. Quantitative management techniques are introduced. (prereq: MA-341 or consent of instructor)

MS-341 Leadership Skills **3** **0** **3**

This course examines leadership as myth or reality, its ambiguity, whether it can be taught or learned, and its evolution from primitive society to current views of managerial personality. Also included are aligned concepts such as authority, power, behavioral skills, followership, new models of leadership, classic and current expansion of leadership, type of environment conducive to the development of leadership potential, and problem-solving abilities. (prereq: MS-221, MS-331)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-342 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 management that are necessary to implement the management process. The international management environment and the social responsibilities to society conclude the study. (prereq: MS-221, MS-331)

MS-354 Principles of Accounting **3** **0** **3**

Accounting principles and the complete accounting cycle are presented using lectures, exercises and problems. A computer spreadsheet is used to illustrate how computers facilitate the accounting process. Areas investigated include accounting for fixed assets, inventories, cash and bonds. (prereq: none)

MS-356 Business Finance I **3** **0** **3**

This course introduces students to various aspects of the financial management of business. Topics include financial analysis and forecasting, the use of leverage, working capital, current asset management, and short-term financing methods. Time value of money concepts is covered as preparation for Business Finance II. (prereq: MS-354)

MS-357 Business Finance II **3** **0** **3**

This course is a continuation of MS-356. It investigates the concepts of risk, cost of capital, and the capital budgeting process. Other topics of study include long-term financing alternatives, the issuance of convertible securities, and company policies on dividends and retained earnings. (prereq: MS-356)

MS-358 Managerial Cost Accounting I **3** **0** **3**

This course investigates cost implications on accounting decisions by analyzing the relationship between cost, volume and profit. The use of budgets, standard costs and associated variance analyses in modern businesses is surveyed. Absorption and variable costing are analyzed and compared. (prereq: MS-354)

MS-359 Managerial Cost Accounting II **3** **0** **3**

This is a continuation of MS-358. Cost accounting principles are applied to decision areas such as pricing, capital budgeting, make or buy, and joint products. It also reviews return on investment and residual income, allocation of service department costs, transfer pricing, process costing, and tax implications on cash flow. (prereq: MS-358)

MS-361 Marketing **3** **0** **3**

An understanding of the buying decision process of both the individual consumer and the organizational customer is developed. From the viewpoint of the firm as an integrated system, the twofold marketing task of discovering what goods and services consumers need and want, and providing these items in the right place, time and at the right price, is stressed. Emphasis is on the importance of proper planning, promotion, and understanding the customers through effective market research. (prereq: MS-221, MS-331)

MS-371 Introduction to Unix Operating Systems **2** **2** **3**

The 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 the student with the Unix basics for further study, and to acquaint the student with the ideals of an open system utilizing multitasking, electronic mail, source code and project control, networking, and high-level computing languages. (prereq: some programming background)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-373 Advanced Unix and System Administration 2 2 3
The second course in Unix is a continuation of the first course, 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. (prereq: MS-371)

MS-381 C++ Programming for Business 3 2 4
The beginning C++ programmer is introduced to the syntax of the C++ language and writes several programs exploring basic techniques. The concepts of data structures are introduced. Problems from the world of business are used. (prereq: some programming background)

MS-383 Advanced C++ Programming for Business 3 2 4
This course is an introduction to OOP using C++, including classes, operator and function overloading, and good OOA techniques. (prereq: MS-381)

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 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: one high-level programming course)

MS-388 Computer Systems Analysis and Design II 3 0 3
This course continues the use of systems analysis skills from 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
The managerial control and the administration of management information systems are emphasized. Topics covered include the structure of the organization, operational logistics, recruitment of skilled employees, and acquisition of hardware and software. (prereq: junior standing)

MS-390 Quantitative Management 3 0 3
This course introduces the student to several of the models used to assist in management decision-making. These include decision theory, risk, decision trees, linear programming, transportation and assignment problems, networks and project management, inventory models, and simulation. Emphasis is placed on applications using computers. (prereq: MA-128, MA-342 or MA-262)

MS-412 Administering Microsoft Windows NT 3 0 3
This course provides students with the knowledge and skills necessary to perform post installation and day-to-day administration tasks in a single-domain or multiple domain Windows NT based network. This class covers the material in Microsoft course # 803 Administering Microsoft Windows NT 4.0. Topics include user and group administration, account and file security, printing administration, audit policies, resource tracking and backup strategies. (prereq: MS-285 or equivalent knowledge and consent of department chair.)

MS-413 Supporting Windows NT 4.0 Core Technologies 4 0 4
This course provides students with the knowledge and skills necessary to install, configure, customize, optimize and identify troubleshooting resources for Windows NT 4.0. The class covers the material in Microsoft course # 922 Supporting Windows NT 4.0 Core Technologies. It will prepare students to meet the Windows NT 4.0 Certified Professional certification requirements.. This is a hands-on lab based course, which is designed to provide students with the opportunity to gain experience in a Windows NT environment. Topics include; installation and configuration of NT Server and Workstation, managing system policies, file systems and partitions, RAS, directory replication and troubleshooting. (prereq: MS-412 or equivalent knowledge and experience)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-414 Supporting Windows NT Server 4.0 Enterprise Technologies **4** **0** **4**

This course provides students with the knowledge and skills necessary to configure, customize, optimize, and troubleshoot Windows NT 4.0 in an Enterprise environment. The class covers the material in Microsoft course # 689 Supporting Windows NT Server 4.0 in Enterprise. This class applies toward the Microsoft MCSE certification. It will prepare students to plan NT directory services, establish trust relationships, analyze network traffic, isolate problems and optimize server and network performance. (prereq: MS-413 or equivalent knowledge and experience. Familiarity with TCP/IP terminology and concepts is also recommended.)

MS-415 Internetworking with Microsoft TCP/IP **4** **0** **4**

Students are provided with the knowledge and skills required for setting up, configuring, using and supporting Transmission Control Protocol/Internet Protocol (TCP/IP) in a Windows NT environment. The class covers the material in Microsoft course # 688 Internetworking Microsoft TCP/IP on Microsoft Windows NT 4.0. It will prepare students to meet part of the Windows NT 4.0 MCSE professional certification requirements. Topics include subnetting, dynamic routing, DHCP, WINS, DNS, FTP and TCP/troubleshooting. (prereq: MS-414 or equivalent knowledge and experience. Knowledge of the function and use of LAN hardware, including network cards, cabling, bridges and routers is essential.)

MS-416 Microsoft Internet Information Server 4.0 **3** **0** **3**

Learn how to support the various features of Microsoft Internet Information Server 4.0. Students will gain understanding of IIS by installing, configuring and supporting IIS 4.0. This class covers the material in Microsoft course # 936 Creating and Configuring a Web Server using Microsoft Internet Information Server 4.0. It will prepare students to meet part of the Windows NT 4.0 MCSE certification requirements. Topics include: installation and support of IIS 4.0, Microsoft Index Server, Microsoft Transaction Server, Site Server Express and active server pages. (prereq: MS-415 and NT Server or equivalent knowledge)

MS-419 A Plus Certification Course **3** **0** **3**

This course provides students with the knowledge and hands-on experience necessary to support personal computers and peripherals. It prepares the individual for the COMPTIA A Plus 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 MCSE or Novell CNE programs. (prereq: none)

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 the 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)

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 flows, sources of funds and property valuations. (prereq: MS-354, MS-356)

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: MS-221, MS-331)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-443 Labor Relations 3 0 3

This course provides the student with a basic understanding of the history, purpose and development of the Labor movement in this country 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)

MS-444 Business and Government Relations 3 0 3

Governmental policies toward business are examined as well as the role of business in society. Business ethics and the social responsibility of corporations are discussed. A review of economic theory is applied to the topics of market structure, governmental regulation and antitrust policy. The role of business is analyzed in relation to its owners, employees and consumers; emphasis is placed on current topics of importance such as ecology, pollution, technology and multinational corporations. (prereq: MS-221, MS-331)

MS-445 Business Forecasting 3 0 3

This course develops a knowledge of the value and uses of forecasting to the success of the business firm. Selected forecasting techniques are identified, discussed and applied to historical situations. The resulting forecasts are then compared to the actual results to provide a basis for evaluation of the accuracy and applicability of each technique. (prereq: MA-342, MS-331, MS-356)

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 — from the development of a mission statement to the implementation of programs to fulfill strategic objectives. (prereq: MS-342, MS-357, senior standing)

MS-447 Management Readings and Issues 3 0 3

The basic functions of management, planning, organizing, actuating and controlling are studied in 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: consent of instructor, MS-356)

MS-448 Employment Law 3 0 3

This course provides the student 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 compensation and workers' compensation laws. (prereq: MS-221, MS-331)

.

MS-449 Human Resource Management 3 0 3

From the early selection process of acquiring personnel, the course surveys the evolution of the activity to the emergence of today's human resource management. 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: MS-221, MS-331)

MS-450 Management Control Systems 3 0 3

Case studies are used to analyze and evaluate methods of controlling and motivating responsibility centers. This includes cost centers, revenue centers, profit centers and investment centers. The following topics and their implications in responsibility accounting are 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-359)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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 the Internal Revenue Service's VITA program. (prereq:MS-356)

MS-452 Investment and Portfolio Analysis 3 0 3

This course is designed to serve the financial manager of a firm who will be actively involved in developing and monitoring the firm's investment portfolio or cash flow position. Units of study include the securities markets and their regulation, security analysis techniques, common stock, convertibles, portfolio theory and market efficiency. (prereq: MS-357)

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. (prereq: MS-221, MS-331)

MS-457 Financial Intermediaries 3 0 3

A broad introduction to the operation, mechanics and structure of the domestic and international financial systems is developed, emphasizing their institutions, markets and instruments. The Federal Reserve System operations are covered, as well as the impact of monetary policy on private sector firms, the economy and the operation of financial institutions. (prereq: MS-356 or consent of instructor)

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 investigates methodology for accounting for partnerships, not-for-profit organizations, and company merger and acquisitions. (prereq: MS-356)

MS-462 Technical Selling 3 0 3

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-221, MS-331)

MS-467 Marketing Research 3 0 3

The course presents materials on major application areas within marketing research, such as demand measurement, forecasting, product research, test marketing, advertising research and survey research. Students participate in the design and application of basic tools used in marketing research, including mail and phone questionnaires, focus groups, research samples and data collection forms. (prereq: MS-356, MS-361)

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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-4715 NetWare 5 System Management **4** **0** **4**

Students are provided with the knowledge and skills required to perform the role of network administrator or system manager for a NetWare 5 environment. The class covers the material in Novell course number 560, NetWare 5 Administration. It will prepare students to meet the Novell CNA 5 certification requirements. It is a hands-on, lab-based course, designed to provide students with the opportunity to gain experience in a NetWare 5 environment. Topics covered include NDS configuration, setting up and managing network users and groups, printing with NDPS, managing the file system and security, and implementing ZEN works. (prereq: basic understanding of personal computers and operating systems such as Windows 95, DOS and Windows NT)

MS-4725 IntraNetWare to NetWare 5 Migration **3** **0** **3**

This course focuses on the significant changes, updates and new features found in NetWare 5. This class covers the material in Novell course number 529, NetWare 4.11 to NetWare 5 Update. Topics covered include upgrade or migration to NetWare 5, managing NetWare using JAVA based utilities, setup of DHCP, DNS and Web services, managing NDPS, and the configuration of Netscape Fastrack Web server. This course prepares an existing NetWare administrator to upgrade to and support a NetWare 5 environment. (prereq: CNE3 or IntraNetWare CNE certification)

MS-4731 Novell Technologies **3** **0** **3**

This course encompasses the Novell 200 course, Networking Technologies. This course prepares students to make informed choices among numerous competing technologies and protocols. It provides in-depth coverage of the OSI Model and the corresponding protocols. Students are prepared to take the Novell CNE 50-147 exam (administered through Sylvan testing centers). (prereq: MS-4714 or consent of department chairman)

MS-4732 Networking Essentials **3** **0** **3**

This course encompasses Microsoft course number 578, Networking Essentials, and Novell's course number 565, Networking Technologies. It prepares you to make informed choices among numerous competing technologies and protocols and provides in-depth coverage of the OSI Model and the corresponding protocols. Topics covered include transmission media, protocols, bridging, switching hubs, routers, the 802.x standards and WAN technologies. (prereq: MS-285 or equivalent computer experience)

MS-4733 Novell NetWare 5 NDS Design **3** **0** **3**

This course is designed to provide network administrators, network designers and networking consultants with the knowledge and skills required to create an NDS Design and Implementation strategy. It covers the material in Novell course number 575, NDS Design & Implementation. Students will complete an NDS Design strategy and then implement the strategy in a hands-on environment. Topics include designing a NetWare network, optimization strategies for implementation and creating a time synchronization strategy. (prereq: MS-4745 and experience with basic NetWare 5 system administration)

MS-4744 Novell IntraNetWare Advanced Administration **3** **2** **4**

This course combines the Novell 525 course, NetWare 4.11 Advanced Administration, and the Novell 804 course, NetWare 4.11 Installation and Configuration Workshop. Students are taught the skills needed to manage complex NetWare 4 environments and fine-tune the internal performance of the NetWare server. Additionally, students are familiarized with the various installation options and configurations. Students are prepared to take the Novell 50-614 and 50-617 exams (administered through Sylvan testing centers). (prereq: MS-4714 or consent of department chairman)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MS-4745 NetWare 5 Advanced System Management **4**

Students are provided with the knowledge and skills required to design, configure and administer a complex NetWare 5 network. MS-4745 covers the material in Novell course number 570, NetWare 5 Advanced Administration. Skills learned include upgrading from a NetWare 3 environment, migrating to NetWare Distributed Print Services, executing JAVA- based utilities, performing a custom installation, optimizing the network and installing Web, DNS and DHCP services. MS-4745 is a hands-on, lab-based course, which is designed to provide students with the opportunity to gain experience in a NetWare 5 environment. (prereq: MS-4715, experience with basic NetWare 5 System Administration)

MS-475 Activity-Based Management **3** **0** **3**

This course helps a student understand the strength, weakness and relative position of traditional vs. activity-based cost management approaches; defines and uses tools that support performance management; and introduces functional decomposition, activity analysis, cost drivers and value-added analysis. (prereq: MS-354, MS-358 and/or consent of instructor)

MS-476 Novell Service and Support **4**

This class covers the material in the Novell 580 course, NetWare Service & Support. Students are called upon to install the physical components of the LAN, including cabling, disk drives and network components. Emphasis is placed on troubleshooting utilities and printing. Troubleshooting strategies, diagnostics and network analysis are also included. This course fulfills part of the Novell CNE requirement and provides students with hands on hardware experience. **(**prereq: MS-4715, MS-4745 or consent of department)

MS-4765 Integrating NetWare 5 and Windows NT **3**

This course is designed to provide students with the fundamentals of Windows NT networking and the knowledge necessary to successfully integrate Windows NT into a NetWare environment. The class covers the material in Novell course number 555, IntraNetWare: Integrating Windows NT. Topics include Windows NT fundamentals, using the NT registry and administration utilities, setting up NT security and integrating Windows NT into a NetWare environment. (prereq: MS-4715, MS-4745)

MS-478 Fundamentals of Wide Area Networking **3**

This course offers a practical approach to internetworking principles with an emphasis on what works and what doesn't work in a real world environment. Bandwidth expanding devices such as bridges and routers are discussed and observed first hand. Wide area network technologies including T1/T3, Fractional T1, Frame Relay and Dialup are investigated from a performance perspective. Students gain significant hands-on familiarity with many internetworking devices: bridges, switches, routers, DSU/CSUs and modems. Students gain experience in labs designing and configuring bridges and routers to overcome limitations in communication and compatibility. This course is designed for students familiar with networking technologies, multiple protocols and network administration. (prereq: MS-412 or MS-4714 or MS-485)

MS-483 Database Management Systems **2** **2** **3**

This course is an overview of current database technology, database models, and data normalization techniques. The laboratories are focused on building interactive queries using SQL. (prereq: MS-281)

MS-484 Business Use and Management of Networks **3** **0** **3**

This course prepares the graduating senior to understand how the person who supervises the people who manage the network does his/her job. The network team, which maintains and manages a wide area network at a large corporation, is explored. Capacity planning, service and lease negotiations, diagnostic hardware and software, and budgeting are also covered. (prereq:MS-485)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MS-485	**Telecommunications**	**3**	**0**	**3**

An overview is provided for both voice and data communications. This course examines the industry, develops technical understanding of the operation of various devices, and provides the ability to discuss telecommunications with professionals. A special emphasis is placed on Local Area Networks (LAN). (prereq: MS-282)

MS-487	**Business Systems Intern I**	**1**	**2**	**2**
MS-489	**Business Systems Intern II**	**1**	**2**	**2**

By mutual agreement, students complete a project or internship with an organization to gain practical experience in a work environment that relates to an area of career interest. Projects vary and may include programming, marketing, systems analysis, finance, accounting and management. (prereq: BCS or BSMS major with junior standing and consent of instructor)

MS-498	**Management Internship Experience**	**3**	**0**	**3**
MS-499	**Management Internship Experience**	**6**	**0**	**6**

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)

MT-100	**Introduction to Mechanical Engineering Technology**	**3**	**3**	**4**

This is an introduction to the scope and typical applications of mechanical engineering technology. The MSOE program requirements and options are explained. The course is supported by laboratory sessions organized to build the foundation for college technical subjects. This includes a glossary of terminology as well as a preview of the calculations, measurements and tools to be employed. The principle objective is to inspire the student by presenting the challenges and excitement of problem solving and decision making. (All term 1 and transfer students must take this subject.) (prereq: none; coreq: MA-125, MS-183)

MT-122	**Introduction to Materials Technology**	**3**	**2**	**4**

This is an introduction to a variety of industrially important materials. The basics of steel and its heat treatment, aluminum, polymers, ceramics and composites are covered. Mechanical properties and testing are also discussed. Correlations between the structure, properties and processing are made. (prereq: MT-100; coreq: CH-100, MA-126)

MT-123	**Introduction to Materials Processing**	**3**	**2**	**4**

This subject deals with production and processing procedures required to make given products. Shaping, forming, thermal treatment, cutting and joining are the main topics covered. (prereq: MT-122)

MT-151	**Applications of Mechanical Engineering Technology**	**3**	**0**	**3**

This course is designed for students enrolled in the technical communication program and is an extension of GE-100 to cover applications of the topics and techniques introduced in that course. How the various engineering functions relate to one another and within a company organization is discussed. Machine design applications are considered from the standpoint of requirements, mechanism, components and load requirements. Energy applications are studied from the standpoint of sources, conversion, transmission, control and load requirements. (prereq: GE-100)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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, MT-100, 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; and corresponding stresses in beams, beam deflections, 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. Topics include the fundamentals of equilibrium thermodynamics; the first law; entropy; general relations for the pure substance; and real and ideal pure substances and their processes and cycles. (prereq: MA-128, MT-100, 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)

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, MT-100, 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-262 Mechanical Components 3 3 4

The purpose of this course is to become familiar with and apply strength of materials concepts to various machine components such as gears, shafts, bearings, belts and fasteners with aid from catalogs and handbooks. The AGMA gearing computer program is also utilized. (prereq: MT-205)

MT-267 Dimensioning and Tolerancing 2 2 3

This course introduces the student to the study of measurements and their applications. Tolerances, or variations of measurements, are studied with the aid of various types of engineering drawings and laboratory experiments. An abbreviated laboratory-oriented study of statistics is also included. (prereq: EG-123, MA-126; coreq: MA-127)

MT-302 Strength of Materials Laboratory 0 3 1

Nondestructive tests are conducted on materials and components to determine their behavior under load. 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 law, work and energy, conservation of energy, and impulse and momentum. (prereq: MA-225, MT-200)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MT-313 Heat Transfer 3 0 3

This 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 thermophysical properties of materials and test analysis, and strategies used to solve thermal design problems. (prereq: CS-185, MA-226, MT-215 or MT-216, MT-218)

MT-314 Thermodynamic Cycles 3 3 4

A continuation of MT-215 or MT-216, 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-185, MT-215 or MT-216)

MT-316 Thermodynamic Applications 3 0 3

This course applies thermodynamic theory to gas compressors, fans, supersonic nozzles, gas turbines, internal combustion engines and refrigeration cycles. (prereq: MT-314)

MT-317 Heat Transfer 3 2 4

This 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, and strategies used to solve thermal design problems. (prereq: CS-185, MA-227, MT-215 or MT-216, MT-218, MT-393or MT-493)

MT-331 Electric 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: ET-151, MA-126, MA-127, MT-262)

MT-332 Power Transmission Control 3 0 3

This course compares the alternative systems for power transmission and shows the calculation of load characteristics for translation and rotary motion, steady-state and transients. The AC induction motor is studied to determine its speed-torque characteristic and performance as a function of NEMA design and insulation class. Related topics include NEMA frame sizes, ventilation, mounting configuration, speed reducers, and adjustable AC and DC speed drives. Electric ladder diagrams are used to define the motor starter requirements and select the necessary switchgear. Then, the ladder diagrams are used to develop relay logic for controlling basic pneumatic and hydraulic circuits. Also, the ladder logic is related to setting the commands for a programmable controller. (prereq: ET-251; coreq: MT-372)

MT-333 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; then, control components and their performance are studied. Analysis of basic input functions is used to examine the transient response of systems that can be defined by first- or second-order differential equations. The Laplace transform is used to investigate linear differential equations. For stability performance, the student is taught frequency-response analysis with graphical solutions by Bode plot and Nichol's chart. Lastly, network compensation is introduced. Laboratory sessions are used to study the operation and performance of components and systems. (prereq: ET-355, MA-227, MT-332, MT-372)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MT-334 Design of Experiments and Measurements	**3**	**0**	**3**

The purpose of this subject is to present the fundamental concepts between the experiment, the design and the analysis with appropriate emphasis on the types and problems in measurements. Topical coverage includesdesign and analysis of experiments, analysis of variants, nested classification, two-way classification, one-way classification, multivarient statistics, regression analysis and linear models. (prereq: MA-262)

MT-335 Statistical Process Control and Quality Assurance	**3**	**0**	**3**

Productivity and quality are necessary to maximize profits and minimize the use of resources and raw materials. This course begins with an introduction to the application of various diagnostic and statistical tools used for analyzing, controlling and improving operations. Topics covered include process capability studies, estimation tests for comparing statistics, simple correlation and regression analysis and sampling. In addition, quality assurance topics are covered such as quality systems and policies, procedures, quality manuals, audits, participative management and the importance of quality education. (prereq: MA-262)

MT-336 Feedback Control Systems for Manufacturing	**3**	**2**	**4**

Designed for manufacturing engineering technology students, this is an introduction to automatic control systems. Feedback is studied initially by use of block diagrams, and then by writing differential equations to describe mechanical and electrical systems. Transient response is studied for first- and second-order systems, using Laplace transforms. Stability performance is analyzed by means of frequency response. Laboratory sessions are used to study the operational performance of components and systems. (prereq: MA-226)

MT-341 Applications of Industrial Robots	**3**	**2**	**4**

Robots are currently being applied to machine activities such as material handling, machine loading, assembly, grinding, spraying and welding. This subject deals with an overview of present applications and methods of developing specific solutions to processes and systems. Laboratory sessions deal with point-to-point and continuous path robot applications including preprogramming simulation and dynamic analysis of various industrial robots. (prereq: none)

MT-342 Manufacturing Process Engineering	**3**	**2**	**4**

Starting with the product design drawings, the student learns 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: IE-423, MT-123, MT-228)

MT-353 Statics and Strength of Materials	**4**	**0**	**4**

This course is designed for electrical engineering technology students. The statics portion covers the study of resultants and 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 manufacturing and electrical 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 subject is devoted to heat transfer concepts and applications to heat sink design and device cooling considerations. (prereq/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-361 Applied Strength of Materials 3 3 4

Mohr's circle and columns are reviewed. The double integration method for beam deflections is covered. Failure theories and analysis of cyclic loadings are applied to several types of mechanical components. Probabilities in design are also considered. (prereq: MA-225, MT-205)

MT-362 Dynamics of Machinery 3 3 4

This subject involves the study of the kinematics of mechanisms. Static and dynamic loading of rigid bodies are also included. Graphical and analytical techniques are used in the analysis. Static and dynamic loading of rigid bodies are also included. (prereq: MT-303)

MT-363 Applied Mechanical Design 3 3 4

This course continues the study of static and dynamic loading of rigid bodies that was begun in MT-362. Force analysis is applied to static and dynamic balancing of rotating systems, the piston engine, critical speeds and flywheels. The kinematics and kinetics of cams are also studied in utilizing a computer program to size a cam spring. (prereq: MT-361, MT 362)

MT-372 Fluid Power Circuits 3 3 4

This course defines fluid power, its advantages and limitations, the prevailing industrial standards, and the use of ANSI graphic symbols. Fluid mechanics applications in hydraulic circuits are also included. The various types of loads are studied and related to the hydraulic performance required. Positive-displacement pumps, motors and actuators are analyzed with laboratory sessions that include component inspection and operation in typical hydraulic circuits. Also included are valves for pressure, directional and flow control, with laboratory experiments in application of these valves in hydraulic circuits. The subject of overall circuit design is addressed, and the use of computer-assisted data acquisition in the laboratory is also included. (prereq: MT-218; coreq: MT-332 or MT-432)

MT-381 Energy Source Alternatives 3 3 4

This course presents an overview of energy resources on the international, national and regional (upper-Midwest) level. A profile of present energy consumption and projections for future developments are analyzed. Political and technical implications are incorporated in making long-range predictions of our future energy resources. (prereq: MT-215 or MT-216 or MT-355)

MT-382 Heating, Ventilating and Air Conditioning Design 3 3 4

This course develops a sequence for HVAC system design including psychrometrics, load calculations, duct/pipe design, equipment selection, controls and energy consumption. Emphasis is on techniques and practical design concepts. It also includes a series of mini-design problems. (prereq: MT-218, and MT-314 or MT-355)

MT-383 Internal Combustion Engines 3 3 4

This subject covers the basic theory of internal combustion engines including spark ignition, compression ignition, rotary, and gas turbine cycles. Also included are engine performance characteristics, mixture preparation, fuels, knock ratings and ignition systems. (prereq: MT-316)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
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-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-185, MT-313 or MT-317, MT-316)

MT-432 Power Transmission Control	**2**	**2**	**3**

This course compares the alternative systems for power transmission and shows the calculation of load characteristics for steady-state and transients. AC and DC electric motors are studied to determine the speed-torque characteristics and performance as a function of NEMA design and insulation class. Related topics include NEMA frame sizes, ventilation, mounting configuration, speed reducers and adjustable AC and DC speed drives. Ladder diagrams are used to develop relay logic for controlling circuits 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 P.I.D. 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-442 Process Engineering	**3**	**2**	**4**

Starting with the product design drawings, the student learns how to select and plan the manufacturing processes and sequence required to produce the part, taking into consideration quality, quantity and cost. (prereq: EG-120, MT-123, MT-228)

MT-445 Material Handling and Plant Layout	**3**	**0**	**3**

This course covers modern approaches to material handling in order to accomplish the flow of components and finished goods to and from required stations in the manufacturing process. Also included is layout of the plant to facilitate the desired movement, and specification and selection of equipment for accomplishing the movement. (prereq: none)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MT-462 Introduction to Computer-Aided Design **3** **0** **3**

This course covers the application of computer-aided design techniques that are available today in science, research and modern industry. Advanced CAD methods are discussed including solid modeling, macro programming, the use of CAD in determining mass properties, splining, meshing, and the use of Boolean algebra in CAD work. (prereq: CS-185, MA-226, MT-262)

MT-464 Computer-Aided Design Engineering **2** **2** **3**

This subject is concerned with devising methods for approximating and simulating physical phenomenon. Algorithms are constructed that help predict the behavior of physical systems and optimize design parameters. This subject provides numerical methods for the solution of numerical problems. (prereq: EG-221, MT-363)

MT-465 Mechanical Design Projects **3** **3** **4**

Course work includes project work that involves the design of a mechanical product to a set of specifications consisting of several types of machine components, as well as a group project involving the design of an automated machine. (prereq: EG-221, EN-332, HS-494, MT-262, MT-363)

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: HS-394, IE-423, MT-123, MT-228, MT-342)

MT-467 CAD/CAM for Manufacturing **2** **2** **3**

This course presents applications of computer-aided design to manufacturing. Typical applications include plant layout, computer integrated manufacturing and solids modeling. Emphasis is placed on the use and purpose of CAD/CAM workstations. Finite element analysis, geometric modeling and physical simulation are used to study the static and dynamic characteristics of the products to be manufactured. In addition, the interface and function of the CAD/CAM system to the shop floor are also covered. Laboratory sessions provide practical experience in the use of a state-of-the-art CAD/CAM system. (prereq: MT-462)

MT-468 Mechanical Design Projects **3** **3** **4**

Course work 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-432, MT-363, MT-466)

MT-484 Power System Design **2** **2** **3**

This course expands upon the application of power systems, which was covered in thermodynamics courses MT-314 and MT-316. The view of more efficient use of thermodynamic cycles is approached in more detail with such topics as regeneration, reheat, cogeneration, combined cycles and topping cycles. (prereq: MT-316)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
MT-485 Energy System Design	**3**	**3**	**4**

This is an open-ended design course intended to allow the students, through group consensus, to investigate two or three energy-related design areas. Students may work independently or in groups to research/design selected systems. Lectures deal with general, related topics; laboratories allow for specific investigation and system design. (prereq: MT-381, MT-382, MT-383, MT-484)

MT-486 Energy Management	**2**	**2**	**3**

Economic energy decision making is studied through the use of life cycle costing after completion of energy audits and facility surveys. Power plant, electrical, fluid and HVAC systems are evaluated for most economical use. Data gathering includes instrumentation and computer usage. (prereq: MT-485)

MT-488 Energy Management and System Design Projects	**3**	**3**	**4**

The course work includes a project based on the study of economic energy decision-making, after completion of energy audits and facility surveys, through the use of life cycle costing. Power plant, electrical, fluid and HVAC systems are evaluated for most economic use and environmental impact. Students work in groups for this project, which is to be presented before the Mechanical Engineering Technology Industrial Advisory Committee. A second open-ended energy design project is required to allow students to investigate two or three energy related areas. Students may work singly or in groups to research/design selected systems. Data gathering includes instrumentation and computer usage. (prereq: EN-332, HS-494, IE-423, MT-122, MT-228, MT-342 or MT-432, MT-381, MT-382, MT-383, MT-484)

MT-490 Professional Orientation	**2**	**0**	**0**

This course is designed to prepare the student for the business/engineering world. The structure of a typical company, the relationship of the engineering department to the rest of the company, different disciplines, planning and engineering projects are covered. Occasional guest lectures from industry are included. (prereq: senior standing)

MT-493 Applied Finite Element Analysis	**3**	**0**	**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 ANSYS 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-494 Senior 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, 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-495 Senior Project Phase II	**1**	**0**	**2**

This course is a continuation of MT-494. It must be taken in the term following MT-494; otherwise, MT-494 must be repeated. (prereq: EN-332, MT-494)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

MT-496 Senior Project Phase I 1 0 1

Designed for manufacturing engineering technology students, this course aims to aid the student in developing the ability to deal with engineering problems, using the project approach with limited supervision. (prereq: completion of term 10 engineering technology subjects and consent of advisor)

MT-497 Senior Project Phase II 1 0 2

Designed for manufacturing engineering technology students, this course is a continuation of MT-496. It must be taken in the term following MT-496; otherwise, MT-496 must be repeated. (prereq: EN-332, MT-496)

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 either the mechanical or manufacturing engineering technology programs. The purpose is topromote the exploration of new and developing fields. (prereq: senior standing, consent of program director and 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. This course also allows a student to continue an investigation that had been started in one of the senior project courses such as MT-400, MT-495 or MT-497. (prereq: senior standing, consent of instructor/advisor and consent 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)

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 for the '90s 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)

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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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)

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)

NU-105 Concepts of 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. Gordons 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: BE-256, EN-131, HS-462, TC-452; prereq/coreq: BE-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: HS-471; prereq/coreq: NU-201, HS-473)

NU-252 Primary Dynamics of Professional Nursing Care **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: HS-431B, NU-200, NU-201, NU-202; prereq/coreq: BE-260, BE-281, BE-290)

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: BE-391, HS-332)

		Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours
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-331)

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-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: HS-466, NU-331)

NU-470	**Nursing Care of Clients with Complex Chronic 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; prereq/coreq: NU-460)

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-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. (prereq: 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. Through the development of a research-based project, the student is expected to exhibit critical thinking skills, independent decision making and judgment. The student has the opportunity to formulate learning objectives and experiences within the context of the course. (coreq: NU-485)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

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. 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-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.

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)

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, goal setting and note-taking. 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 to 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 will be given to enhance skills in oral presentation, written expression, classroom discussion and group participation. (prereq: none)

OR-301 Transfer Student Orientation **1** **0** **0**

This course is designed to provide information and orientation to students transferring into MSOE from another institution. The lecture series is intended to help transfer students understand and adapt to established practices and policies and effectively adjust to their new educational environment. Among topics covered are transfer credit, academic policies and procedures, career options and leadership, registration procedures, and course prerequisites and scheduling. Attendance is required. No outside assignment or examination is required. Only students transferring into MSOE from another institution are required to schedule this course. (prereq: none)

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, life-long learning and professional responsibilities. (prereq: junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

PH-100 Introduction to Physical Science I 3 2 4

This subject introduces the student to the basic concepts of physical science. Simple algebraic expressions are given in the lecture to illustrate basic principles and laws. Laboratory sessions lend support to topics discussed in lecture. This subject is designed for students NOT majoring in engineering or engineering technology. Both the subject material and the illustrations have been chosen so as to give a large amount of useful information. Subject areas include the principles of mechanics, heat, electricity and nuclear physics. (prereq: two years of high school mathematics)

PH-101 Physical Science II 3 2 4

This course is the second quarter of physical science; it is designed for students NOT majoring in engineering or engineering technology. The subject areas covered in this course include the periodic table, compounds, molecules and ions, chemical principles, water solutions, organic chemistry, geology (internal and surface processes), rocks and minerals, the atmosphere (winds, air masses), the solar system (space and time and the moon), and pollution (air, land and water). (prereq: PH-100)

PH-102 Pretechnology Physics 3 3 4

This subject is taken by all students who have not had one unit of high school physics. Topics covered include units, geometric optics, vectors, forces, equations of motion, work, energy and momentum. Laboratory experiments complement the lecture and provide material for the student to exercise and develop report writing skills. Certain programs at MSOE require a prerequisite of one year of high school physics and proficiency on a physics placement exam. If these conditions are not met, the student will need to take this course to meet prerequisite course requirements for future physics and chemistry courses. (prereq: two years of high school mathematics, including one year of algebra, or MA-125)

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. (prereq: one year of high school physics or PH-102; coreq: MA-137)

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 the student 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. (prereq: MA-137, PH-110)

	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, bonding energies, photoelectric effect, Compton effect, pair production and quantum mechanics including solutions to the Schrodinger equation for simple systems. In integrated laboratory sessions, the student is introduced to nuclear counting techniques, gamma-ray spectrometry and pulse height analysis, x-ray diffraction and emission. (prereq: MA-235, PH-220, PH-230)

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 the student hands-on experience in spectroscopy, laser safety, laser beam properties and laser applications. (prereq: PH-220 or PT-220)

PH-360 Physics of Electronics 3 3 4

This subject provides the electrical engineering student with the fundamentals of semiconductor physics. The concept of band theory is developed and applied to the p-n junction to explain its behavior. This is extended to the bipolar junction transistor, unijunction transistor, field-effect transistor, silicon-controller rectifier, tunnel diode, various electro-optical devices, semiconductor lasers, and Hall effect devices. Where possible, laboratory experiments of the actual operation and construction of these devices provide additional insight and reinforcement to the lecture material. (prereq: PH-250)

PH-361 Physics of Materials 3 3 4

This course begins with an in-depth discussion of the structure of the atom, 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, and X-ray emission and absorption. (prereq: CH-100, ET-210, MA-227, PT-220)

PH-408 Environmental Issues 3 0 3

The purpose of this course is to provide the student with an increased understanding of the impacts to our global environment (atmosphere, hydrosphere, biosphere) from human activities, particularly those due to the appropriation of land for food, housing and transportation and the use of energy and materials. (prereq: junior standing)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

PH-420 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: PH-220 or PT-220)

PH-441 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 detailed discussion of the procedure for constructing a reflecting telescope. One or two observational field trips are included. (prereq: two college-level physics courses or consent of instructor)

PH-454 Nuclear Physics 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: PH-220 and PH-230, or PT-220)

PH-455 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 the psychological effects of sound, music and noise. The second part of this course acquaints the student with the basic physics of light and illumination. Included are lectures on photometry and photometric units, interaction of visible light and matter, light sources and control, color, and energy usage calculations. (prereq: PH-220)

PH-470 Introduction to 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. (prereq: junior standing)

PH-471 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 and their causes, locations, characteristics and effects on land masses; ocean wave mechanics; physics of sea water; acoustical properties of the ocean; and the instruments and techniques used to measure ocean properties. Emphasis is on the technology required to design and operate undersea research vehicles and structures that are used in the sea, such as oil drilling rigs. Also studied is the interaction between warm water masses and the atmosphere, which acts as a heat engine, causing energy interchanges that 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. (prereq: junior standing)

PH-499 Independent Study 3 0 3

Students are given the opportunity to pursue an approved subject not covered in regularly scheduled course work. Weekly meetings with the course advisor and a final report to be filed in the Physics and Chemistry Department are required. This course fulfills the science elective requirement in many programs. (prereq: junior standing and consent of the chairman of the Physics and Chemistry Department)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

PT-110 Physics for Technologists 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 the student direct experience with some of the concepts presented in the lectures. The laboratory also provides an opportunity for the student to become familiar with laboratory instruments and techniques, error analysis and report writing. This subject is designed for engineering technology students. (prereq: MA-125, and one year of high school physics or PH-102; coreq: MA-126)

PT-220 Physics for Technologists 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 vector fields, electric scalar potential fields, capacitance, simple DC circuits and Ohm's law, forces on charged particles in magnetic fields, and magnetic fields because of electric currents. The last section 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 a bouble slit and thin films. The associated laboratory is designed to give the student direct experience with the concepts presented in lecture. The laboratory also serves to familiarize the student with laboratory techniques and equipment. This subject follows PT-110 and is designed for engineering technology students. (prereq: PT-110, MA-126)

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 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-3091 Software Development Laboratory I 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: CS-286, 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 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

SE-381 Formal Methods 3 0 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-382 Software Requirements and Specification 3 0 3

This course covers activities that relate to the determination and documentation of software system requirements. Topics include requirements elicitation, object-oriented analysis techniques, prototyping, requirements tracking, and re-engineering. (prereq: SE-280, SE-381)

SE-400 Senior Design Project I 3 0 3

This is the first course in the two-course senior design sequence SE-400/401, 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)

SE-401 Senior Design Project II 3 0 3

This is the second course in the two-course senior design sequence SE-400/401. In this course, the student team implements the design developed in SE-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: 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-382)

SE-483 Software Verification and Validation 3 0 3

This course introduces the theory and practice of determining whether a software system conforms to its specification and meets the client's expectations. Topics include testing strategies and techniques, test planning, testing tools, the role of inspections and formal methods, and the economics of software testing. The relationship of testing to other quality assurance techniques is discussed, as is the integration of verification and validation into the overall software process. (prereq: SE-280, SE-3091, SE-382)

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 elected, weekly meetings with the course advisor are required. A final report, the format of which is left to the discretion of the advisor, is required at the end of the term. (prereq: senior standing, consent of program director)

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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

TC-151 Theory of Human Communication **3** **0** **3**

Various theories of communication are examined in order to establish a framework for understanding the complexities of human communication. Students completing this course improve their communication skills by understanding the way communication works, giving them an advantage when communicating with others. A number of theories covering a wide range of communication concepts are studied including semantics, nonverbal communication, interpersonal communication and persuasion. Theories are examined critically to determine how the theories relate to human communication. As the theories are discussed, many problems humans have while engaging in communication are analyzed. Strengths and weaknesses of the theories are also discussed. Throughout the course, personal application of the theories is encouraged to solve real life communication problems. (prereq: none)

TC-172 Information Processing **2** **2** **3**

This course combines classroom discussion and a "hands-on" computer laboratory to prepare students to construct 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 FrameMaker, Adobe Illustrator, scanning software, and other multimedia and Internet software programs. 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 work place. 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**

Theories of attitude, change and audience analysis are covered. 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)

TC-261 Research Methods **3** **0** **3**

This subject will introduce 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 concentrating on the various aspects and fundamentals of visual communication. Professional computer graphic and traditional techniques and methods of production are explored. Copy preparation and printing techniques are presented covering overhead projection, 35mm slide, video and Web page design. The application of typographic design and color is integrated throughout the course. (prereq: EN-132 or TC-232 or TC-233 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 group. 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)

	Lecture Hours Per Week	Lab Hours Per Week	Credit In Quarter Hours

TC-342 Professional Presentation Techniques **2** **2** **3**

This subject acquaints the student with various types of professional techniques used in industry. 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 are emphasized. 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 structure. 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)

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 status, 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
George D. Dalton
Chairman
Fiserv Inc.
Brookfield, Wis.

Vice Chairmen
James L. Dorman
Chairman and CEO
Intercontinental Trading Ltd.
West Allis, Wis.

Robert J. Hillis
President and CEO
Direct Supply Inc.
Milwaukee, Wis.

Gerald F. Lestina
President and CEO
Roundy's Inc.
Pewaukee, Wis.

Alan J. Ruud, P.E., '69
D. Eng. (Hon.)
Chairman and CEO
Ruud Lighting Inc.
Racine, Wis.

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

Vice President of Academics
Charles F. James Jr., Ph.D.
Milwaukee School of Engineering
Milwaukee, Wis.

Vice President of Development
Frank Habib
Milwaukee School of Engineering
Milwaukee, Wis.

Vice President of Operations
Kenneth A. McAteer
Milwaukee School of Engineering
Milwaukee, Wis.

Controller, Assistant Treasurer and Assistant Secretary to the Board of Regents
Fredric G. Lex
Milwaukee School of Engineering
Milwaukee, Wis.

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.

Jon R. Appel '62
President
Industrial Electronic Resources
Corona, Calif.

James H. Beardsley
President and CEO
DBI/Sala
Red Wing, Minn.

Jack M. Blank*
D. Eng. (Hon.)
Retired President
The Falk Corp. – a sub. of Sundstrand Corp.
Milwaukee, Wis.

Jeffrey L. Bleustein, Ph.D.
Chairman, President and CEO
Harley-Davidson Inc.
Milwaukee, Wis.

J. Michael Borden
President and CEO
Hufcor Inc.
Janesville, Wis.

Richard G. Carlson, Ph.D.
President
Whitnall Summit Co.
West Allis, Wis.

Michael J. Cudahy
D. Eng. (Hon.)
The Endeavors Group LLC
Milwaukee, Wis.

George D. Dalton*
Chairman
Fiserv Inc.
Waukesha, Wis.

Willie D. Davis
President
All-Pro Broadcasting
Inglewood, Calif.

James L. Dorman*
Chairman and CEO
Intercontinental Trading Ltd.
West Allis, Wis.

William E. Edstrom '57
President
Edstrom Industries Inc.
Waterford, Wis.

James D. Ericson
President and CEO
Northwestern Mutual Life Insurance Co.
Milwaukee, Wis.

Warner C. Frazier
Consultant and Chairperson of the Simplicity Manufacturing Inc. Board of Directors
Mequon, Wis.

Richard D. Gebhardt
Chairman
Uihlein Electric Co. Inc.
Brookfield, Wis.

Jodie K. Glore
Private Investor
Salt Lake City, Utah

Richard R. Grigg
President, COO and
Chief Nuclear Officer
Wisconsin Electric Power Co.
Milwaukee, Wis.

Richard C. Grove
President and CEO
Milwaukee Electric Tool Corp.
Brookfield, Wis.

Thomas J. Hauske Jr.
Vice President
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 and CEO
Jacobus Wealth Management Inc.
Milwaukee, Wis.

Donald R. Johnson
President and CEO
Modine Manufacturing Co.
Racine, Wis.

Robert D. Kern
Chairman and CEO
Generac Power Systems
Waukesha, Wis.

Gerald F. Lestina*
President and CEO
Roundy's Inc.
Pewaukee, Wis.

Joan R. Lloyd
President
Joan Lloyd & Associates
Milwaukee, Wis.

Marshall A. Loewi*
D. Bus. Econ. (Hon.)
Retired President and CEO
Milwaukee Resistor Corp.
Milwaukee, Wis.

Fred G. Luber*
D. Eng. (Hon.)
Chairman and CEO
Super Steel Products Corp.
Milwaukee, Wis.

John K. MacIver*
D. Laws and Econ. Dev. (Hon.)
Senior Partner
Michael Best & Friedrich LLP
Milwaukee, Wis.

Carl R. Marschke
Chairman
Marquip Inc.
Phillips, Wis.

Donald D. Maurer '60
President and Owner
Maurer & Associates Inc.
Marine-on-St. Croix, Minn./
Sanibel Island, Fla.

James F. McKinley Jr.
President, CEO and COO
Scot Forge
Spring Grove, Ill.

John A. Mellowes
Chairman and CEO
Charter Manufacturing Co. Inc.
Mequon, Wis.

Thomas L. Misiak '77
President
The Falk Corp. – a sub. of Sundstrand Corp.
Milwaukee, Wis.

Scott Moon
President
Res Manufacturing Co.
Milwaukee, Wis.

Alan J. Ruud, P.E, '69*
D. Eng. (Hon.)
Chairman and CEO
Ruud Lighting Inc.
Racine, Wis.

Richard L. Schmidt
Chairman and CEO
C. G. Schmidt Inc.
Milwaukee, Wis.

Larry A. Schotz '73
President and Owner
L.S. Research Inc.
Cedarburg, Wis.

Loraine E. Schuffler
D. Hum. Ltrs. (Hon.)
President
Glenn & Gertrude
Humphrey Foundation
Milwaukee, Wis.

John S. Shiely
President and COO
Briggs & Stratton Corp.
Milwaukee, Wis.

John W. Splude
President and CEO
HK Systems
Milwaukee, Wis.

Brian J. Stark '71
President, Controls
Johnson Controls
Milwaukee, Wis.

R. Baird Stephenson
Retired President and CEO
Siemens Power Corp.
Milwaukee, Wis.

Gary A. Stimac '73
Chairman/Consultant
Office Domain
Montgomery, Texas

Alfred J. Tector, M.D.
CEO, Midwest Heart Surgery Institute
Director, Transplant Program
St. Luke's Medical Center
Milwaukee, Wis.

Jean B. Tyler
Consultant
Local Government Issues
Milwaukee, Wis.

David V. Uihlein Jr.
President
Uihlein Wilson Architects
Milwaukee, Wis.

William D. Van Dyke III
Senior Vice President
Salomon Smith Barney
Milwaukee, Wis.

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

James B. Wigdale
Chairman and CEO
Marshall & Ilsley Corp.
Milwaukee, Wis.

Larry D. Yost '77
Chairman and CEO
Meritor Automotive Inc.
Troy, Mich.

Foster A. Blankenbaker '43
D. Eng. (Hon.)
President
FAB Inc.
Scottsdale, Ariz.

Fred L. Brengel
D. Eng. (Hon.)
Retired President and CEO
Johnson Controls Inc.
Fox Point, Wis./Tequesta, Fla.

Paul F. Bronson
Chairman
Best Block Co.
Milwaukee, Wis./Scottsdale, Ariz.

Francis J. Buckley Jr.
Retired General Manufacturing Manager
GM Electric
Roswell, Ga.

James J. Burns '56
President/Associate
Anagram Associates Inc.
Tucson, Ariz.

Thomas J. Burns
Chairman
Burns-Milwaukee Inc.
Milwaukee, Wis.

Gene P. Carter '60
D. Eng. (Hon.)
Private Investor
Saratoga, Calif.

Don H. Davis Jr.
Chairman and CEO
Rockwell International Corp.
Milwaukee, Wis.

William K. Eastham
Retired Vice Chairman
S.C. Johnson & Son Inc.
Racine, Wis.

Peter I. Georgeson
D. Eng. (Hon.)
Chairman
Scot Forge
Spring Grove, Ill./Naples, Fla.

Eckhart G. Grohmann
D. Eng. (Hon.)
Chairman and President
Aluminum Casting & Engineering Co.
Milwaukee, Wis.

David T. Kahler
D. Eng. (Hon.)
President
Kahler Slater
Milwaukee, Wis.

Jack F. Kellner
D. Bus. Econ. (Hon.)
Retired Chairman
Western Industries Inc.
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.

James A. Lovell Jr.
D. Eng. (Hon.)
President
Lovell Communications
Lake Forest, Ill.

George W. Mead II
Chairman
Consolidated Papers Inc.
Wisconsin Rapids, Wis.

Richard M. Merriman '50
Retired Attorney
Reid & Priest
Washington, D.C.

Yuzaburo Mogi
President and CEO
Kikkoman Corp.
Tokyo, Japan

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
Milwaukee, Wis.

Gerald S. Parshalle
Retired President and CEO
Realist Inc.
Mequon, Wis.

Bernard J. Peck
Proprietor
Water Street Garage
Milwaukee, Wis./Ft. Lauderdale, Fla.

I. Andrew Rader
D. Eng. (Hon.)
Chairman
The Lynde & Harry Bradley Foundation
San Diego, Calif.

Edward W. Raether '68
Vice President and Deputy Managing
Director – Central Europe
American Appraisal Hungary Co. Ltd.
Budapest, Hungary

Earl E. Richter
Retired President
Modine Manufacturing Co.
Racine, Wis.

Walter L. Robb, Ph.D.
D. Eng. (Hon.)
Consultant
Vantage Management
Schenectady, N.Y.

Paul J. Schierl
President and Director
Cornerstone Foundation of N.E. Wisconsin
De Pere, Wis.

George A.D. Schuett
D. Eng. (Hon.)
Architect
Plunkett Raysich Architects
Milwaukee, Wis.

John R. Seeger
Retired Legal Counsel
Milwaukee School of Engineering
Mequon, Wis./Sarasota, Fla.

Richard G. Sim, Ph.D.
Chairman, President and CEO
Applied Power Inc.
Milwaukee, Wis.

Robert R. Spitzer, Ph.D.
D. Eng. (Hon.)
President Emeritus
Milwaukee School of Engineering
Burlington, Wis.

Warren R. Stumpe
D. Eng. (Hon.)
Executive Consultant
Mequon, Wis.

Robert D. Teece Sr.
D. Eng. (Hon.)
Retired Executive Vice President
Harnischfeger Industries Inc.
Naples, Fla.

Nancy Johnson Templin
Scottsdale, Ariz.

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
Firstar Bank
Brookfield, Wis.

George A. Wardeberg
Chairman and CEO
WICOR
Milwaukee, Wis.

C. R. Whitney
D. Eng. (Hon.)
Retired Chairman
Allen-Bradley Co.
Hot Springs Village, Ark.

Nathaniel K. Zelazo
D. Eng. (Hon.)
CEO
Astronautics Corp. of America
Milwaukee, Wis.

Academic Administration of MSOE

President's Office
Hermann Viets, Ph.D.
President

Vice President of Academics' Office
Charles F. James Jr., Ph.D.
Vice President of Academics

REPORTING ACADEMIC DEPARTMENTS

Aerospace Studies Department
Lt. Col. Timothy Hurst, MA
Chairman, Aerospace Studies Department

Architectural Engineering and Building Construction Department
Matthew W. Fuchs, MS, P.E.
Chairman, Architectural Engineering and Building Construction Department

School of Business
George Lephardt, Ph.D.
Chairman, School of Business

Electrical Engineering and Computer Science Department
Ray W. Palmer, MS, P.E.
Chairman, Electrical Engineering and Computer Science Department

General Studies Department
Roger J. Frankowski, Ph.D.
Chairman, General Studies Department

Mathematics Department
Peter K.F. Kuhfittig, Ph.D.
Chairman, Mathematics Department

Mechanical Engineering Department
Matthew A. Panhans, Ph.D., P.E.
Chairman, Mechanical Engineering Department

School of Nursing
Mary Louise Brown, Ph.D., RN
Chairperson, School of Nursing

Physics and Chemistry Department
Anders Schenstrom, Ph.D.
Chairman, Physics and Chemistry Department

Full-Time Faculty

Donald F. Ashby, Associate Professor, General Studies; Director, TRIOPrograms; BS Ball State University '65; MS Ball State University '70; Ed.D. Indiana University '80

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; Program Director, Mechanical Engineering Technology; 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

Jeffrey J. Blessing, Associate Professor, Electrical Engineering and Computer Science; BS University of Wisconsin-Milwaukee '81; MS University of California-San Diego '84

Robert Y. Bodine, Associate Professor, Mechanical Engineering; Program Director, Mechanical Engineering; BS Bradley University '54; MS University of Kansas '58; Ph.D. University of Wisconsin-Madison '61; Registered Professional Engineer in the State of Wisconsin

Gary Boelkins, Associate Professor, General Studies, BA Grand Valley State College '75; MA Marquette University '98

Marvin L. Bollman, Professor, General Studies; BS Stout State University '71; MS University of Wisconsin-Milwaukee '89

Connie Borowicz, Assistant Professor, General Studies; BA University of Wisconsin-Eau Claire '74; MS University of Wisconsin-Stout '75.

Jon K. Borowicz, Associate Professor, General Studies; BA University of Wisconsin-Madison '75; MA Johns Hopkins University '79; Ph.D. Johns Hopkins University '86

Christopher Brabant, Assistant Professor, Clinical Perfusion; BS St. Norbert College '91; BS St. Louis University '94; Certification, American Board of Cardiovascular Perfusion; Children's Hospital of Wisconsin

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; Program Director, MS in Perfusion; 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; MCSM 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, MS in Engineering; 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 Christie, Associate Professor, Mechanical Engineering; BS Milwaukee School of Engineering '75; MS Milwaukee School of Engineering '80; MS University of Wisconsin-Milwaukee'85.

Patrick J. Coffey, Professor, General Studies; Dean of Students; BA Holy Cross College '65; MA University of Wisconsin-Madison '66

Robert S. Crockett, Assistant Professor, Mechanical Engineering; BS University of California-Berkeley '89; MBA Pepperdine University '92; Ph.D. University of Arizona '97

Karl David, Associate Professor, Mathematics; BA University of Richmond '69; MA University of Massachusetts '74; Ph.D. University of Massachusetts '78

J. William Dawicke, Professor, Physics and Chemistry; BS University of Wisconsin-Milwaukee '66; MS University of Wisconsin-Milwaukee '68; Ph.D. Marquette University '80

Kenneth K. Dawson, Professor, School of Business; Program Director, Management Systems; BS Purdue University '61; MBA Marquette University '69

Richard A. DeVries, Assistant Professor, Architectural Engineering and Building Construction; BS University of Texas, Austin '87; MS University of California, Berkeley '89; Ph.D. University of Texas, Austin '96; Registered Professional Engineer in the State of Oklahoma.

Cecilia E. Diaz, Assistant Professor, School of Nursing; BSN Marquette University '68; MSN Boston University '72.

James W. Dieball, Associate Professor, Physics and Chemistry; BS University of Wisconsin-Milwaukee '70; MS University of Wisconsin-Milwaukee '73

Carol Diggelman, Professor, Physics and Chemistry; BS University of Wisconsin-Milwaukee '65; MS University of Wisconsin-Milwaukee '86; Ph.D. University of Wisconsin-Madison '98

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

John H. Farrow, Professor, Mechanical Engineering; BS Marquette University '56; MS Marquette University '80; Registered Professional Engineer in the State of Wisconsin

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

Paul E. Feuerstein, Professor, 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

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; Chairman, General Studies Department; BA Marquette University '65; MA Marquette University '68; MEd Marquette University '86; Ph.D. Marquette University '92

Dawn M. Frederickson, Assistant Professor, School of Nursing; BSN Alverno College '72; MSN Marquette University '82

James 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; Chairman, Architectural Engineering and Building Construction Department; 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

Waldemar Gerassimoff, Professor, Electrical Engineering and Computer Science; BS University of Wisconsin-Madison '65; MS Milwaukee School of Engineering '89; Registered Professional Engineer in the State of Wisconsin

Ronald Gerrits, Assistant Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '94; Ph.D. Medical College of Wisconsin '99

Richard Greengard, Associate Professor, Physics and Chemistry; BS Georgia Institute of Technology '67; Ph.D. Wayne State University '75

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

Jerri Hoehn, Assistant Professor, School of Nursing; BSN University of Wisconsin-Oshkosh '78; MSN Marquette University '88

William Edward Howard, Assistant Professor, Mechanical Engineering; BS Virginia Tech '80; MS Virginia Tech '85

Harvey L. Hoy, Associate Professor, Mechanical Engineering; Program Director, Mechanical Engineering Technology; BS University of Wisconsin-Madison '60; Registered Professional Engineer in the State of Wisconsin

Timothy Hurst, Lieutenant Colonel, Professor, Aerospace Studies; Chairman, Aerospace Studies Department; BS University of South-Western Louisiana '78; MA Louisiana Tech University '83

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; Program Director, MS in Environmental Engineering; 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

Charles F. James Jr., Professor, Mechanical Engineering; Vice President, Academics; BS Purdue University '58; MS Purdue University '60; Ph.D. Purdue University '63

Michael Jay Jenkins, Assistant Professor, Mechanical Engineering; BS Union College '82; MS University of Iowa '83

Terri Jones, Captain, Assistant Professor, Aerospace Studies; BAS Troy State University '93; MBA Chapman University '97

R. David Kent, Assistant 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

Brigita E. Kore-Kakulis, Professor, Physics and Chemistry; BS University of Wisconsin-Madison '54; MS Marquette University '62

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

Peter K.F. Kuhfittig, Professor, Mathematics; Chairman, Mathematics Department; BS University of Wisconsin-Milwaukee '65; MS University of Wisconsin-Milwaukee '67; Ph.D. George Peabody College of Vanderbilt University '72

Subha 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 Labus, Professor, Mechanical Engineering; BS Purdue University '68; MS University of Illinois '71

Sherrill L. Leifer, Assistant Professor, School of Nursing; BSN University of Wisconsin-Madison '74; MSN University of Wisconsin-Milwaukee '89

Robert O. Lemke, Assistant Professor, Architectural Engineering and Building Construction; BS University of Wisconsin-Milwaukee '83; MS Milwaukee School of Engineering '99; Professional Architect in Wisconsin (NCARD certified)

George P. Lephardt, Professor, School of Business; Chairman, School of Business; BS University of Delaware '69; MS University of Wisconsin-Milwaukee '71; Ph.D. University of Tennessee '76

Susannah P. Locke, Associate Professor, General Studies; BS Marquette University '58; MA Marquette University '64

John Lumkes, Assistant Professor, Mechanical Engineering; BS Calvin College '90; MSE University of Michigan-Ann Arbor '92; Ph.D. University of Wisconsin-Madison '97

John Lunz, Adjunct Associate Professor, Electrical Engineering and Computer Science; BS Marquette University '66; MS University of Wisconsin-Milwaukee '70

Eugene R. Magnuson, Professor, Physics and Chemistry; BS University of Nebraska '55; MS University of Nebraska '58; Ph.D. Kansas State University '66

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, School of Business; Program Director, MS in Medical Informatics; 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

Richard Mett, Assistant Professor, Physics and Chemistry; BS Milwaukee School of Engineering '82; MS University of California-Berkeley '85; Ph.D. University of Wisconsin-Madison '90

Lisa Milkowski, Assistant Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '91; MS Marquette University '93; Ph.D. Marquette University '95

Joseph C. Musto, Assistant Professor, Mechanical Engineering; Program Director, Mechanical Engineering; BS Clarkson University '89; MS Rensselaer Polytechnic Institute '90; Ph.D. Rensselaer Polytechnic Institute '94

Charles Nailen, Assistant Professor, School of Business; AB Ripon College '88; MS University of Wisconsin - Milwaukee '95

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

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.

Mary Ann Perdue, Professor; Director of the Library and Information Resources; BA Valparaiso University '67; MA University of Wisconsin-Milwaukee '77

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

Sandra K. Plach, Associate Professor, School of Nursing; BSN Carroll/Columbia College '87; MSN University of Wisconsin-Milwaukee '92; Ph.D. University of Wisconsin-Milwaukee '99

Randy R. Rapp, Assistant Professor, Architectural Engineering and Building Construction; BS U.S. Military Academy '75; MS University of Missouri-Rolla '83. Registered Professional Engineer in the State of Virginia.

Douglas L. Reed, Professor, 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

Mary Lynn Robinson, Assistant Professor, School of Nursing; BS Bowling Green University '64; BSN University of Wisconsin-Milwaukee '81; MSN University of Wisconsin-Madison '86

Ted Robles, Professor, Electrical Engineering and Computer Science; BS Central Philippine University '64; MS Montana State University '69; Ph.D. Montana State University '75

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 Schenstrom, Professor, Physics and Chemistry; Chairman, Physics and Chemistry Department; MS Linkoping Institute of Technology, Sweden '80; MS University of Wisconsin-Milwaukee '82; Ph.D. University of Wisconsin-Milwaukee '87

Robert P. Schilleman, Associate Professor, Mathematics; BS University of Wisconsin-Madison '59; MS Marquette University '76

Larry J. Schmedeman, Professor, School of Business; Program Director, Business and Computer Systems; BS University of Wisconsin-Milwaukee '72; BIM Milwaukee School of Engineering '82; MBA University of Wisconsin-Whitewater '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

Kevin Seward, Instructor, Physics and Chemistry; BA Iowa State University '87; MS University of Wyoming '91

Richard G. Shrubb, Associate Professor, General Studies; Program Director, Technical Communication; BA Lee College '83; MA Southeastern Louisiana University '87; Ph.D. University of Southern Mississippi '92; MBA William Carey College '94

John G. Slater, Professor, 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, 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

Joyce M. Solochek, Instructor, Physics and Chemistry; BS University of Wisconsin-Madison '66; MBA Marquette University '67

Douglas C. Stahl, Assistant 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

John A. Starr, Associate Professor, Electrical Engineering and Computer Science; BS University of Wisconsin '69; MS University of Wisconsin - Madison '75

Melvin J. Stavn, Professor, Physics and Chemistry; BS Massachusetts Institute of Technology '63; MS McGill University '64; Ph.D. University of Wisconsin-Madison '69

Robert A. Strangeway, Professor, Electrical Engineering and Computer Science; Program Director, Electrical Engineering Technology; BS Milwaukee School of Engineering '79; MS Marquette University '86; Ph.D. Marquette University '96

L. Wayne Surratt, Captain, Assistant Professor, Aerospace Studies; BS Northern Michigan University '88; MS University of Montana '93

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, Assistant 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, School of Business; BA Amherst College '63; MS University of Pennsylvania '67; Ph.D. University of Pennsylvania '73; MBA University of Chicago '81

Hue 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

Matthew A. Treu, Associate Professor, Electrical Engineering and Computer Science; BS Milwaukee School of Engineering '81; MS University of Wisconsin-Milwaukee '82

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, Associate Professor, Mechanical Engineering; BS and AB University of Illinois '56; MS Milwaukee School of Engineering '78; Registered Professional Engineer in the State of Wisconsin

Leonard A. Vanden Boom, Professor, General Studies; Dean of Institutional Research; BS Stout State University '63; MS Stout State University '68

Hermann Viets, Professor, Mechanical Engineering; President, Milwaukee School of Engineering; BS Polytechnic University '65; MS Polytechnic University '66; Ph.D. Polytechnic University '70

Mary P. Voell, Instructor, School of Business; BS University of Wisconsin-Milwaukee '85; MA University of Wisconsin-Milwaukee '99

Dan Wagner, Major, Assistant Professor, Aerospace Studies; BA Indiana University '81; MBA University of South Dakota '88

Ruth M. Waite, Associate Professor, School of Nursing; BSN Alverno College '77; MSN Marquette University '81; Ph.D. Marquette University '89

Dennis L. Wanless, Professor, School of Business; BS University of Wisconsin-Madison '76; MS University of Northern Colorado '79; Ph.D. University of Wisconsin-Madison '83

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, Assistant Professor, General Studies; BA Wright State University '81; MA University of Wisconsin-Milwaukee '86; Ph.D. University of Wisconsin-Milwaukee '92

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

Glenn T. Wrate, Associate Professor, Electrical Engineering and Computer Science; 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 Young, Associate Professor, School of Nursing; Program Director, Nursing; BSN University of Wisconsin-Milwaukee '76; MSN Marquette University '88

John A. Zachar, Professor, Architectural Engineering and Building Construction; Program Director, BS and MS in 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 Zidek, Assistant Professor, Mechanical Engineering; BS Marquette University '90; MS Marquette University '92

Professors Emeriti

Edward Allan, Professor Emeritus, Mechanical Engineering; BS Lafayette College '43; MS Wayne State University '56

Alden Q. Beaty, Professor Emeritus, Mechanical Engineering; BS Georgia Institute of Technology '38; MS University of Akron '68; Registered Professional Engineer in the States of Ohio and Pennsylvania

Richard C. Born, Professor Emeritus, Electrical Engineering and Computer Science; BS Michigan Technological University '61; MS University of Wisconsin-Madison '62; Ph.D. University of Wisconsin-Madison '66

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

Matt G. Bushner, Professor Emeritus, Physics; BA Ripon College '42; MS University of Michigan '48

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, 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, Electrical Engineering and Computer Science; BS University of New Mexico '62; MS University of Houston '74

Thomas R. Gaulke, Professor Emeritus, Mechanical Engineering; BS University of Wisconsin-Madison '43; MS University of Wisconsin-Madison '50

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

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

Janina Levy, Professor Emerita, Chemistry; BS Copernicus University in Torun, Poland '55; MS University of Warsaw '57

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, School of Business; BS University of Denver '48; MBA University of Denver '52

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

Andrew Schmirler, Professor Emeritus, Mathematics; BS St. Norbert College '57; Marquette University '75

Harry A. Schopler, Professor, 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

Judith A. Steininger, Professor, 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 and the chairperson for each.

ARCHITECTURAL ENGINEERING
Norbert Schmidt '79 ABCET
Vice President – Mechanical Division
J.F. Ahern Co.

MS ARCHITECTURAL ENGINEERING
Dewey Hemba
Principal
Graef, Anhalt,Schloemer & Assoc.

BUSINESS/MANAGEMENT
Earl Winkelman
Vice President and General Counsel
Jockey International

COMPUTER ENGINEERING
Wyndham Gary
Marquette Medical Systems

CONSTRUCTION MANAGEMENT
Mary Buczynski
Principal
Bay Construction Advisors

ELECTRICAL ENGINEERING
Owe Petersen, Ph.D.
Program Director/Professor
Milwaukee School of Engineering

ELECTRICAL ENGINEERING TECHNOLOGY
Donald J. Backys, PE '67 EE
Staff Systems Engineer
Motorola Inc.

ENGINEERING GRAPHICS
Ron Fait
Program Manager
GE Medical Systems Operation

MS ENGINEERINGMANAGEMENT
Gene Wright '79 BIM, '87 MSEM
Director, Research and Development
Brady Corp.

MS ENVIRONMENTAL ENGINEERING
Cynthia Slavic '90 MSEM
Investment Officer
Northwestern Mutual Life Insurance

FLUID POWER INSTITUTE
John G. Slater, Ph.D.
Mechanical Engineering
Milwaukee School of Engineering

HUMANITIES/SOCIAL SCIENCES/ENGLISH
Herbert Goetsch
Milwaukee, Wisconsin

INDUSTRIAL ENGINEERING
James Schwai
Business Broker
Metropolitan Business Brokers

MECHANICAL ENGINEERING
Tom Calenberg
Vice President
MSCTechnologies Inc.

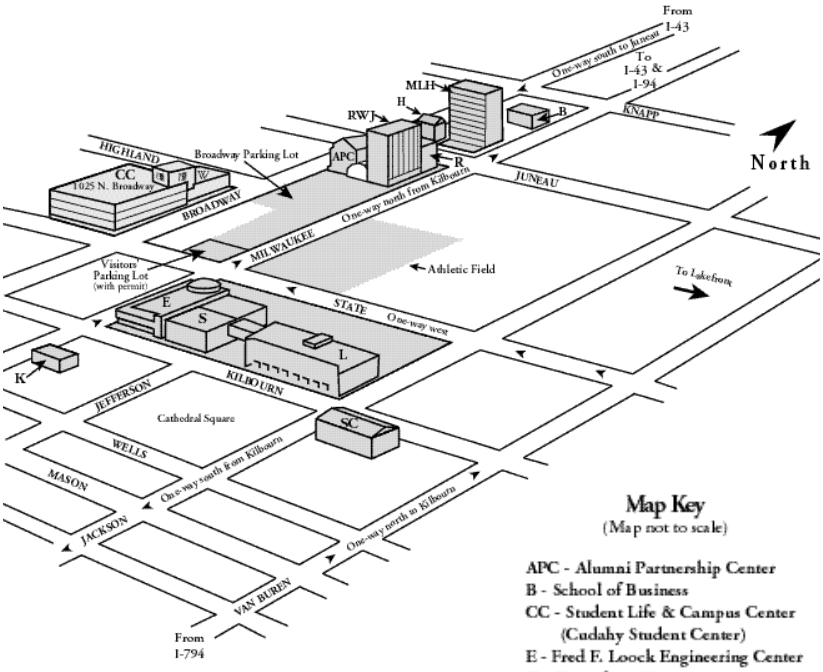
MECHANICAL ENGINEERING TECHNOLOGY
Val Kukuljian '69 ME, '77 MSEM
Consultant
Engineering Consultant Services
Advanced Manufacturing Technologies

NURSING
Mary Louise Brown, Ph.D., RN
Chairperson/Professor,School of Nursing
Milwaukee School of Engineering

TECHNICAL COMMUNICATION
Barry Glasford '93 TC
Technical Information Product Developer
GE Marquette Medical Systems

Additional committees comprised of industrial and business representatives also exist to advise in other areas of the university such as recruitment and marketing.

CAMPUS MAP



Map Key
(Map not to scale)

APC - Alumni Partnership Center
B - School of Business
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 handicap, 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, with out 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
or visit our Web site at
www.msoe.edu.