

# MERCER UNIVERSITY

## Catalog 2006-2007



**College of Liberal Arts**

**Eugene W. Stetson School of  
Business and Economics**

**School of Engineering**

**Tift College of Education**

**School of Medicine**

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*Macon, Georgia 31207*

# The School of Engineering

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An engineer takes the discoveries of the scientist, the tools of the mathematician, and the imagination of the inventor and transforms them into goods, services, and information to satisfy human needs. The purpose of Mercer University's School of Engineering is to educate a student who is prepared to be a practicing engineer, one who can responsibly contribute to a global society that is becoming ever more dependent on technology.

The engineering program of study includes a solid foundation in mathematics and sciences along with a broad range of courses in engineering topics. The program culminates in engineering design courses in which a student explores solutions to recognized needs as a member of a team, since so much of modern engineering is a team effort. Engineering courses place emphasis on the written and spoken word; enabling graduates to effectively communicate their ideas to both technical and non-technical audiences. Because the computer is such an essential tool for analysis, the courses integrate computer methods of problem-solving. Within the engineering curriculum are the general education requirements which promote social, cultural, and global awareness, and draw on Mercer University's distinguished Judaeo-Christian ethical value structure. All of this contributes to the development of a practicing engineer who is a responsible contributor to the global society.

While the focus of the engineering school is to educate engineers, its graduates may enter many fields of graduate study, especially those requiring the disciplined problem solving methods developed in the undergraduate engineering curriculum. Mercer School of Engineering graduates have entered professional graduate programs in medicine, law, and business, as well as graduate engineering programs. The Mercer Bachelor of Science in Engineering (BSE) program is accredited by the Engineering Accreditation Commission of ABET, Inc.

In addition to the specializations that lead to a Bachelor of Science in Engineering, the School of Engineering offers two Bachelor of Science (BS) degree programs. The Bachelor of Science in Industrial Management focuses on applying selected engineering tools to management decisions. This program is accredited by the Applied Science Accreditation Commission of ABET, Inc. The Bachelor of Science in Technical Communication provides a foundation in sciences, mathematics and technology with a strong emphasis on communication skills. Both of the BS programs are intended to provide a technical, scientific, and analytical foundation so the graduate can pursue engineering-related careers that require some engineering-like expertise. The programs are a mutual effort

between the School of Engineering, the College of Liberal Arts, and the Stetson School of Business.

The faculty within the engineering school is dedicated to staying abreast of the latest developments and conveying that current practice to the students in a supportive environment. Each student is encouraged and expected to draw on faculty assistance for knowledge, motivation, value clarification, and transition to the world of engineering.

## **Mercer University General Education**

The five undergraduate schools and colleges of Mercer University are clearly distinct. The autonomy and traditions of each is respected. Although each school is unique, all have identified goals, objectives, and outcomes that they share and that are reflective of a Mercer education. The objectives and specific outcomes, related to each major goal, do not constitute an exhaustive list but rather a summary of the central, intersecting objectives and outcomes.

Mercer University is dedicated to the ideal of educating the whole person and providing a foundation that can be described by the Greek term “Paideia”. Paideia is consistent with the founding vision of Jesse Mercer as he sought to encourage learning and culture for both clergy and laity. Teaching, character development, service and leadership, classical education, and the nurturing of a prevailing culture are all instrumental. Mercer’s aim is to prepare all students to contribute to society through a sharing of their knowledge, skills, and character.

Through the general education curriculum Mercer University graduates will be able to:

- A. Reason effectively
- B. Demonstrate broad and deep knowledge
- C. Demonstrate habits of free inquiry
- D. Demonstrate an understanding of themselves in light of the values and traditions upon which the University was founded.

From these four goals flow the intended educational outcomes for general education at Mercer University:

- A.
  - 1. Communicate clearly, responsibly, and with integrity in written and oral forms
  - 2. Master at least the basic principles of mathematical and scientific reasoning
  - 3. Identify, access, and evaluate information and materials as needed for personal, academic, and professional purposes
- B.
  - 4. Acquire foundational knowledge important to becoming an informed person and/or for the major
  - 5. Relate theory, principles, and content from one discipline to another
  - 6. Demonstrate familiarity with cultures and traditions other than one’s own
- C.
  - 7. Work as part of a team/group, to learn and teach cooperatively, to develop an appreciation of individual differences, and to assess one’s own and other’s roles in a working group

8. Consider viewpoints other than one's own, including viewpoints associated with other cultures and traditions
  9. Commit to live as an engaged and informed citizen
- D.
10. Reflect on one's life and learning experience
  11. Develop a respect for intellectual and religious freedom

## **National Engineering Advisory Board**

The National Engineering Advisory Board, established in 1986, supports the School of Engineering in the offering of high-quality engineering education at the undergraduate and graduate levels; the offering of research opportunities appropriate to the needs of the School, the University, industry and society in general; promoting faculty development as a means to achieve national prominence as a quality educational institution; obtaining financial support from corporate and other sources throughout the nation; and serving the educational, technical, and consulting needs of local industry.

Members of the Board include: Chairman: Mr. L. Donald LaTorre, L & G Management Consultants; Members: Mr. James L. Bond, Public Service Telephone Co.; Mr. Peter Bryant, Mercer Engineering Research Center; The Honorable Saxby Chambliss, United States Senate; Mr. Robert V. Dumke, Siemens Medical Systems Company; Mr. Eugene Dunwody, Dunwody, Beeland, Architects, Incorporated; Mr. A. V. Elliott, Jr., The Elliott Machine Shop, Incorporated; Mr. Ernest Gay, Imerys Pigments and Additives Group; Mr. Arthur L. Grady, Northrop Grumman Corporation (retired); The Honorable George Hooks, Senator, State of Georgia-District 14; Mr. Obie B. Jones, The Boeing Company; Mr. John Krawczuk, BAE Systems Platform Solutions; Mr. Melvin Kruger, L. E. Schwartz & Son, Incorporated; Dr. Dan E. Nale, Gulfstream Aerospace Corporation; Mr. Jim Rogers, R.J. Reynolds Tobacco Company; Mr. John Rowe, Matsushita Battery Industrial Corporation of America; Mr. Chris R. Sheridan, Jr.; Chris R. Sheridan and Company; Mr. Joe E. Timberlake, III, JET Foundation, Incorporated; Dr. Jurgen Vogt, CIBA Vision Corporation; and Mr. Tom Wilkason, Raytheon; Ms. Karen A. Albrecht, Lockheed Martin Aeronautics Company; Mr. G. Holmes Bell, IV, Hussey, Gay, Bell & DeYoung, Inc; Mr. W. Miles Greer, Savannah Electric Company; Mr. W. Michael Hatcher, Headquarters Warner Robins Air Logistics Center; Mr. Brian C. Highley, Avail Medical Products; Mr. Robert Spadoni, Engelhard Corporation.

## **Mercer Engineering Research Center**

The Mercer Engineering Research Center, established by Mercer University in 1987, is closely affiliated with the School of Engineering with the mutual benefit of the two units through the conduct of research and development activities. The Mercer Engineering Research Center maintains a staff of research scientists, engineers, analysts and support personnel to conduct fundamental and applied research and development in engineering. The center provides advanced engineering and computational services, and disseminates the results through products and services delivered to the customer, publications, training courses and conferences. These activities are conducted with support and sponsorship of the federal government (civilian and military agencies), state and local governments and private, commercial, or philanthropic organizations and institutions. They

include design, analysis, testing and other services relating to the support of the research and development activities.

MERC operates out of its research facility located in Warner Robins, Georgia and employs a core group of approximately 100 research engineers and scientists.

## **Degree Programs**

### **Undergraduate**

#### **BACHELOR OF SCIENCE IN ENGINEERING**

Specializations:

- Biomedical
- Computer
- Electrical
- Environmental
- Industrial
- Mechanical

#### **BACHELOR OF SCIENCE**

Majors:

- Industrial Management
- Technical Communication

### **Minor**

Technical Communication

### **Graduate**

#### **MASTER OF SCIENCE IN ENGINEERING**

Majors:

- Biomedical Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Management
- Mechanical Engineering
- Software Engineering

#### **MASTER OF SCIENCE**

Majors:

- Software Systems
- Technical Communication Management
- Technical Management

## **Advanced Placement**

Advanced placement and CLEP credits for appropriate courses which satisfy University criteria may be included in the BSE degree.

## **Transfer Credit**

Students who transfer into the School of Engineering must have a minimum of 2.5 GPA in all college enrollments. In addition, students must also have a 2.5 GPA or higher in all college Math, Science and Engineering courses (excluding developmental Math courses). They must also be in good standing—that is, not on warning, probation, suspension, or equivalent. The School of Engineering will

consider transfer students at any stage in their education; however, it is recommended that prospective transfer students follow a pre-engineering course of study if available at their institution. The core of any pre-engineering course of study includes: mathematics (i.e., calculus through differential equations); laboratory based chemistry; and calculus based physics with laboratory. While all legitimate transfer credits are accepted, students must meet the degree requirements established by the School of Engineering. Any additional hours will be reflected on a student's transcript as general electives.

## **Full Admission for Transfer Students**

Transfer students who seek full admission to the School of Engineering must satisfy the following conditions:

- 1) Have a minimum of a 2.5 GPA in all college enrollments;
- 2) Have a 2.5 GPA or higher in all degree relevant college math, science and engineering courses attempted. Courses are considered degree relevant only if they could be used (were an appropriate grade earned) to satisfy degree requirements in the specialization or program to which the student is seeking transfer admission. For the purpose of this computation, all attempts or individual courses are included.
- 3) Have completed courses, which transfer as CHM 111, PHY 161, PHY 121L, MAT 191, and MAT 192.
- 4) Be in good standing at their previous school—that is, not on warning, probation, suspension, or the equivalent.

## **Conditional Admission for Transfer Students**

Students who have completed a course which transfers as MAT 133 and have not yet completed CHM 111, PHY 161/PHY 121L, MAT 191, and /or MAT 192, but who are otherwise eligible, may be granted conditional admission to the School of Engineering. Full admission will not be granted until these courses have been completed satisfactorily. Students who are granted conditional admission to the School of Engineering will have their academic performance evaluated at the end of each semester by the Scholarship and Academic Standards Committee of the School of Engineering. Students who have not earned a term average of at least 2.0 in any given semester during this period will be suspended from the School of Engineering. Students conditionally admitted will remain in this status until the four indicated courses are completed with a composite GPA of 2.5 or better (including repeated courses). Students have one calendar year from first admission to the School to satisfy these requirements. In addition:

- 1) Students must also have an overall GPA of 2.5 or better in all degree relevant courses attempted during the period of the conditional admission.
- 2) Students must satisfy the general academic standards of the University and/or the School of Engineering.

Students unable to satisfy the requirements of the conditional admission will be suspended from the School of Engineering.

## **Articulation Agreements**

Mercer School of Engineering has transfer articulation agreements in exis-

tence and under development with schools throughout the Southeast that have pre-engineering programs. These agreements follow the patterns of the Regent's Engineering Transfer Program.

## **Credit by Examination**

Students who have completed course work or other training that cannot be accepted as transfer credit for a School of Engineering course may elect to receive credit by examination. This can be done by passing a comprehensive test prepared and administered by a School of Engineering faculty member who has recently taught the course. A fee is charged for taking the examination, and there must be sufficient evidence that a passing grade will be achieved before the examination will be given.

## **English Requirement**

Any student whose written or spoken English in any course is unsatisfactory may be reported by the instructor of that course to the Dean of the School of Engineering. The Dean may choose to assign supplementary work, including additional course work, consistent with the needs of the student. The granting of a degree may be delayed until the work assigned is satisfactorily completed.

## **Credit Hours**

The number of credit hours awarded for a course is based on the number of lecture and laboratory hours per week. The School of Engineering has defined a unit of credit for programs under its jurisdiction. An hour of work is the equivalent of 50 minutes of class time (often called a "contact hour") or 60 minutes of independent study work. The normal semester is 15 weeks in length.

## **Satisfactory - Unsatisfactory Grading Option**

Students seeking degrees from the School of Engineering are not permitted to take courses on a Satisfactory - Unsatisfactory basis for credit toward graduation unless the course is only offered on an S-U basis.

## **Academic Requirements**

A baccalaureate degree will be awarded to those students in good academic standing who successfully satisfy the academic requirements of the University and the School of Engineering, and who have adhered to the standards of conduct generally applicable to the engineering or related profession.

## **Dean's List**

Criteria for achieving dean's list status are listed in the Academic Information section of this catalog.

## **Engineering Honors Program**

The Engineering Honors Program provides exceptional students a program of study that presents challenges beyond the normal requirements for an undergraduate degree in the School of Engineering. The goals of the Engineering honors Program are to: (1) provide a common freshman experience that challenges the students and faculty members both technically and non-technically, and (2) pro-

vide a project experience that demonstrates knowledge and skills that exceed normal undergraduate requirements. Students are admitted to the Program by invitation only.

All engineering honors students must: (1) participate in a weekly one hour credit Engineering Honors Seminar, (2) complete a total of eight honors seminar credits, (3) maintain a cumulative grade point average of at least 3.3, (4) complete an approved honors project in addition to the undergraduate degree requirements, (5) provide a poster session honors project progress report for the project each year, and (6) complete an approved final project report at the conclusion of the honors project. Students who fall below 3.3 will be allowed to continue in the Engineering Honors Program for one semester.

Engineering honors students are encouraged to include one term of study or work experience preferably outside the United States that complements the required program of study and the honors project. This may be part of a study abroad experience provided to all qualifying Mercer University undergraduate students and may be fulfilled during a summer or May-term.

## **Academic Warning, Probation, and Suspension**

To implement the University requirements for academic warning, probation, and suspension, the School of Engineering has adopted the following provisions to assure engineering students who experience difficulty will receive prompt attention.

### **1. Warning**

A student may be placed on academic warning if his or her term grade point average is below 2.0. A student who is on academic warning may be returned to academic good standing by achieving a term grade average of 2.0 or greater and an accumulative grade point average of 2.0 or greater.

### **2. Probation**

A student will be placed on academic probation if his or her term grade point average is below 1.0 or the cumulative grade point average is below the minimum University requirement. A student who is on academic warning will be placed on academic probation if his or her term grade point average is below 2.0.

A student who is on academic probation may have conditions imposed on him or her as a requirement to return to academic good standing. A student who is on academic probation cannot be returned to good standing until a term grade point average and a cumulative grade point average of 2.0 or greater are both achieved.

### **3. Suspension**

A student who is on academic probation may be suspended if his or her term grade point average is below 2.0. Any full-time student who fails to pass a minimum of three hours in any term will be subject to academic suspension. Additionally, students who have demonstrated an inability to complete the special academic requirements of their chosen program of study may be suspended.

Normally a student who is suspended is not readmitted. A request for readmission will be considered only after one or more terms of no enrollment

in Mercer School of Engineering courses. Readmission will be granted only with specific conditions imposed by the Academic Standards Committee.

A student may appeal a warning, probation, and suspension to the Academic Standards Committee.

## **Second Specializations, Majors and Minors**

Students who pursue the B.S.E. degree may earn a second major or a minor in programs offered through the College of Liberal Arts. A second major in business, through the Stetson School of Business and Economics, may be earned only by completing all of the requirements for a second degree, the B.B.A. degree, including the general education requirements. Minors for non-business students are offered in accounting, business administration, and economics by the Stetson School of Business and Economics. A student must officially declare the second major, degree, or minor, and follow proper University procedures, which call for fulfilling the specific course requirements for the second major, degree, or minor, plus additional requirements that may be arranged on an individual basis.

Students wishing to earn a second major or degree must request or seek a second advisor from that department, who will serve in addition to their primary engineering advisor.

Engineering students may pursue two specializations simultaneously. To do this, a student must officially declare each specialization, be assigned an advisor from each specialization, and complete all the requirements of each specialization. Second specializations and minors will be noted on permanent records. Second specializations will be noted on diplomas.

Within the School of Engineering, minors are offered to all qualified university students in technical communication.

## **Student Work Experiences**

Students working toward degrees in engineering may qualify for work-learning experiences. Through industrial experience, students combine work in the classroom with practical experience in industry, business, or government. The School of Engineering encourages students to view the employment phases of the program, not as mere practice, but rather as a complementary part of the educational process. Through industrial opportunities, students experience practical application for at least one academic semester. While formally enrolled in a work experience, students are considered as being enrolled full-time.

In order to receive academic credit for work experience, students will submit periodic reports on their work experiences as related to their engineering studies. These reports will be evaluated by the students' employers and faculty advisors who will assign a grade at the end of each work period. Students who receive a satisfactory grade for three semesters (or three periods of work experience which include at least 400 hours on the job in each work period) will receive the Industrial Experience Certificate upon graduation.

Work assignments exist, or can be developed, in every area of study within the School of Engineering. Assignments are available nationwide. Through diversified types of employment, students acquire a wide range of experience in fields related to their specializations. The level of responsibility and expertise required for the job increases to match the student's progress through the academic curriculum,

thus assuring a stimulating, challenging employment situation. Salaries are established by individual employers, and increase as the student progresses academically.

## **Qualifying for Industrial Experience Program**

Students applying to the industrial experience program should be full-time students in good academic standing with at least a 2.5 GPA. Freshman applicants qualify for an initial industrial experience after successfully completing at least 30 credit hours. Transfer students must complete a minimum of 12 hours as students in the School of Engineering. All students must have the equivalent of three full-time industrial experience semester credit hours to earn the certificate of completion. Policy information and specifics relating to the industrial experience program are available in the Industrial Experience and Graduate Programs Office. Students interested in applying for participation in the industrial experience program should contact the Industrial Experience Director in the School of Engineering or the Office of Career Services, Mercer University, Macon, GA 31207.

## **Off Campus Educational Programs**

The School of Engineering offers courses at the Robins Air Force Base, adjacent to the city of Warner Robins and located approximately 17 miles southeast of the main campus in Macon is one of these locations. Courses are held on the base in the late afternoon and evening for the convenience of those who hold full-time jobs in the area. Programs of study are offered at the graduate level. All of the courses held on-base are open to U.S. citizens with a pass authorizing entry to the air base. All laboratory courses for any off campus undergraduate program are held on the main campus in Macon. Further information about these programs is available from the Industrial Experience and Graduate Programs Office.

## **Undergraduate Curricula**

### **Bachelor of Science in Engineering Degree Program**

The strength of Mercer's BSE program lies in its combination of breadth and depth. Breadth is achieved by every student completing a set of courses that build a strong foundation in writing, speaking, mathematics, lab sciences, and engineering fundamentals. In addition, special emphasis is placed on cross-disciplinary work, with all BSE students required to complete courses grounding them in the basic tools and techniques of electrical, mechanical, and industrial engineering. These "breadth" courses constitute the "core" of the BSE degree and are covered in greater detail in subsequent sections of this catalog. Depth is achieved by adding to the core foundation a set of courses in one area of specialization. The areas of specialization available are:

- Biomedical
- Computer
- Electrical
- Environmental
- Industrial
- Mechanical

The program educational objectives that have been established for the Bachelor of Science in Engineering program are as follows. Graduates are pre-

pared to be practicing engineers with the knowledge and skills needed to: (1) identify, formulate, and solve engineering problems through analysis and design, using the principles of science and mathematics and the modern tools of engineering; (2) work effectively in a variety of contexts, using superior communication skills, knowledge of contemporary issues with a commitment to professional ethics, and life-long learning; (3) pursue additional graduate or professional education; and (4) participate in their local and global communities through sustaining service and leadership.

The program outcomes that have been established for the Bachelor of Science in Engineering program are as follows. Students at the time of graduation will know and be able to: (1) apply mathematics and science principles to the solution of engineering problems, (2) apply appropriate breadth and depth of skills in identification of engineering problems, (3) apply appropriate breadth and depth of skills in engineering design and analysis of engineering problems, (4) design and conduct experiments and analyze data, (5) function on interdisciplinary teams, (6) communicate to both specialized and public audiences in a variety of modes, i.e., writing, presentation, etc., (7) relate the practice of engineering to global contemporary issues, to professional ethics, and to the need for lifelong learning, and (8) contribute to sustaining and improving community.

Mercer engineering seniors are required to exhibit their ability to conduct appropriate analysis and design a system, component, or process under a variety of realistic constraints. This engineering design project is a capstone requirement for all BSE seniors.

All senior engineering students are strongly encouraged to take the Fundamentals of Engineering (FE) exam during their senior year and demonstrate proficiency in both general and specialization areas of engineering. The FE exam is a nationally normed exam administered by the National Council of Engineering Examiners. Successful completion of this exam is the first step in attaining a license as a professional engineer. It is offered once during the fall and spring terms.

## **General Education Requirements**

Engineers in the 21st century work in a complex world shaped significantly by culture and globalization. The general education requirements broaden the student experience beyond science, technology, engineering and mathematics. Students are encouraged to investigate their diverse talents and interests as part of an ongoing process of life-long learning. Four general education options, each requiring a minimum of 15 hours, allow latitude for students to explore among a rich array of topics at Mercer University or to pursue an in-depth expertise. Note that courses completed to satisfy the general education requirements cannot be used to satisfy other degree requirements. In keeping with the university's Baptist heritage, the School of Engineering requires its students, through each general education option below, to complete at least one religion course.

Engineering graduates from Mercer are increasingly employed in an international environment. Some graduates work for foreign companies. Others are placed in companies that compete in international markets. Many engineers and corporate executives have emphasized the need for schools of engineering to prepare graduates to practice in a global environment. Engineering students are encouraged to take courses that promote social, cultural, and global awareness.

Also, Mercer sponsors a number of international study alternatives for stu-

dents, some of which have an engineering emphasis. Students are encouraged to take advantage of these travel and study opportunities to fulfill part of the general education requirements.

General education requirements may be satisfied by one of the following four options: Note that courses taken in any of these options may have prerequisites which must be satisfied.

### **Option 1, Minor. (minimum of 15 credit hours)**

Students must complete the requirements for any one of the following minors, which do not include science, technology, engineering and mathematics courses. If not fulfilled by minor requirements, students must also complete one 3-hour religion course selected from AFR 230, CHR (any course), GBK 203, PHI 331, SOC 340, or WGS 363.

Minors typically require 15-18 hours; see appropriate departmental sections in this catalog for details. Request a Minor Advisor from that department.

Accounting	Journalism
African American Studies	Latin
Anthropology	Media Studies
Art	Music
Business Administration	Philosophy
Christianity	Photography
Communications and Theatre Arts	Political Science
Criminal Justice	Psychology
Economics	Sociology
English	Spanish
French	Teacher Education
German	Theater
History	Women's and Gender Studies

### **Option 2, Distributional Education Program. (15 credit hours)**

Students must choose 3 hours from Group 1 and 3 hours from Group 2 for a total of 6 hours. The remaining 9 hours may be chosen from any of Groups 1-4. At least 3 hours must be 300-level or higher and build on a lower level experience.

#### **Group 1, Religion (minimum of 3 hours)**

AFR 230, CHR 101 or 150, GBK 203, PHI 331, SOC 340, or WGS 363

#### **Group 2, Global, Social, & Cultural Studies (minimum of 3 hours)**

Courses of the following disciplines: AFR, ANT, CRJ, CTA, ECN, EDUC, Foreign Languages, PSY, POL, PLS, SCP, SOC, WGS, or courses taken during an approved Study Abroad program

#### **Group 3, Humanities & Fine Arts**

Courses of the following disciplines: ART, CHR, CLA, CON, CTA, ENG, Foreign Languages above 111-112 (excluding FLL 467, 470), GBK, HIS, JRN, MUS, Applied Music, PHI, PHO, SST

#### **Group 4, Business**

Courses of the following disciplines: ACC, BUS, ECN, FIN, MGT, or MKT

### **Option 3, Thematic Program. (15 credit hours)**

Working with their faculty advisor, students may propose an individualized, focused general education program. At least three hours must be taken in religion (Group 1 of Option 2). At least 3 hours must be 300-level or higher and build on a lower level experience.

Students may choose from a rich assortment of study abroad, interdisciplinary, and specialized studies. Approval of the faculty advisor and the Dean of the School of Engineering is required for all programs in this option.

#### **Option 4, Great Books Program. (15 credit hours)**

Complete 15 hours from the Great Books Program to include GBK 203 to fulfill the religion course requirement.

#### **Integrated Bachelor of Science in Engineering (BSE) / Master of Science in Engineering (MSE)**

An integrated bachelor of science in engineering/master of science in engineering program which involves a minimum of 30 semester hours (a full fifth year) beyond the 129 semester hours required for the BSE degree is available as an option for students who qualify for admission to the graduate program. Please see the graduate section near the back of this catalog for more information about this program.

#### **Engineering Core**

The engineering core is a set of required courses taken by all BSE students. Most of the freshman and sophomore courses are dedicated to basic subject matter in writing, speaking, mathematics, lab sciences, and engineering fundamentals. Special emphasis is placed on cross-disciplinary work, with all BSE students required to complete courses grounding them in the basic tools and techniques of electrical, mechanical, and industrial engineering. Following this preparation, students dedicate their junior and senior years to development of specialized proficiency. Prior to graduation each student must exhibit an ability to accomplish engineering design by completing a project in which small groups design, build and test a realistic engineering system.

A typical array of courses taken by students enrolled in the BSE programs is shown below. More detailed information appears in the specialization presentations shown elsewhere in this catalog.

#### **Bachelor of Science in Engineering Basic Level Curriculum**

##### Freshman Year

<b>First Semester</b>			<b>Second Semester</b>		
UNV 101	Freshman Experience	1	EGR 107	Intro to Engr Design	3
EGR 108	Professional Practice <sup>1</sup>	3	EGR 126	Programming for Engineers <sup>1</sup>	3
MAT 191	Calculus I	4	MAT 192	Calculus II	4
CHM 111	General Chemistry	4	PHY 161	General Physics I <sup>3</sup>	3
XXX	Gen Ed I <sup>2</sup>	3	PHY 121L	General Physics I Lab <sup>3</sup>	1
			XXX	Gen Ed II	3
		15			17

<sup>1</sup> Approximately half of all engineering freshmen take EGR 108 in the fall semester, followed by EGR 126 in the spring. The other half of the freshman class takes EGR 126 in the fall semester followed by EGR 108 in the spring.

<sup>2</sup> XXX Gen Ed = General Education Requirement

<sup>3</sup> Biomedical and environmental students take CHM 112 this semester, and they begin their physics sequence in the fall semester of the sophomore year. For more detail see the course sequence for specific specializations.

## Sophomore Year

<b>First Semester</b>			<b>Second Semester</b>		
XXE 28Z	Intro to (Specialty) Engr <sup>4</sup>	1	EGR 236	Dynamics	3
EGR 232	Statics/Solid Mechanics	3	EGR 235	Thermodynamics <sup>6</sup>	3
EGR 244	Electrical Fundamentals	4	EGR 245	Electrical Fund. II	3
MAT 330	Intro to Differential Eqns	3	EGR 246L	Electrical Fund II Lab	1
PHY 162	General Physics II <sup>5</sup>	3	EGR 252	Prob. and Stats. for Engr.	3
PHY 162L	General Physics II Lab <sup>5</sup>	1		Technical course required by specialty	4
		15			17

<sup>4</sup> XXX 28Z includes BME 288 and ISE 288, both one-credit courses taken by students in the specializations of biomedical and industrial engineering. The environmental specialization includes this introduction as a three-credit course, while the computer, electrical and mechanical specialization includes a three-credit HU/SS/GA course. For more detail see the course sequence for specific specializations.

<sup>5</sup> Environmental students take Biological/Earth Science course work in place of PHY 162 and PHY 162L. For more details, see the course sequence for specific specializations.

<sup>6</sup> Biomedical and computer engineering students take EGR 235 in the junior year. For more detail see the course sequence for specific specializations

## Junior Year

<b>First Semester</b>			<b>Second Semester</b>		
EGR 312	Engineering Economy	3	EGR 386	Feedback Control	3
MAT 293	Multivariable Calculus <sup>7</sup>	3	TCO 341	Technical Communication	3
	Technical course(s) required by specialization	11	XXX	Gen Ed III	3
		17		Technical course(s) required by specialization	7
					16

<sup>7</sup>Multivariable calculus is taken by students enrolled in the biomedical traditional path, electrical and mechanical specializations

## Senior Year

<b>First Semester</b>			<b>Second Semester</b>		
EGR 487	Engr Design Exhibits I	2	EGR 488	Engr Design Exhibits II	2
XXX	Gen Ed IV	3	XXX	Gen Ed V	3
	Technical course(s) required by specialization	11		Technical course(s) required by specialization	11
		16			16

## **EGR Courses**

### **EGR 101. Freshman Engineering Honors (1-0-1)**

Prerequisites: Outstanding high school GPA and SAT score. Permission of the dean.

Co-requisites: EGR 126 and MAT 191.

To familiarize the students with robots and robotic programming as a foundation to discuss the general topic of autonomy. EGR 101 is the first of two courses sequence that introduces freshmen engineering honors students to advanced topics normally not covered in freshman courses. This course is graded S/U.

**EGR 102. Freshman Engineering Honors II (1-0-1)**

Prerequisites: EGR 101 or permission of the dean.

Students explore fundamental issues involved in the design of autonomous entities including the possibility mimicking human behavior. EGR 102 is the second of a two-course sequence that introduces freshmen engineering honors students to advanced topics normally not covered in freshman courses. This course is graded S/U.

**EGR 107. Introduction to Engineering Design (2-3-3)**

Prerequisite: Be a fully admitted student in the School of Engineering or have the written permission of the dean.

Systematic procedures for engineering design. Student teams pursue design projects that incorporate problem identification, information gathering, development of alternative solutions, merit analysis, decision presentation, implementation, testing, and redesign. Students practice skills in preparing and presenting a variety of engineering-related written and oral reports.

**EGR 108. Professional Practices (3-0-3)**

Prerequisite: Be a fully admitted student in the School of Engineering or have the written permission of the dean.

In a seminar format, small groups explore the history of engineering, engineering ethics, and the impact of engineering practice in the context of society. Critical reading and thinking skills are developed through extensive readings and discussions of relevant engineering, social science, and humanities topics. Students gain fluency in preparing and presenting the results of these discussions, both in written and oral format.

**EGR 126. Programming for Engineers (3-0-3)**

Prerequisite: Be a fully admitted student in the School of Engineering or have the written permission of the Dean.

Computer programming and the use of computers to solve engineering problems. Special attention is given to development of an organized thought process in which analysis, modeling, and construction of algorithms lead to structured procedures for solving non-trivial problems.

**EGR 190-290-390-490. Cooperative Education  
Work Experience (0-1-1)**

Prerequisites: Minimum GPA of 2.50; approval of Director of Cooperative Education and faculty advisor. Satisfy resident credit requirements. Four month work periods alternated with academic semesters.

**EGR 201. Sophomore Engineering Honors I (1-0-1)**

Prerequisite: EGR 102 or permission of the Dean.

Each student develops a personal project plan for the remainder of the engineering honors experience. This course is graded S/U.

**EGR 202. Sophomore Engineering Honors II (1-0-1)**

Prerequisite: EGR 201 or permission of the Dean.

Each student works with a faculty advisor in accordance with a personal project plan that was approved for the remainder of the engineering honors experience. This course is grade S/U.

**EGR 232. Statics/Solid Mechanics (3-0-3)**

Corequisites: MAT 192, PHY 161.

Equilibrium of concurrent force systems. Stress, strain, and axial deformation. Hooke's Law. Rigid-body equilibrium. Stresses and deformation in shafts and beams. Shear and bending moment diagrams. Column buckling.

**EGR 235. Thermodynamics (3-0-3)**

Prerequisites: PHY 161, MAT 192.

A first course in the fundamentals of thermodynamics. Properties of substances, open and closed systems, conservation of mass, conservation of energy and the second law of thermodynamics. Second law analysis of systems. Introduction to cycle analysis. Use of these principles in the analysis and solution of engineering problems.

**EGR 236. Dynamics (3-0-3)**

Prerequisites: EGR 232, MAT 192, PHY 161.

Planar kinematics of particles and rigid bodies. Planar kinetics of particles and rigid bodies: force and acceleration, work and energy, and impulse and momentum.

**EGR 244. Electrical Engineering Fundamentals I (3-2-4)**

Corequisite: MAT 330.

Basic electrical circuit analysis; DC and sinusoidal steady-state circuits, manual and computer analysis methods, capacitance and inductance.

**EGR 245. Electrical Engineering Fundamentals II (3-0-3)**

Prerequisite: EGR 244.

Corequisite: EGR 246L.

An introduction to electronic components: diodes, junction transistors, field effect transistors, operational amplifiers, and small signal amplifiers. Magnetic fields and circuits. Rotational and moving iron transducers, AC and DC motors and generators, transformers, single phase power and stepper motors.

**EGR 246L. Electrical Fundamentals Lab (0-3-1)**

Corequisite: EGR 245.

Basic methods and instrumentation for measurements of electrical circuits and operational amplifier and diode circuits. Planning of experimental processes and procedures; manual and direct computer collection of experimental data, and off-line and on-line data analysis. Reports of experimental investigation, including descriptions of study objectives, procedures and methods, analysis methods, results, and conclusions.

**EGR 252. Probability and Statistics for Engineers (3-0-3)**

Prerequisite: MAT 192.

Techniques and applications of probability and statistics. Variability and representation of data. Laws of probability, random variables and distributions. Confidence intervals and statistical hypothesis testing. Quality control and statistical inference. Design of experiments. Regression analysis. Use of spreadsheets and statistical software packages.

**EGR 301. Junior Engineering Honors I (1-0-1)**

Prerequisite: EGR 202 or permission of the Dean.

Each student works with a faculty advisor in accordance with a personal project plan that was approved for the remainder of the engineering honors experience. This course is graded S/U.

**EGR 302. Junior Engineering Honors II (1-0-1)**

Prerequisite: EGR 301 or permission of the Dean.

Each student works with a faculty advisor in accordance with a personal project that was approved for the remainder of the engineering honors experience. This course is graded S/U.

**EGR 312. Engineering Economy (3-0-3)**

Prerequisite: MAT 192.

Economics in engineering decision making, interest and present worth, depreciation, economic analysis of engineering alternatives. Project management, budgeting and cost estimation, and economic analysis. The use of software tools in economic analysis and project management.

**EGR 386. Feedback Control and Modeling for Engineers (3-0-3)**

Prerequisite: MAT 330.

Corequisites: EGR 236, EGR 245.

Solving linear time-invariant differential equations using Laplace transforms. Transient response for first and second order systems, including time constants, damping ratio, natural frequencies, overshoot and settling time. Relative and absolute stability. Analytical and empirical modeling of engineering systems. Control engineering topics including block diagrams, Routh Hurwitz, root locus and bode plots. Introduction to PID and lead/lag compensators and to design of feedback control systems with root locus, bode and or simulation.

**EGR 401. Senior Engineering Honors I (1-0-1)**

Prerequisite: EGR 302 or permission of the Dean.

Each student submits a draft version of his or her Engineering Honors Report. This course is graded S/U.

**EGR 402. Senior Engineering Honors II (1-0-1)**

Prerequisite: EGR 401 or permission of the Dean.

Each student revises the draft version of his or her engineering Honors Report in response to faculty reviews and submits the final version in completion of the requirements for the Engineering Honors Program. This course is graded S/U.

SPECIAL COURSES: EGR 191, 192, 193, 491, 492, 493, 498, 499 for variable credit. May be repeated for credit with approval of academic advisor and department chair.

**EGR 191-192-193. Special Topics (1-6 hours)**

**EGR 291-292-293. Special Topics (1-6 hours)**

**EGR 491-492-493. Special Topics (1-6 hours)**

**EGR 498. Professional Seminar (1-6 hours)**

**EGR 499. Independent Study (1-6 hours)**

## **Biomedical Engineering Specialization**

During the last quarter century the world has witnessed unprecedented progress in engineering and medical science resulting in dramatic lifestyle changes. Biomedical engineering is at the confluence of modern engineering and medicine. Biomedical engineers apply engineering methods to problems in medicine and the life sciences and have played a vital role in the rapid and unparalleled advances that have occurred in these fields.

Biomedical engineers contribute to improved health care and enrich the quality of our lives. A biomedical engineer may work as a member of a research team, along with other health professionals, to find solutions to diverse medical problems. Biomedical engineers design new therapeutic and diagnostic instruments that permit treatment and visualization of internal organs. Biomedical engineers develop new materials and devices to supplant or augment diseased or malfunctioning organs and systems. Biomedical engineers analyze human and prosthetic performance in clinical environments. Among the most visual examples of biomedical engineering developments are the computer assisted tomography (CAT) and ultrasonic imaging scanners, kidney dialysis units, and pacemakers, heart valves and vascular grafts.

Biomedical engineering graduates have secured challenging positions in a variety of related fields with responsibilities ranging from the practice of medicine and traditional engineering, to the design and manufacture of bioinstrumentation devices, to the administration health-care services and management of hospital components, to the computer monitoring and simulation of medically related systems.

In recognition of the complexity of the biomedical engineering field, many employers expect entry-level graduates to possess academic credentials beyond the Bachelor of Science in Engineering Degree. Because of this, and to increase one's flexibility, biomedical engineering students are strongly encouraged to excel academically so that graduate/professional school is an option.

### **Academic Requirements for BSE, Biomedical Engineering Specialization**

In addition to the retention, graduation, and academic requirements of Mercer University and the School of Engineering, students choosing to specialize in biomedical engineering must maintain a Mercer grade point average of at least 2.0 in required biomedical engineering courses and technical electives.

### **Departmental Honors for BSE, Biomedical Engineering Specialization**

Each year, the biomedical engineering faculty determines the graduating biomedical engineering student who has best distinguished himself or herself and recognizes this student as the Outstanding Graduate in Biomedical Engineering.

### **The Biomedical Engineering BSE Curriculum**

The goals of the biomedical engineering curriculum are to produce graduates who can effectively accomplish biomedical engineering design and analysis, who can effectively communicate orally and in writing, and who can successfully compete with other engineers in their first engineering position, and to provide a curriculum that exceeds minimum recognized standards for engineering education.

Owing to the technical complexities of, and team-oriented approach to, solving medical problems, biomedical engineering students study the basic sciences, mathematics, and engineering common among traditional engineering fields. Beyond this, they study the life sciences and how traditional engineering can be used to understand, analyze, and design physiological and medical systems. Specific components of the curriculum are outlined in the following section.

In recognition of the expectations of employers, all biomedical engineering students are required to select elective courses and curricular paths that allow

them to explore engineering or medical sciences in more detail. Among these options at the bachelor's level are the pre-medical or other science course requirements or a concentration of courses in at least one of the other engineering disciplines. Qualified students are strongly encouraged to pursue post baccalaureate education whether in a medical or other professional school, or in graduate school, all of which are available at Mercer.

Mercer's five-year Master of Science in Engineering (MSE) in Biomedical Engineering degree is available to the top academic students and also includes the emphasis of minoring in another engineering discipline. The emphasis of this degree is on the practice of engineering. Students accepted into the MSE program begin combined BSE and ME studies at the beginning of their senior year. The two degrees are awarded simultaneously upon graduation. The MSE degree may also be used as a stepping stone for advanced graduate education at other institutions.

Mercer's schools of engineering and medicine have established a cooperative admission program for highly motivated and talented students who are residents of Georgia. Students who apply, are accepted, and maintain enrollment in The **Dual Biomedical Engineering Medical School Admission Program (DBemSAP)** are accepted to the Mercer School of Medicine upon completion of their biomedical engineering graduation requirements. Application to the program is done at the beginning of the sophomore year and is initiated by contacting the Biomedical Engineering Chairperson. Admission to this program is highly selective and DBemSAP students must indicate their continued compliance with the mission of the Mercer School of Medicine and must maintain high academic achievements. More information may be obtained from the departmental office.

**Bachelor of Science in Engineering (BSE)  
Degree Requirements: Biomedical Engineering Specialization**

- 1. UNV 101 .....1 hour
- 2. Engineering Core .....61 hours
- 3. Additional Mathematics\* .....3 hours  
 MAT 293 Multivariable Calculus  
 \*Premedical Path Students may substitute CHM 222 Organic Chemistry II
- 4. General Education Requirements .....15 hours
- 5. Other Required Courses outside of BME .....16 hours  
 BIO 205. Introduction to Biology for Biomedical Engineers  
 BIO 325. Comparative Animal Physiology  
 CHM 112. General Chemistry II  
 CHM 221. Organic Chemistry I
- 6. Required Biomedical Engineering (BME) courses .....24 hours  
 BME 288. Introduction to Biomedical Engineering I  
 BME 402. Biomedical Instrumentation  
 BME 412. Biomechanics  
 BME 425. Basic Transport Phenomena  
 BME 445L. Senior Biomedical Engineering Lab 2  
 BME 440. Dynamics of Biological Fluids  
 BME 460. Biomedical Materials  
 BME 470. Biomedical Applications/Microprocessors

- BME 480. Introduction to Senior Design
- BME 487. Engineering Design Exhibit I
- BME 488. Engineering Design Exhibit II

7. Technical Electives . . . . .9 hours  
 Technical electives are advanced engineering, science, and math courses chosen with the approval of the student, faculty advisor, and specialization chair for the purpose of providing additional depth in areas of special interest to the student. Students pursuing the MSE degree must select technical electives consistent with minor requirements in another engineering discipline. Students are strongly encouraged to pursue post baccalaureate education.

Total Semester Hours Required (Traditional Path) . . . . .129 hours

**Biomedical Engineering-Traditional Path**

**Freshman Year**

<b>Fall Semester</b>				<b>Spring Semester</b>			
EGR 108	Professional Practices			EGR 108	Professional Practices		
<b>OR</b>		<b>3</b>	<b>0 3</b>	<b>OR</b>		<b>3</b>	<b>0 3</b>
EGR 126	Program for Engineers			EGR 126	Program for Engineers		
MAT 191	Calculus I	<b>4</b>	<b>0 4</b>	EGR 107	Intro to Engr Design	<b>2</b>	<b>3 3</b>
CHM 111	General Chemistry I	<b>3</b>	<b>3 4</b>	MAT 192	Calculus II	<b>4</b>	<b>0 4</b>
UNV 101	The Freshman Experience	<b>1</b>	<b>0 1</b>	CHM 112	General Chemistry II	<b>3</b>	<b>3 4</b>
XXX	Gen Ed I	<b>3</b>	<b>0 3</b>	XXX	Gen Ed II	<b>3</b>	<b>0 3</b>
		<hr/>	<hr/>			<hr/>	<hr/>
		<b>14</b>	<b>3 15</b>			<b>15</b>	<b>6 17</b>

**Sophomore Year**

<b>Fall Semester</b>				<b>Spring Semester</b>			
BME 288	Intro Biomedical Engr	<b>0</b>	<b>3 1</b>	EGR 236	Dynamics	<b>3</b>	<b>0 3</b>
EGR 232	Statics/Solid Mech	<b>3</b>	<b>0 3</b>	EGR 245	Electrical Fund II	<b>3</b>	<b>0 3</b>
EGR 244	Electrical Fund I	<b>3</b>	<b>2 4</b>	EGR 246L	Electrical Fund Lab	<b>0</b>	<b>3 1</b>
MAT 330	Intro to Diff Eqns	<b>3</b>	<b>0 3</b>	EGR 252	Prob & Stats for Engr	<b>3</b>	<b>0 3</b>
PHY 161	General Physics I	<b>3</b>	<b>0 3</b>	MAT 293	Multivar Calculus	<b>3</b>	<b>0 3</b>
PHY 121L	General Physics I Lab	<b>0</b>	<b>3 1</b>	PHY 162	General Physics II	<b>3</b>	<b>0 3</b>
		<hr/>	<hr/>	PHY 162L	General Physics I Lab	<b>0</b>	<b>3 1</b>
		<b>12</b>	<b>8 15</b>			<hr/>	<hr/>
						<b>15</b>	<b>6 17</b>

**Junior Year**

<b>Fall Semester</b>				<b>Spring Semester</b>			
CHM 221	Organic Chemistry I	<b>3</b>	<b>3 4</b>	BIO 205	Biology for BME's	<b>3</b>	<b>3 4</b>
EGR 235	Thermodynamics	<b>3</b>	<b>0 3</b>	BME 402	Bio Instrumentation	<b>2.5</b>	<b>1.5 3</b>
EGR 386	Feedback Control	<b>3</b>	<b>0 3</b>	BME 425	Basic Transport Pheno	<b>2.5</b>	<b>1.5 3</b>
TCO 341	Tech Communication	<b>3</b>	<b>0 3</b>	BME 480	Intro to Senior Design	<b>0</b>	<b>1 0</b>
XXX	Technical Elective	<b>3</b>	<b>0 3</b>	EGR 312	Engr Economics	<b>3</b>	<b>0 3</b>
		<hr/>	<hr/>	XXX	Gen Ed III	<b>3</b>	<b>0 3</b>
		<b>15</b>	<b>3 16</b>			<hr/>	<hr/>
						<b>14</b>	<b>7 16</b>

### Senior Year

#### **Fall Semester**

BIO 325	Comp Animal Phys.	3	3	4
BME 412	Biomechanics	3	0	3
BME 440	Dynamics of Bio Fluids	3	0	3
BME 445L	BME Sr. Capstone Lab	0	3	1
BME 470	Bio Appl of Microcont.	3	0	3
BME 487	Engr Dsgn Exhibit I	0	6	2
		<u>12</u>	<u>12</u>	<u>16</u>

#### **Spring Semester**

BME 460	Bio Materials	3	0	3
BME 488	Engr Dsgn Exhibit II	0	6	2
XXX	Gen Ed IV	3	0	3
XXX	Gen Ed V	3	0	3
XXX	Technical Elective	3	0	3
XXX	Technical Elective	3	0	3
		<u>15</u>	<u>6</u>	<u>17</u>

### Pre-Med Path

#### Freshman Year

#### **Fall Semester**

EGR 108	Professional Practices	3	0	3
<b>OR</b>				
EGR 126	Programming for Engr	4	0	4
MAT 191	Calculus I	3	3	4
CHM 111	General Chemistry I	3	0	3
XXX	Gen Ed I	1	0	1
UNV 101	The Freshman Experience			
		<u>14</u>	<u>3</u>	<u>15</u>

#### **Spring Semester**

EGR 108	Professional Practices	3	0	3
<b>OR</b>				
EGR 126	Programming for Engr	2	3	3
EGR 107	Intro to Engr Design	4	0	4
MAT 192	Calculus II	3	3	4
CHM 112	General Chemistry II	3	0	3
XXX	Gen Ed II			
		<u>15</u>	<u>6</u>	<u>17</u>

### Sophomore Year

#### **Fall Semester**

BME288	Intro Biomedical Engr	0	3	1
EGR 232	Statics/Solid Mech	3	0	3
EGR 244	Electrical Fund I	3	2	4
MAT 330	Intro to Diff Eqns	3	0	3
PHY 161	General Physics I	3	0	3
PHY 121L	General Physics I Lab	0	3	1
		<u>12</u>	<u>8</u>	<u>15</u>

#### **Spring Semester**

EGR 236	Dynamics	3	0	3
EGR 245	Electrical Fund II	3	0	3
EGR 246L	Electrical Fund Lab	0	3	1
EGR 252.	Prob & Stats for Engr	3	0	3
PHY 162	General Physics II	3	0	3
PHY 162L	General Physics I Lab	0	3	1
XXX	Gen Ed III	3	0	3
		<u>15</u>	<u>6</u>	<u>17</u>

### Junior Year

#### **Fall Semester**

BIO 210	Intro to Biology I	4	3	5
CHM 221	Organic Chemistry I	3	3	4
EGR 235	Thermodynamics	3	0	3
EGR 386	Feedback Control	3	0	3
TCO 341	Tech Communication	3	0	3
		<u>16</u>	<u>6</u>	<u>18</u>

#### **Spring Semester**

BIO 220	Intro to Biology II	4	3	5
BME 402	Bio Instrumentation	2.5	1.5	3
BME 425	Basic Transport Pheno	2.5	1.5	3
BME 480	Intro to Senior Design	0	1	0
CHM 222	Organic Chemistry II	3	3	4
EGR 312	Engr Economics	3	0	3
		<u>16</u>	<u>7</u>	<u>18</u>

### Senior Year

<b>Fall Semester</b>				<b>Spring Semester</b>					
BIO 325	Comp Animal Phys.	3	3	4	BME 460	Bio Materials	3	0	3
BME 412	Biomechanics	3	0	3	BME 488	Engr Design Exhibit II	0	6	2
BME 440	Dynamics of Bio Fluids	3	0	3	XXX	Gen Ed IV	3	0	3
BME 445L	BME Sr. Capstone Lab	0	3	1	XXX	Gen Ed V	3	0	3
BME 470	Bio Appl of Microcont.	3	0	3	XXX	Technical Elective	3	0	3
BME 487	Engr Design Exhibit I	0	6	2	XXX	Technical Elective	3	0	3
		12	12	16			15	6	17

### Fifth Year

See Master of Science in Engineering (MSE) Degree Programs  
in the Graduate section of this catalog.

## **BME Courses**

### **BME 288. Introduction to Biomedical Engineering (0-3-1)**

An introduction to LabVIEW programming language and to biomedical engineering.

### **BME 310. Numerical Methods for Biomedical Engineers (3-0-3)**

Prerequisites: EGR 252. and MAT 330.

The course objectives are to build concrete concepts/ideas and skills of numerical methods and to apply these to solve engineering and scientific problems for Biomedical Engineers. Topics include modeling, computers, error analysis, roots of equations, linear algebraic equations, optimization, curve fitting, numerical differentiation, ordinary differential equations, and partial differential equations. MATLAB is the main computer software to solve problems numerically. Independent course project is required.

### **BME 402. Biomedical Instrumentation (2.5-1.5-3)**

Prerequisite: EGR 245, and EGR 386.

Methods and instrumentation for measuring quantities of biological and medical significance, especially electrical signals from the body, but also including temperature, blood pressure, and body chemistry. Design of biomedical instruments. A laboratory experience is associated with this class and provides hands-on experience on instrument component design including amplifiers and filters.

### **BME 412. Biomechanics (3-0-3)**

Prerequisites: EGR 232, EGR 236.

Stress-strain characteristics of bone, muscle, and soft tissues. Analysis of human motion. Design of orthopedic appliances. Study of fracture and failure mechanisms. Evaluation of joint and muscle forces and moments. Time-dependent mechanical properties. Friction, lubrication and wear of diarthrodial joints.

### **BME 413. Advanced Biomechanics (3-0-3)**

Prerequisite: BME 412.

Current topics in biomechanics research including musculoskeletal mechanics, sports biomechanics, tissue engineering, 3-D segmental analysis, fracture fixation, implant design, and/or clinical biomechanics are examined. Students will be exposed to current issues in the field through discussions, presentations, and paper.

**BME 425. Basic Transport Phenomena (2.5-1.5-3)**

Prerequisites: EGR 330.

Fundamentals of the transport of energy, mass and momentum in human cells and tissues. Introduction to the chemical and physical properties of body fluids, cell and tissue structures, and solute transport in biological systems. Thermal transport via conduction, convection, radiation, and evaporation in the human body. Oxygen transport in the lungs and other biological tissue. Introduction to pharmacokinetic analysis and modeling. Applications and design of transport processes in extracorporeal devices. A laboratory experience is associated with this class providing hands-on experience with the concepts.

**BME 426. Diagnostic Imaging Systems (3-0-3)**

Prerequisites: EGR 244, EGR 245, MAT 330.

Applications of modern imaging methods to presentation of visual information obtained from a variety of sources including x-ray, fluoroscopy, computed tomography, fiber optics, nuclear medicine, ultrasonic and magnetic resonance imaging.

**BME 440. Dynamics of Biological Fluids (3-0-3)**

Prerequisites: BME 425.

Fluid statics. Cardiovascular system function. Rheology of blood. Mechanics of blood vessels. Navier-Stokes equations. Reynolds number and Womersley parameter. Flow of Newtonian and non-Newtonian fluids. Steady and pulsatile flows. Wave propagation. Design of cardiovascular systems.

**BME 445L. Senior Biomedical Engineering Laboratory (0-3-1)**

Prerequisites: BME 402, BME 425.

Laboratory investigation of biomedical instrumentation and signal analysis. Basic experiments in biofluid and thermal transport. Design and conduct of experiments using modern techniques, skills and tools.

**BME 450/550\*. Advanced BioFluids (3-0-3)**

Prerequisites: BME 440 or MAE 430 (or permission of instructor)

The course objectives continue to build on advanced theories and solution techniques related to biological fluid flow phenomena primarily concentrating on the flows in cardiovascular and respiratory systems. Topics covered include: hemodynamics in carotid artery bifurcations, coronary arteries, abdominal bifurcations, arterial anastomoses, and air-particle transport in the lung airways. Computational fluid dynamics modeling and simulation are the tools to solve the flow phenomena numerically. A group project report and presentation, in the form of a conference paper/presentation, are required.

**\*NOTE:** 5xx course are graduate courses available only to students enrolled in a graduate program. They have additional requirements beyond those specified for the corresponding 4xx courses.

**BME 460. Biomedical Materials (3-0-3)**

Prerequisites: BIO 205 or BIO 220, CHM 221, EGR 232.

Chemical and physical properties of metals, polymers, and ceramics for use in biomedical applications. Biological corrosion of materials, and response of living tissue to foreign substances. Criteria for evaluation of materials for prostheses and artificial organs. Design considerations for implantable prostheses materials.

**BME 470. Biomedical Applications of Microcontrollers (3-0-3)**

Prerequisite: EGR 245.

Interface of memory and other devices such as analog-to-digital converters and digital-to-analog converters to microcontroller chips. Selection and assembly-language programming of microcontrollers for interfacing to peripherals. Design of microcomputer systems for medical use. Includes laboratory exercises and design projects.

**BME 480. Introduction to Senior Design (0-1-0)**

Corequisites: BME 402, BME 425, EGR 312, and TCO 341.

Course will provide guidance for the selection of team members and topic for the senior design project to be completed in BME 487 and BME 488. To successfully complete the course, a student must belong to a team (3 to 4 persons) and briefly outline the project goals to be implemented in BME 487 and BME 488. A seminar series will be conducted to facilitate student introduction to potential industrial clients and projects. Seminar attendance is required to obtain a satisfactory course grade. This course is graded S/U.

**BME 487. Engineering Design Exhibit I (0-6-2)**

Prerequisites: EGR 312, TCO 341, BME 402, BME 425, and BME 480. Must have completed all required 100- and 200-level engineering, mathematics, and science courses.

Corequisites: BME 445L. Multi-disciplinary design projects with substantial BME content.

Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

**BME 488. Engineering Design Exhibit II (0-6-2)**

Prerequisite: BME 487.

Continuation of BME 487 multi-disciplinary design projects with substantial BME content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

SPECIAL COURSES: BME 491, 492, 493, 498, 499 for variable credit. May be repeated for credit with approval of academic advisor and department chair.

**BME 491-492-493. Special Topics (1-6 hours)**

**BME 498. Professional Seminar (1-6 hours)**

**BME 499. Independent Study (1-6 hours)**

## **Computer Engineering Specialization**

The central focus of the computer engineering specialization is the engineering design of systems which operate in real-time with computers embedded in the system as a component or controller. The embedded computer is often a single chip "microcontroller" or a custom designed small computer which consists of a small number of chips. A mix of electronics fundamentals, general engineering fundamentals, engineering design, and computer system principles form the computer engineering program. This is obviously a rapidly expanding field of which growth is fueled by the progress in semiconductor chip size and speed. The amount of memory available on a single chip has quadrupled each three years for over two decades. Processor and logic chips are not far behind in this growth pattern and this has led to astonishing increases in the power of computers, especially at the

low cost end of the spectrum. As a consequence, computers are found “embedded” in the design of everything from household appliances to automobiles. The growth in chip capacity also leads to the ability to put a lot of software on just one or two chips, enabling these embedded, low-cost computers to run more and more complex software. That drives computer engineering programs to include not only modern programmable chip based hardware design, but also modern software design methodology in anticipation of the implementation of more and more complex software on even cheaper systems. As the Internet expands, local communication capability between computers is also rising in importance.

### **Academic Requirements for BSE, Computer Engineering Specialization**

The computer engineering specialization builds upon the base provided by the engineering core and general studies. Beyond this base, the curriculum is composed of two parts; computer engineering required courses and technical electives. Approved technical elective courses enable students to deepen their background in computer engineering and to expand their knowledge in related fields. Successful completion of the curriculum leaves the student prepared to embark on a career in computer engineering or to pursue advanced education in graduate school. The attention of the student is directed to the retention, graduation and academic requirements of the University and the School of Engineering. Required computer engineering courses require a C or better in prerequisites which include: EGR 244, EGR 245, ECE 202, CSC 204, CSC 205, ECE 322 and ECE 323. Elective computer engineering courses also require a C or better in the applicable prerequisites. Students must also maintain a minimum cumulative grade point average of 2.0 in courses with the ECE and CSC prefix. Computer engineering students must complete the key foundation courses in the discipline before enrolling in senior design (ECE 485).

### **Departmental Honors for BSE, Computer Engineering Specialization**

Each year, the computer engineering faculty determines the graduating computer engineering student who has best distinguished himself or herself and recognizes this student as the Outstanding Graduate in Computer Engineering.

### **Bachelor of Science in Engineering (BSE) Degree Requirements: Computer Engineering Specialization**

1. UNV 101 .....1 hour
2. Engineering Core .....61 hours
3. Additional Mathematics .....4 hours  
MAT 225. Topics in Discrete Mathematics
4. General Education Requirements .....15 hours
5. Required ECE and CSC Courses .....45 hours  
ECE 202. Signals and Systems  
CSC 204. Programming I  
CSC 205. Programming II  
CSC 245. Data Structures and Algorithm Analysis  
CSC 480. Software Engineering  
ECE 322. Digital Logic and Computer Organization

- ECE 323. Microcomputer Fundamentals
- ECE 340. Electromagnetic Applications
- ECE 424. Digital Design with VHDL
- ECE 425. Introduction to Computer Architecture
- ECE 426. Embedded Computer Systems
- ECE 455. Computer Networks
- ECE xxx. Senior Design Elective
- ECE 481. Introduction to Senior Design for Computer Engrs.
- ECE 485. Computer Engineering Design Exhibit I
- ECE 486. Computer Engineering Design Exhibit II

6. Technical Electives . . . . .3 hours  
 Technical electives are chosen with the approval of the student's faculty advisor and specialization chair for the purpose of advancing the student's academic goals. Technical electives must be selected from list provided by the computer engineering faculty, and must provide depth and appropriate design content in computer engineering areas.

Total Semester Hours Required . . . . .129 hours

### Computer Engineering

#### Freshman Year

Fall Semester				Spring Semester			
CHM 111	General Chemistry	3	3 4	EGR 107	Intro to Engr Design	2	3 3
EGR 126	Programming for Engr	3	0 3	EGR 108	Professional Practices	3	0 3
MAT 191	Calculus I	4	0 4	MAT 192	Calculus II	4	0 4
UNIV 101	Freshman Experience	1	0 1	PHY 161	General Physics I	3	0 3
XXX	Gen Ed I	3	0 3	PHY 121L	General Phys I Lab	0	3 1
				XXX	Gen Ed II	3	0 3
		14	3 15			15	6 17

#### Sophomore Year

Fall Semester				Spring Semester			
EGR 232	Statics/Solid Mech	3	0 3	CSC 204	Prog I	3	3 4
EGR 244	Electrical Fund I	3	2 4	ECE 322	Digital Logic	2	0 2
MAT 330	Intro to Diff Eqns	3	0 3	EGR 236	Dynamics	3	0 3
PHY 162	General Physics II	3	0 3	EGR 245	Electrical Fund II	3	0 3
PHY 162L	General Phys II Lab	0	3 1	EGR 246L	Electrical Fund Lab	0	3 1
XXX	Gen Ed III	3	0 3	EGR 252	Prob & Stats for Engr	3	0 3
		15	5 17			14	6 16

#### Junior Year

Fall Semester				Spring Semester			
CSC 205	Programming II	3	3 4	CSC 245	Data Struct and Algo	3	0 3
ECE 202	Signals and Systems	3	0 3	ECE 424	Digital Design w/VHDL	3	0 3
ECE 323	Microcomputer Fund	2	3 3	ECE 426	Embedded Comp Sys	2	3 3
MAT 225	Topic in Discrete Math	4	0 4	ECE 481	Intro to Senior Design	0	1 0
EGR 386	Feedback Control	3	0 3	EGR 235	Thermodynamics	3	0 3
				TCO 341	Tech Communication	3	0 3
		15	6 17			14	4 15

### Senior Year (Standard BSE program)

<b>Fall Semester</b>				<b>Spring Semester</b>			
CSC 480	Software Engineering	3	0 3	ECE 455	Computer Networks	3	0 3
ECE 340	Electromagn Appl	3	0 3	ECE 486	Engr Design Exhibits II	0	6 2
ECE 485	Engr Design Exhibits I	0	6 2	ECE 4xx	ECE Tech Elective	3	0 3
EGR 312	Engineering Economy	3	0 3	ECE 4xx	Tech Elective	3	0 3
XXX	Gen Ed IV	3	0 3	ECE 425	Computer Architecture	4	0 4
XXX	Gen Ed V	3	0 3				
		15	6 17			13	6 15

### **Integrated Bachelor of Science in Engineering /Master of Science in Engineering in Computer Engineering**

Students who complete the first three years of the Bachelor of Science in Engineering with a specialization in Computer Engineering or in any engineering specialization with appropriate computer courses included and with grades which qualify them for graduate study may directly pursue the Master of Science in Engineering degree during their fourth and fifth years of study. A full calendar year, including one summer term, is needed to complete the Master of Science in Engineering in Computer Engineering or in Electrical Engineering degrees. See the graduate studies section near the back of this catalog for more information about the integrated master of science in engineering programs.

#### Senior Year (Integrated Bachelor of Science in Engineering/ Master of Science in Engineering students only)

<b>Fall Semester</b>				<b>Spring Semester</b>			
ECE 340	Electromagn Appl.	3	0 3	ECE 455	Computer Networks	3	0 3
ECE 485	Engr Design Exhibits I	0	6 2	ECE 486	Engr Design Exhibits II	0	6 2
SSE 556	Java Design I	3	0 3	ECE 4xx	ECE Technical Elective*	3	0 3
EGR 312	Engineering Economy	3	0 3	SSE 571	Java Design II	3	0 3
ECE 4xx	ECE Technical Elective*	3	0 3	ECE 425	Computer Architecture	4	0 4
XXX	HU/SS/GA III	3	0 3				
		15	6 17			13	6 15

#### Graduate Year (Integrated Bachelor of Science in Engineering/ Master of Science in Engineering students only)

<b>Fall Semester</b>				<b>Spring Semester</b>			
ECE 6xx	Grad ECE Course	3	0 3	ECE 6xx	Grad Course	3	0 3
SSE 6xx	Grad SSE Course	3	0 3	ECE 6xx	Grad Course	3	0 3
ECE 5/6xx	Grad Course	3	0 3	ECE 6xx	Grad Course	3	0 3
ECE 4xx	ECE Tech Elective	3	0 3	XXX	HU/SS/GA IV	3	0 3
		12	0 12			12	0 12

#### Summer Term (Integrated Bachelor of Science in Engineering/ Master of Science in Engineering students only)

ECE 6xx	Grad Course	3	0 3
ECE 6xx	Grad Course	3	0 3
		6	0 6

See graduate section of this catalog for more information about the Integrated Bachelor of Science in Engineering/Master of Science in Engineering Program.

## **Electrical Engineering Specialization**

The professional activities of electrical engineers directly affect the lives of most of the world's population every day. They are responsible for the design and application of digital computers, design and development of telephone networks and communication systems, radio and television transmitters and receivers, automatic control systems, electric power generation and distribution systems, and a wide variety of other electrical and electronic systems. Within the broad scope of these systems, the electrical engineer is concerned with a challenging and diverse array of design and development problems, and is in fact functioning as a prime mover in the "high tech" age.

Electrical engineers design minuscule semiconductor integrated circuits which contain many thousands of elementary devices. They design systems for automatically controlling mechanical devices and a variety of processes. They are responsible for the design of satellite communication links as well as biomedical instrumentation for patient monitoring systems for hospitals and medical research. The development of the microprocessor has expanded the opportunities for electrical engineers to improve the design of familiar products since these devices are now incorporated into automobiles, consumer and office products, entertainment systems, communication systems and a vast variety of test and measurement instruments and machine tools.

### **Academic Requirements for BSE, Electrical Engineering Specialization**

The electrical engineering specialization builds upon the base provided by the engineering core and general studies. Beyond this base, the curriculum is composed of two parts; electrical engineering required courses and technical electives. Approved technical elective courses enable students to deepen their background in electrical and computer engineering and to expand their knowledge in related fields. Successful completion of the curriculum leaves the student prepared to embark on a career in electrical engineering or to pursue advanced education in graduate school. The attention of the student is directed to the retention, graduation and academic requirements of the University and the School of Engineering. Required electrical engineering courses require a C or better in prerequisites which include: EGR 244, EGR 245, ECE 202, and ECE 311. Elective electrical engineering courses also required a C or better in the applicable prerequisites. Students must also maintain a minimum cumulative grade point average of 2.0 in courses with the ECE prefix. Electrical engineering students must complete the key foundation courses in the discipline before enrolling in senior design, ECE 487.

### **Departmental Honors for BSE, Electrical Engineering Specialization**

Each year, the electrical engineering faculty determines the graduating electrical engineering student who has best distinguished himself or herself and recognizes this student as the Outstanding Graduate in Electrical Engineering.

### **The Dixie Crow Educational Foundation Scholarship**

The Dixie Crow Educational Foundation Scholarship program provides financial awards for selected undergraduate students of the Mercer School of

Engineering, with a preference for those who are pursuing a degree in electrical engineering and are residents of the Middle Georgia area. These scholarships are renewed for three additional years provided the student meets the academic requirements required for renewal, enrolls full-time, and maintains continuous enrollment. The Dixie Crow Chapter of the National Old Crows Association is an electronic warfare engineering organization.

## The Electrical Engineering BSE Curriculum

The electrical engineering curriculum is designed to provide a foundation for a student to pursue a career in engineering with expertise in electrical engineering and possibly special expertise in one or more of its sub-fields. The program puts emphasis on learning to function within teams of professionals whose members are pursuing a common engineering goal, and on communicating effectively with both technical and non-technical audiences. Graduates of the bachelors degree program are competent engineers who are prepared to pursue a broad variety of professional avenues.

### Bachelor of Science in Engineering (BSE)

#### Degree Requirements: Electrical Engineering Specialization

1. UNV 101 .....1 hour
2. Engineering Core .....61 hours
3. Additional Mathematics .....3 hours  
MAT 293. Multivariable Calculus
4. General Education Requirements .....15 hours
5. Required ECE Courses .....46 hours  
ECE 202. Signals and Systems  
ECE 311. Electronics I  
ECE 312. Electronics II  
ECE 312L. Electronics II Laboratory  
ECE 322. Digital Logic and Computer Organization  
ECE 323. Microcomputer Fundamentals  
ECE 340. Electromagnetic Applications  
ECE 341. Electromagnetic Field Theory  
ECE 431. Analog and Digital Signal Processing  
ECE 451. Communications I  
ECE 451L. Communications Laboratory  
ECE 452. Digital Communications and Stochastic Processes  
ECE xxx. Senior Design Elective  
ECE xxx. Senior Design Elective  
ECE xxx. Senior Design Elective  
ECE xxx. Senior Design Elective  
ECE 480. Introduction to Senior Design  
ECE 487. Electrical Engineering Design Exhibit I  
ECE 488. Electrical Engineering Design Exhibit II
6. Technical Electives .....3 hours  
Electives are chosen with the approval of the student, faculty advisor, and specialization chair for the purpose of advancing the student's academic goals. The four ECE Senior Design Electives are selected from a list of

ECE courses provided by the electrical engineering faculty. The additional Technical Elective is selected from a list of engineering, mathematics, computer science, chemistry, and physics courses provided by the electrical engineering faculty.

Total Semester Hours Required . . . . .129 hours

### Electrical Engineering

#### Freshman Year

Fall Semester				Spring Semester			
CHM 111	General Chemistry	3	3 4	EGR 107	Intro to Engr Design	2	3 3
EGR 126	Programming for Engr	3	0 3	EGR 108	Professional Practices	3	0 3
MAT 191	Calculus I	4	0 4	MAT 192	Calculus II	4	0 4
UNV 101	Freshman Experience	1	0 1	PHY 161	General Physics I	3	0 3
XXX	Gen Ed I	3	0 3	PHY 121L	General Phys I Lab	0	3 1
				XXX	Gen Ed II	3	0 3
		14	3 15			15	6 17

#### Sophomore Year

Fall Semester				Spring Semester			
EGR 232	Statics/Solid Mech	3	0 3	ECE 202	Signals and Systems	3	0 3
EGR 244	Electrical Fund I	3	2 4	EGR 236	Dynamics	3	0 3
MAT 330	Intro to Diff Eqns	3	0 3	EGR 235	Thermodynamics	3	0 3
PHY 162	General Physics II	3	0 3	EGR 245	Electrical Fund II	3	0 3
PHY 162L	General Phys II Lab	0	3 1	EGR 246L	Electrical Fund Lab	0	3 1
XXX	Gen Ed III	3	0 3	EGR 252	Prob & Stats for Engr	3	0 3
		15	5 17			15	3 16

#### Junior Year

Fall Semester				Spring Semester			
ECE 311	Electronics I	3	0 3	ECE 312	Electronics II	2	0 2
ECE 322	Digital Logic	2	0 2	ECE 312L	Electronics II Lab	0	3 1
ECE 431	Analog/Digital Sig Proc	3	0 3	ECE 323	Microcomputer Fund	2	3 3
EGR 386	Feedback Control	3	0 3	ECE 341	Emag Field Theory	3	0 3
MAT 293	Multivariable Calculus	3	0 3	ECE 480	Intro to Senior Design	0	1 0
ECE 340	Electromagnetic Applic	3	0 3	EGR 312	Engineering Economy	3	0 3
				TCO 341	Tech Communication	3	0 3
		17	0 17			13	7 15

#### Senior Year (Standard BSE program)

Fall Semester				Spring Semester			
ECE 451	Communications I	3	0 3	ECE 488	Eng Design Exhib II	0	6 2
ECE 451L	Comm Lab	0	3 1	ECE 4xx	ECE Technical Elect*	3	0 3
ECE 487	Eng Design Exhibit I	0	6 2	ECE 4xx	ECE Technical Elect*	3	0 3
ECE 4xx	ECE Technical Elect*	3	0 3	ECE 452	Digital Comm & Stoc		
ECE 4xx	ECE Technical Elect*	3	0 3		Proc	3	0 3
XXX	Gen Ed IV	3	0 3	XXX	Technical Elective*	3	0 3
				XXX	Gen Ed V	3	0 3
		12	9 15			15	6 17

## **Integrated Bachelor of Science in Engineering/Master of Science in Engineering, Electrical Engineering Specialization**

Students who complete the first three years of the Bachelor of Science in Engineering with a specialization in Electrical Engineering with grades which qualify them for graduate study may directly pursue the Master of Science in Engineering degree during their fourth and fifth years of study. A full calendar year, including one summer term, is needed to complete the Master of Science in Engineering in Electrical Engineering or in Computer Engineering degrees. See the graduate studies section near the back of this catalog for more information about the integrated Master of Science in Engineering programs.

### **Senior Year (Integrated Bachelor of Science in Engineering/ Master of Science in Engineering students only)**

<b>Fall Semester</b>			<b>Spring Semester</b>		
ECE 451	Communications I	3 0 3	ECE 488	Eng Design Exhib II	0 6 2
ECE 451L	Comm Lab	0 3 1	ECE 452	Dig Comm & St Proc	3 0 3
ECE 487	Eng Design Exhibit I	0 6 2	ECE 4xx	ECE Technical Elect*	3 0 3
ECE 4xx	ECE Technical Elect*	3 0 3	ECE 4xx	ECE Technical Elect*	3 0 3
ECE 4xx	ECE Technical Elect*	3 0 3	ECE 5/6xxx	Grad Course	3 0 3
ECE 6xxx	Grad Course	3 0 3	XXX	Technical Elective*	3 0 3
		<u>12 9 15</u>			<u>15 6 17</u>

### **Graduate Year (Integrated Bachelor of Science in Engineering/ Master of Science in Engineering students only)**

<b>Fall Semester</b>			<b>Spring Semester</b>		
ECE 6xx	Grad Course	3 0 3	ECE 6xx	Grad Course	3 0 3
ECE 6xx	Grad Course	3 0 3	ECE 6xx	Grad Course	3 0 3
ECE 5/6xx	Grad Course	3 0 3	ECE 5/6xx	Grad Course	3 0 3
XXX	HU/SS/GA	3 0 3	XXX	HU/SS/GA	3 0 3
		<u>12 0 12</u>			<u>12 0 12</u>

### **Summer Term (Integrated Bachelor of Science in Engineering/ Master of Science in Engineering students only)**

6xx	Grad Course	3 0 3
6xx	Grad Course	3 0 3
		<u>6 0 6</u>

See graduate section of this catalog for more information about the Integrated Bachelor of Science in Engineering/Master of Science in Engineering Program.

## **ECE Courses**

### **ECE 202. Signals and Systems (3-0-3)**

Prerequisites: C or better in EGR 244, MAT 330.

Transform analysis of circuits and systems; frequency-domain analysis of circuits; frequency selective filters; Bode plots; two-port networks; active filters; Fourier Series and Fourier Transform; linear time-invariant systems; impulse response and convolution.

### **ECE 311. Electronics I (3-0-3)**

Prerequisites: C or better in ECE 202, C or better in EGR 245.

Introduction to the characterization of passive and active semiconductor devices

and applications in electrical circuits. Focus on diodes, junction and field effect transistors, integrated circuit operational amplifiers, and on their typical uses in amplifiers, ac/dc conversion, switching, and other linear and nonlinear systems. Features extensive use of simulation tools.

### **ECE 312. Electronics II (2-0-2)**

Prerequisite: C or better in ECE 311.

Corequisite: ECE 312L.

Continuation of the study of characteristics and applications of semiconductor devices electronic circuits. Extension to power devices, multi-component integrated circuits, optoelectronic devices, and to oscillators and filters at video and RF frequencies. Focus hands-on laboratory experiences and the circuit design process.

### **ECE 312L. Electronics II Laboratory (0-3-1)**

Corequisite: ECE 312.

Hands-on laboratory experiences with a focus on the circuit design process.

### **ECE 322. Digital Logic and Computer Organization (2-0-2)**

Prerequisite: C or better in EGR 244.

Engineering approaches to design and analysis of digital logic circuits. Number systems, Boolean algebra, logic gates, truth tables, Karnaugh maps, combinational circuits, sequential circuits, PLDs in digital design, computer organization and operation, microprocessors and microcontrollers.

### **ECE 323. Microcomputer Fundamentals (2-3-3)**

Prerequisite: C or better in ECE 322.

Corequisite: ECE 323L.

A study of the basic principles related to the design and interfacing of microcomputer systems. Designing microprocessor based CPU modules, EPROM, SRAM, and DRAM memory interfaces. Address decoding techniques, timing requirements, adding wait states for slow memory systems. Concepts related to parallel I/O, serial I/O, and Programmed I/O. Introduction to hardware interrupts and DMA. Embedded systems. Experiments and design projects related to digital logic circuits, microprocessors, programming, and interfacing are an important part of the course.

### **ECE 340. Electromagnetic Applications (3-0-3)**

Prerequisites: Phy 162, C or better in EGR 245.

Applications of electromagnetic field theory and principles to the design of modern electronic systems. Emphasis on applications in high-frequency analog and high-speed digital systems. Time-varying fields and Maxwell's equations, uniform plane waves, transmission lines, microwaves, and antennas.

### **ECE 341. Electromagnetic Field Theory (3-0-3)**

Prerequisite: PHY 162.

Corequisite: MAT 293.

An introduction to the theory of electromagnetic fields with emphasis on time-varying applications. Vector calculus, Maxwell's equations, uniform plane waves, transmission lines, microwaves, and antennas.

### **ECE 410/510\*. Analog Filter Design (3-0-3)**

Prerequisites: C or better in ECE 202, C or better in ECE 311.

Principles of analog active and passive filter design. Network functions. Time and frequency domain approximations.

**ECE 411/511\*. Power Electronics (3-0-3)**

Prerequisite: C or better in ECE 312.

Principles of diode rectifiers and controlled rectifiers, inverters, voltage regulators and large-signal discrete and integrated-circuit power amplifiers.

**ECE 424/524\*. Digital Design with VHDL (3-0-3)**

Prerequisite: C or better in ECE 323.

VHDL is introduced as a hardware design language for the design of large scale digital systems. Specific targets include FPGA, MACH, and other VLSI programmable chips.

**ECE 425/525\*. Introduction to Computer Architecture (3-0-3)**

Prerequisite: C or better in ECE 323.

Concepts of computer architecture including pipelining, cache memory, memory management, disk management systems, computer arithmetic, and instruction set architecture. Design of microprogrammed and hardware controllers.

**ECE 426/526\*. Embedded Computer Systems (2-3-3)**

Prerequisites: C or better in ECE 323, C or better in CSC 204 and C or better in CSC 205.

Design of computer systems as components of larger engineering systems. Emphasis in on real-time applications. Integration of high-level and low-level software components in a real-time environment.

**ECE 427/527. Introduction to Computer Architecture (4-0-4)**

Prerequisite: C or better in ECE 323.

Concepts of computer architecture including pipelining, cache memory, memory management, disk management systems, computer arithmetic, and instruction set architecture. Design of microprogrammed and hardware controllers.

**ECE 431/531\*. Analog and Digital Signal Processing (3-0-3)**

Prerequisite: C or better in ECE 202.

Fundamentals of signal processing in both analog and digital domains, emphasizing the relationships between the two. Review of Fourier analysis and Bode plot. Analog filter design techniques: Butterworth, Chebyshev, and elliptic; implementation of analog filters using active circuits. Sampling and mapping of analog frequency to digital frequency. Basic topics in digital signal processing: difference equations, impulse response, z transform, IIR and FIR digital filters, discrete-time Fourier Transform and DFT.

**ECE 432/532\*. Digital Signal Processing (3-0-3)**

Prerequisite: C or better in ECE 431.

Introduction to DSP, with emphasis on applications: z-transform, frequency-selective digital filters (Butterworth, Chebyshev, and elliptic), filter structures, transient and steady-state response of filters, DFT, FFT, windowing effects, frequency resolution. Use of Matlab and Simulink to implement and analyze digital filters.

**ECE 435/535\*. Introduction to Data Compression (3-0-3)**

Prerequisite: C or better in ECE 431 or consent of the instructor.

Mathematics and techniques for common methods of both lossless and lossy compression of digital data: compression of one-dimensional and two-dimensional signals; quantization; predictive coding; transform coding; sub-band coding.

**ECE 441/541\*. Fiber Optic Communications (3-0-3)**

Prerequisite: C or better in ECE 341.

Introduction to optics and optical systems as applied to modern engineering problems. Principles and applications of fiber optic communication systems. Optical communications channel design. Fiber optic sensing. Optic fiber waveguides. Traveling-wave amplification and optical resonators (Lasers).

**ECE 442/542\*. Electromagnetic Compatibility (4-0-4)**

Prerequisite: C or better in ECE 340.

Design of electronic systems to prevent interference and to satisfy governmental regulations on radiated and conducted emissions. Interference scenarios, EMC requirements on electronic systems, non-ideal behavior of components, signal spectra, radiated emissions, conducted emissions, crosstalk, shielding.

**ECE 443/543\*. Antenna Theory (3-0-3)**

Prerequisite: C or better in ECE 340.

Introduction to the theory and applications of antennas. Antenna fundamentals, patterns, directivity, gain, impedance, polarization. Electrically small dipoles and loops, arrays, line sources, resonant antennas, and broadband antennas.

**ECE 445/545\*. Transmission Lines (3-0-3)**

Prerequisite: C or better in ECE 340.

Advanced study of transmission line theory in the design of high-frequency analog and high-speed digital system. Emphasis on electrically-long lines. Signal integrity in high-speed digital interconnects, crosstalk in multi-conductor transmission lines. Extensive use of computer simulation tools.

**ECE 451/551\*. Communication Systems I (3-0-3)**

Prerequisites: C or better in ECE 202, EGR 252.

Corequisite: ECE 451L.

Review of Fourier analysis, linear channels, and linear distortion, linear modulation schemes, DSBTC, DSBSC, SSB, VSB, frequency and phase modulation, radio broadcasting, discrete probability, random variables, probability distribution functions, expected values and correlation.

**ECE 451L. Communications Lab (0-3-1)**

Corequisite: ECE 451.

Software and hardware tools for communication/telecommunication systems experimentation and design, RF system design for communications, simulation of complex communication links.

**ECE 452/552\*. Communication Systems II (3-0-3)**

Prerequisite: C or better in ECE 451.

Stochastic processes, stationary and ergodic processes, autocorrelation function and power spectral density, linear channels and random input, white noise and AWGN channels, sampling theorem and pulse code modulation, Nyquist criteria, binary modulation schemes and their performance in AWGN channels, coherent and noncoherent detection.

**ECE 455/555\*. Computer Networks (3-0-3)**

Prerequisite: C or better in ECE 323.

Protocols and structures for computer networks. Circuit and Packet switch networks. Basic network performance issues.

**ECE 461/561\*. Feedback Control Systems: Digital Control (3-0-3)**

Prerequisite: C or better in EGR 386.

Control system analysis and design with emphasis on digital controllers and additional topics include multi-input/multi-output systems and non-linear controllers.

**ECE 471/571\*. Power Systems Fundamentals (3-0-3)**

Prerequisites: C or better in ECE 202, C or better in EGR 245.

Basic power system analytical concepts, three-phase systems, phasors, impedances, steady-state network analysis, normalization, transmission lines, transformers, synchronous machines, power flow.

**ECE 480. Introduction to Senior Design for Electrical Engineers (0-1-0)**

Corequisites: TCO 341, ECE 311, ECE 323, and EGR 386.

Course will provide guidance for the selection of team members and topic for the senior design project to be completed in ECE 487 and ECE 488. To successfully complete the course, a student must belong to a team (3 to 4 persons) and briefly outline the project goals to be implemented in ECE 487 and ECE 488. A seminar series will be conducted to facilitate student introduction to potential industrial clients and projects. Seminar attendance is required to obtain a satisfactory course grade. This course is graded S/U.

**ECE 481. Introduction to Senior Design for Computer Engineers (0-1-0)**

Corequisites: TCO 341, ECE 323, EGR 202, EGR 386, and CSC 205.

Course will provide guidance for the selection of team members and topic for the senior design project to be completed in ECE 485 and ECE 486. To successfully complete the course, a student must belong to a team (3 to 4 persons) and briefly outline the project goals to be implemented in ECE 485 and ECE 486. A seminar series will be conducted to facilitate student introduction to potential industrial clients and projects. Seminar attendance is required to obtain a satisfactory course grade. This course is graded S/U.

**ECE 485. Computer Engineering Design Exhibit I (0-6-2)**

Prerequisites: TCO 341, ECE 202, ECE 323, ECE 481, EGR 386, and CSC 205. Must have completed all required 100- and 200-level engineering, mathematics, and science courses.

Multi-disciplinary design projects with substantial Computer Engineering content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

**ECE 486. Computer Engineering Design Exhibit II (0-6-2)**

Prerequisite: ECE 485.

Continuation of ECE 485 multi-disciplinary design projects with substantial Computer Engineering content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

**ECE 487. Electrical Engineering Design Exhibit I (0-6-2)**

Prerequisites: TCO 341, ECE 311, ECE 323, ECE 480, and EGR 386. Must have completed all required 100- and 200-level engineering, mathematics, and science courses.

Multi-disciplinary design projects with substantial ECE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

## **ECE 488. Electrical Engineering Design Exhibit II (0-6-2)**

Prerequisite: ECE 487.

Continuation of ECE 487 multi-disciplinary design projects with substantial ECE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

SPECIAL COURSES: ECE 491, 492, 493, 498, 499 for variable credit. May be repeated for credit with approval of academic advisor and department chair.

**ECE 491-492-493. Special Topics (1-6 hours)**

**ECE 498. Professional Seminar (1-6 hours)**

**ECE 499. Independent Study (1-6 hours)**

*\*NOTE: 5xx courses are graduate courses available only to students enrolled in a graduate program. They have additional requirements beyond those specified for the corresponding 4xx courses.*

## **Environmental Engineering Specialization**

Environmental consciousness and safety have surfaced as primary initiatives during the last quarter century. The negative effects of modern society on the earth's natural environment are the result of numerous man-made environmental calamities. The prevention of future environmental accidents, reduction of pollutants into the environment, and clean up of priority containment sites have come to be recognized initiatives in virtually all nations.

Environmental engineers translate physical, chemical, biological, and engineering sciences into processes and systems for the protection of the public's health and safety. Environmental engineers are charged with implementing and designing systems that meet environmental standards and control pollution in water, air, and on land. Environmental engineers consult with regional authorities in the site selection, design, construction, and management of secure landfills; potable water treatment facilities, and wastewater reclamation plants. Environmental engineers assess the danger of groundwater contamination and devise plans to minimize ecological risk. Environmental engineers study atmospheric conditions and the effects of air pollutants on the surrounding community. Environmental engineers recommend process improvements to reduce the amount of spent/utilized industrial waste.

Employment opportunities for environmental engineering graduates are diverse. Major employers include consulting engineering firms, industrial facilities, local, state and federal governments, as well as regulatory agencies.

## **Academic Requirements for BSE, Environmental Engineering Specialization**

In addition to the retention, graduation, and academic requirements of Mercer University and the School of Engineering, all environmental engineering students must obtain a grade of C or better in EVE 290, EVE 384, and EVE 405. Also, environmental engineering students must maintain a Mercer grade point average of at least 2.0 in each of the following four course categories that applies toward the Bachelor of Science in Engineering degree: 1) required science and math courses; 2) required humanities, social science and global awareness courses; 3) engi-

neering core courses and; 4) environmental engineering courses and technical electives.

## **Departmental Honors for BSE, Environmental Engineering Specialization**

Each year, the environmental engineering faculty determines the graduating environmental engineering student who has best distinguished himself or herself, and designates this student as the Dr. Robert Rozett Outstanding Graduate in Environmental Engineering.

## **The Environmental Engineering BSE Curriculum**

The goal of the BSE program in environmental engineering is to produce graduates who are prepared for employment in professional practice or for graduate study. The natural environment in itself represents a complex and interactive biological, chemical, and physical system. Moreover, engineering strategies that operate in concert with environmental systems rely on application of fundamental engineering expertise coupled with specific environmental engineering practice. Environmental engineering students study in the basic sciences, mathematics, and traditional engineering so they can apply engineering analysis and design to environmental systems. Beyond this they study well-established environmental engineering topics including water and wastewater treatment, air pollution control, solid waste systems, public health, atmospheric chemistry, and bioremediation. Hands-on environmental engineering is accomplished through laboratory exercises and experiences. Opportunities for environmental engineering students to deepen and broaden their technical education exist through several avenues.

## **Bachelor of Science in Engineering (BSE) Degree Requirements: Environmental Engineering Specialization**

1. UNV 101 .....1 hour
2. Engineering Core .....57 hours
3. General Education Requirements .....15 hours
4. Other Required Courses outside of EVE .....14 hours  
CHM 112. General Chemistry II  
MAE 205. Visualization and Graphics

### **(One of the following three biological science courses is required)**

- BIO 205. Introduction for Biomedical Engineers
- BIO 210. Introduction to Biology I
- BIO 211. Introduction to Biology

### **(One of the following four earth science courses is required)**

- EES 110. Meteorology
- EES 210. Environmental Geology
- EES 220. Oceanography
- EES 330. Geographic Information Systems

5. Required Environmental Engineering (EVE) courses .....39 hours  
EVE 290. Intro to Environmental Engineering  
EVE 290L. Intro to Environmental Engineering Laboratory  
EVE 384. Engineering Hydraulics  
EVE 385. Engineering Hydrology

- EVE 402. Air Pollution Generation and Control
- EVE 403. Atmospheric Chemistry I
- EVE 405. Design and Analysis of Wastewater Systems
- EVE 406. Design and Analysis of Water Systems
- EVE 420. Solid Waste Management
- EVE 430. Bioremediation
- EVE 445L. Senior Environmental Engineering Laboratory
- EVE 480. Introduction to Senior Design
- EVE 486. Public Health
- EVE 487. Engineering Design Exhibit I
- EVE 488. Engineering Design Exhibit II
- EVE 490. Groundwater Hydrology

6. Technical Electives . . . . .3 hours  
 Technical electives are 300/400 level advanced engineering, science and math courses chosen with the approval of the student, faculty advisor, and specialization program director for the purpose of providing additional depth in areas of special interest to the student.

Total Semester Hours Required . . . . .129 hours

### **Environmental Engineering**

#### **Freshman Year**

<b>Fall Semester</b>				<b>Spring Semester</b>					
CHM 111	General Chemistry I	3	3	4	EGR 107	Intro to Engr Design	2	3	3
EGR 126	Programming for Engr	3	0	3	EGR 108	Professional Practices	3	0	3
XXX	Gen Ed I	3	0	3	MAT 192	Calculus II	4	0	4
MAT 191	Calculus I	4	0	4	CHM 112	General Chemistry II	3	3	4
UNV 101	Freshman Experience	1	0	1	XXX	Gen Ed II	3	0	3
		14	3	15			15	6	17

#### **Sophomore Year**

<b>Fall Semester</b>				<b>Spring Semester</b>					
EGR 232	Statics/Solid Mech	3	0	3	EGR 236	Dynamics	3	0	3
EGR 244	Electrical Fund I	3	2	4	EGR 235	Thermodynamics	3	0	3
EVE 290	Intro to EVE	3	0	3	EGR 245	Electrical Fund II	3	0	3
MAT 330	Intro to Diff Eqns	3	0	3	EGR 246L	Electrical Fund Lab	0	3	1
PHY 161	General Physics I	3	0	3	EGR 252	Prob & Stats for Engr	3	0	3
PHY 121L	General Phys I Lab	0	3	1	EVE 290L	Intro to EVE Lab	0	3	1
		15	5	17	XXX	Gen Ed III	3	0	3
							15	6	17

#### **Junior Year**

<b>Fall Semester</b>				<b>Spring Semester</b>					
EGR 312	Engineering Economy	3	0	3	EGR 386	Feedback Control	3	0	3
EVE 384	Engineering Hydraulics	3	0	3	EVE 385	Engineering Hydrology	3	0	3
TCO 341	Tech Communication	3	0	3	EVE 405	Des/Anal/WW Sys	3	0	3
XXX	Biological/Earth Science	3	3	4	EVE 420	Solid Waste Mgt	3	0	3
XXX	Gen Ed IV	3	0	3	EVE 480	Intro to Senior Design	0	1	0
MAE 205	Visual and Graphics	0	6	2	XXX	Biological/Earth Science	3	3	4
		15	9	18			15	4	16

## Senior Year

<b>Fall Semester</b>				<b>Spring Semester</b>			
EVE 402	Air Pollution Control	3	0 3	EVE 403	Atmospheric Chemistry I	3	0 3
EVE 406	Des/Anal/Water Sys	3	0 3	EVE 430	Bioremediation	3	0 3
EVE 486	Public Health	3	0 3	EVE 488	Eng Design Exhib II	0	6 2
EVE 487	Eng Design Exhibit I	0	6 2	EVE 4xx	Technical Elective I	3	0 3
EVE 490	Groundwater Hydrology	3	0 3	XXX	Gen Ed V	3	0 3
EVE 445L	Environmental Lab	0	3 1				
		12	9 15			12	6 14

## **EVE Courses**

### **EVE 290. Introduction to Environmental Engineering (3-0-3)**

Prerequisites: CHM 111 and MAT 191.

An overview of the major topics in environmental engineering, including water quality and treatment, solid and hazardous waste management, and air pollution; mass and energy balance principles; pollutant fate and transport characteristics; ethical implications of global business practices.

### **EVE 290L Introduction to Environmental Engineering Laboratory (0-3-1)**

Prerequisites: CHM.

An introduction to environmental engineering analyses with emphasis on traditional water and wastewater analyses. Parameters to be measured include: pH; alkalinity; hardness; total solids; suspended solids; dissolved solids; chemical oxygen demand; biochemical oxygen demand; dissolved oxygen, making standard solutions; and microbiological techniques.

### **EVE 384. Engineering Hydraulics (3-0-3)**

Prerequisite: EVE 290 or consent of instructor.

Introduction to hydrostatics, fluid motion, continuity, momentum, and energy applications. Applications to pipe networks and hydraulic systems. Modeling of water distribution systems.

### **EVE 385. Engineering Hydrology (3-0-3)**

Prerequisite: EVE 290 or consent of instructor.

Precipitation, evaporation, consumptive use, infiltration, flood routing; statistical analysis of hydrological data; introduction to urban drainage design; and modeling of hydrologic systems.

### **EVE 402. Air Pollution Generation and Control (3-0-3)**

Prerequisite: EVE 290.

Fundamental concepts including the origin and fate of air pollutants. Basic concepts of atmospheric chemistry and meteorology, atmospheric dispersion phenomena, governmental regulations, emission and air-quality standards. Design of processes and equipment for control of gaseous and particulate emissions. Current issues.

### **EVE 403. Atmospheric Chemistry I (3-0-3)**

Prerequisite: EVE 402.

An introduction to atmospheric chemical transformations; atomic structure and chemical bonding; thermodynamics, gas-phase kinetics, and photochemistry; tropospheric processes; stratospheric processes.

**EVE 405. Design and Analysis of Wastewater Systems (3-0-3)**

Prerequisites: EVE 290 and EVE 384.

Analysis and design of wastewater treatment systems beginning with an overview of the sources of water pollution and discussion of wastewater characteristics. Fundamental theory and design of conventional wastewater treatment facilities is presented followed by the principles used to design advanced wastewater treatment facilities. A design project is required along with a plant trip.

**EVE 406. Design and Analysis of Water Systems (3-0-3)**

Prerequisites: EVE 290 and EVE 384.

Analysis and design of water treatment systems beginning with an overview of the sources of water and discussion of water quality parameters. Fundamental theory and design of conventional water treatment facilities is presented followed by the principles used to design advanced water treatment facilities. A design project is required along with a plant trip.

**EVE 410. Process Chemistry (3-0-3)**

Prerequisites: EVE 290 or consent of instructor.

A study of aqueous processes occurring in natural waters and in water and wastewater treatment systems. Topics covered include chemical thermodynamics and equilibrium, kinetics, acid-base chemistry, the carbonate system, precipitation and dissolution, complexation, and redox chemistry. Complimentary laboratory experiences will be conducted.

**EVE 420. Solid Waste Management (3-0-3)**

Prerequisite: CHM 112 and EVE 290.

Chemical, mechanical and biological equipment and instrumentation for the collection, processing and disposal of solid wastes are studied and designed. Federal, state, and local regulations regarding generation and disposal of wastes are covered. Handling and recycling of municipal wastes is emphasized.

**EVE 421. Advanced Solid and Hazardous Waste Management (3-0-3)**

Prerequisite: EVE 420.

Advanced management concepts for solid and hazardous wastes including thermal, chemical, biological treatment, waste-to-energy, and resource recovery systems.

**EVE 430. Bioremediation (3-0-3)**

Prerequisite: EVE 405.

Introduction to the underlying microbial physiological/biochemical capabilities responsible for contaminant transformation, mathematical descriptions of biological processes, applications and limitations of microbial reactors, applications and limitations of in-situ bioremediation techniques currently used in field-scale remediation, and current and future directions of bioremediation research and field applications.

**EVE 445L. Senior Environmental Engineering Laboratory (0-3-1)**

Prerequisites: Senior standing; EVE 290L; EVE 405 and EVE 420.

Corequisite: EVE 402.

Laboratory investigation of unit operations and processes in environmental engineering: coagulation, flocculation, settling; biological treatment of wastewater; oxygen transfer kinetics; nitrogen analyses; beer's law; and off-gases analyses. Design, conduct, and analyze experiments using modern techniques, skills, and tools.

### **EVE 460. Environmental Law, Regulations and Contracts (3-0-3)**

Prerequisite: Senior standing or consent of instructor.

An introduction to the American legal system and the public policy process. A discussion of relevant laws and regulations pertaining to environmental ordinances. Definition of environmental pollutants and relevant state and Federal acts under which they are regulated. A study of the policy making and implementation governmental units that deal with environmental issues. Technical and historical foundations of environmental policies and law. Guest lectures from law offices, industry and government. Engineering contracts, procurement and bidding and resident inspection discussed.

### **EVE 480. Introduction to Senior Design (0-1-0)**

Corequisites: TCO 341, EVE 405, and EVE 420.

Course will provide guidance for the selection of team members and topic for the senior design project to be completed in EVE 487 and EVE 488. To successfully complete the course, a student must belong to a team (3 to 4 persons) and briefly outline the project goals to be implemented in EVE 487 and EVE 488. A seminar series will be conducted to facilitate student introduction to potential industrial clients and projects. Seminar attendance is required to obtain a satisfactory course grade. This course is graded S/U.

### **EVE 486. Public Health (3-0-3)**

Prerequisites: Senior standing, EGR 252, EVE 405, and EVE 420.

Corequisite: EVE 402.

Public health engineering principles for protection against biological and chemical hazards. Introduction to toxicology and epidemiology. Basic risk assessment concepts as applied to water, airbourne, and toxic pollutants. Emphasis on major communicable diseases that plague mankind, organisms that cause them, routes of transmission, and engineering control methods. Appropriate control methods, for rural areas and developing countries.

### **EVE 487. Engineering Design Exhibit I (0-6-2)**

Prerequisites: TCO 341, EVE 405, EVE 420, and EVE 480. Must have completed all required 100- and 200-level engineering, mathematics, and science courses. Multi-disciplinary design projects with substantial EVE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral projects.

### **EVE 488. Engineering Design Exhibit II (0-6-2)**

Prerequisite: EVE 487.

Continuation of EVE 487 multi-disciplinary design projects with substantial EVE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

### **EVE 490. Groundwater Hydrology (3-0-3)**

Prerequisite: EVE 385.

Fundamental theories and properties of porous media, groundwater movement, geological factors are presented. This course emphasizes development of fundamental governing equations and the determination of aquifer formation constants. The design of production and monitoring wells and the development of aquifer testing plans are introduced.

SPECIAL COURSES: EVE 491, 492, 493, 498, 499 for variable credit. May be repeated for credit with approval of academic advisor and program director.

**EVE 491-492-493. Special Topics** (1-6 hours)

**EVE 498. Professional Seminar** (1-6 hours)

**EVE 499. Independent Study** (1-6 hours)

## **Industrial Engineering Specialization**

Industrial engineering is concerned with the design, improvement, and installation of integrated systems of people, material, information, equipment, and energy. The discipline draws upon specialized knowledge and skills in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems.

To a large extent the industrial engineer is a “people” engineer, joining the worker together with the “things” that are designed by engineers from other disciplines such as mechanical and electrical engineering. As a consequence of the need for people skills the Mercer program places a heavy emphasis on working as a team and working on real industrial engineering problems from the neighboring communities. The development of the skill in working with and through other people results in many industrial engineers rising to the top of technical companies through the ranks of management.

The industrial engineering specialization at Mercer draws upon four foundational areas—management science, the application of mathematical techniques to solve management problems; ergonomics, the study and design of the interaction between humans and machines; manufacturing, the design and development of processes and systems to transform inputs to products; and quality, the application of statistical methods and managerial principles to improve the quality of products and services. This broad base provides industrial engineering specialization students at Mercer with a solid and varied background as they pursue a career in the wide-ranging field of industrial engineering.

### **Academic Requirement for BSE, Industrial Engineering Specialization**

In addition to the retention, graduation, and academic requirements of the University and the School of Engineering, the student specializing in industrial engineering must achieve a grade of C, or better, in EGR 252. A student may not enroll or remain enrolled in a course for which EGR 252 is a pre-requisite without satisfying this requirement. Students must also maintain a grade point average of at least 2.0 in all courses carrying an ISE prefix. Students must complete all required 100 and 200 level engineering, mathematics, and science courses prior to enrolling in ISE 487.

### **Departmental Honors for BSE, Industrial Engineering Specialization**

Each year, the industrial engineering faculty determines the graduating industrial engineering student who has best distinguished himself or herself and recognizes this student as the Outstanding Graduate in Industrial Engineering.

## The Industrial Engineering BSE Curriculum

The industrial engineering undergraduate program prepares graduates to use techniques such as application of probability and statistics, modeling and simulation, and optimization methods to analyze engineering problems. Industrial engineering design places special emphasis on factors such as ergonomics, safety, and engineering economics.

### Bachelor of Science in Engineering (BSE)

#### Degree Requirements: Industrial Engineering Specialization

1. UNV 101 .....1 hour
2. Engineering Core .....61 hours
3. General Education Requirements .....15 hours  
(ISE Students are strongly encouraged to include ECN 150 or ECN 151 as part of their General Education Requirements.)
4. Required ISE Courses .....46 hours
  - ISE 288. Intro. to Industrial Engineering and Mfg. Engineering
  - ISE 302. Management Science/Operations Research
  - ISE 311. Ergonomics and Work Measurement
  - ISE 327. Statistical Process and Quality Control
  - ISE 352. Design of Experiments
  - ISE 362. Production Planning and Control
  - ISE 370. Manufacturing Processes
  - ISE 403. Modeling and Simulation
  - ISE 412. Introduction to Human Factors Engineering
  - ISE 424. Computer Assisted Manufacturing Systems (CAMS)
  - ISE 424L. Computer-Assisted Manufacturing Systems Lab
  - ISE 460. Facilities Planning and Design
  - ISE 480. Introduction to Senior Design
  - ISE 482. Industrial Engineering Capstone Design
  - ISE 487. Engineering Design Exhibit I
  - ISE 488. Engineering Design Exhibit II
  - ACC 204. Introductory Financial Accounting
  - MAE 205 Visualization and Graphics
  - MAE 305L. Manufacturing Practices
5. Technical Electives .....6 hours  
An industrial engineering student must take, as an elective, at least one course with an ISE prefix that is not one of the required ISE courses listed above. Acceptable electives may include the following: ISE 427 (Reliability and Quality Assurance), ISE 428 (Quality Engineering), ISE 429 (Robotics), or ISE 491-493 (Special Topics).

In addition, an industrial engineering student must take one additional professional elective. The student should carefully plan this elective in consultation with his or her advisor. Typically, courses from the Department of Psychology, the Department of Computer Science, the Stetson School of Business and Economics, or the School of Engineering are acceptable professional electives. The student's faculty advisor will provide specific guidance in the selection of a professional elective.

Total Semester Hours Required .....129 hours

## Industrial Engineering

### Freshman Year

#### Fall Semester

EGR 108	Professional Practices	3	0	3
<i>Or</i>				
EGR 126	Programming for Engr	4	0	4
MAT 191	Calculus I	3	3	4
CHM 111	General Chemistry I	1	0	1
UNV 101	Freshman Experience	3	0	3
XXX	Gen Ed I			
		14	3	15

#### Spring Semester

EGR 108	Professional Practices	3	0	3
<i>Or</i>				
EGR 126	Programming for Engr	2	3	3
EGR 107	Intro to Engr Design	4	0	4
MAT 192	Calculus II	3	0	3
PHY 161	General Physics I	0	3	1
PHY 121L	General Physics I Lab	3	0	3
XXX	Gen Ed II			
		15	6	17

### Sophomore Year

#### Fall Semester

EGR 232	Statics/Solid Mech	3	0	3
EGR 244	Electrical Fund I	3	2	4
MAE 205	Visualization and Graphics	0	6	2
MAT 330	Intro to Diff Eqns	3	0	3
PHY 162	General Physics II	3	0	3
PHY 162L	General Physics II Lab	0	3	1
		12	11	16

#### Spring Semester

EGR 236	Dynamics	3	0	3
EGR 235	Thermodynamics	3	0	3
EGR 245	Electrical Fund II	3	0	3
EGR 246L	Electrical Fund Lab	0	3	1
EGR 252	Prob & Stats for Engr	3	0	3
EGR 312	Engineering Economy	3	0	3
ISE 288	Intro to ISE	0	3	1
		15	6	17

### Junior Year

#### Fall Semester

ISE 302	Mgt Science/OR	3	0	3
ISE 327	Stat Process & Qual Ctrl	3	0	3
ISE 352	Design of Experiments	3	0	3
MAE 305L	Manuf Practices Lab	0	6	2
TCO 341	Technical Communic	3	0	3
XXX	Gen Ed III	3	0	3
		15	6	17

#### Spring Semester

EGR 386	Feedback Control	3	0	3
ISE 311	Ergonomic/Work Mst	3	0	3
ISE 362	Prod Planning and Ctrl	3	0	3
ISE 370	Mfg. Processes	3	0	3
ISE 480	Intro to Senior Design	0	1	0
XXX	Gen Ed IV	3	0	3
		15	1	15

### Senior Year

#### Fall Semester

ACC 204	Intro to Financial Acct	3	0	3
ISE 403	Modeling/Simulation	3	0	3
ISE 412	Human Factors Engr	3	0	3
ISE 424	Comp Asst Mfg Sys	3	0	3
ISE 424L	CAM Systems Lab	0	3	1
ISE 487	Engr Design Exhibit I	0	6	2
ISE xxx	ISE Elective	3	0	3
		15	9	18

#### Spring Semester

ISE 460	Fac Planning & Dsgn	3	0	3
ISE 482	ISE Capstone Design	3	0	3
ISE 488	Engr Design Exhibit II	0	6	2
XXX	Technical Elective	3	0	3
XXX	Gen Ed V	3	0	3
		12	6	14

## Master of Science in Engineering in Engineering Management

The increasing demand for technology in today's society creates additional demand for graduate degrees in engineering as the entry level degree for engineering practice. The purpose of the Master of Science in Engineering in Engineering Management degree is to prepare engineers to successfully address

supervisory and managerial needs in a technological environment. The Master of Science in Engineering in Engineering Management is designed to enable students to simultaneously obtain a Bachelor of Science in Engineering and a Master of Science in Engineering degree in five years. Thirty additional hours of graduate coursework are required for the Master of Science in Engineering degree. This coursework is integrated throughout the fourth and fifth years of study.

Students who complete the coursework required in the first three years of the bachelor's degree in an engineering program with grades which qualify them for graduate study may apply for admission to the Master of Science in Engineering program. In general, application for admission would be made during the term in which the last of the required courses is taken. Final acceptance into the program will be granted on satisfactory completion of work in progress at the time of application.

For additional details, program requirements, and course descriptions, please refer to the information in the graduate studies section of this catalog.

### 5 Year BSE/MSE Program

#### 4th Year

<b>Fall Semester</b>			<b>Spring Semester</b>		
ACC 204	Intro to Financial Acct	3 0 3	ISE 480	Intro to Senior Design	0 1 0
ISE 412	Human Factors Engr	3 0 3	ISE 482	ISE Capstone Design	3 0 3
ISE 424	Comp Asst Mfg Sys	3 0 3	ETM 6XX	ETM Graduate Course	3 0 3
ISE 424L	CAM Systems Lab	0 3 1	EGR XXX	Graduate Course	3 0 3
ETM 6XX	ETM Graduate Course	3 0 3	XXX	Gen Ed V	3 0 3
EGR XXX	Graduate Course	3 0 3			
		<u>15 3 16</u>			<u>12 1 12</u>

#### Summer Semester

ETM 6XX	Graduate Course	3 0 3
		<u>3 0 3</u>

#### 5th Year

<b>Fall Semester</b>			<b>Spring Semester</b>		
ISE 403	Modeling/Simulation	3 0 3	ISE 460	Fac Planning & Dsgn	3 0 3
ISE 487	Engr Design Exhibit I	0 6 2	ISE 488	Engr Design Exhibit II	0 6 2
ISE XXX	ISE Elective	3 0 3	XXX	Technical Elective	3 0 3
EGR XXX	Graduate Course	3 0 3	EGR XXX	Graduate Course	3 0 3
ETM 6XX	Graduate Course	3 0 3	ETM 6XX	Graduate Course	3 0 3
		<u>12 6 14</u>			<u>12 6 14</u>

#### Summer Semester

ETM 6XX	Graduate Course	3 0 3
		<u>3 0 3</u>

## ISE Courses

### ISE 288. Introduction to Industrial Engineering and Manufacturing Engineering (0-3-1)

Prerequisite: Sophomore standing.

An overview of the concepts important to industrial engineering and manufacturing engineering. Topics include operations research, facility design, quality con-

trol, information systems, economic analysis, management concepts, and human factors.

**ISE 302. Management Science/Operations Research (3-0-3)**

Prerequisites: C or better in EGR 252 or MAT 126, MAT 191 or MAT 141 or equivalent.

Applications of, and theory behind deterministic models in management science/operations research, including; linear, integer, goal, non-linear and dynamic programming; network models to include the transportation and assignment algorithms, forecasting and decision analysis.

**ISE 311. Ergonomics and Work Measurement (3-0-3)**

Prerequisite: C or better in EGR 252.

Design and evaluation of tools, work spaces, work methods, and work environments, with an emphasis on industrial environments. Task analysis, time/motion studies, and work sampling. Physiological and biomechanical considerations. Safety engineering.

**ISE 327. Statistical Process and Quality Control (3-0-3)**

Prerequisite: C or better in EGR 252.

Statistical process control methods for products and services; design of quality assurance systems; control inputs, production processes and outputs. Contributions of Deming and Taguchi.

**ISE 352. Design of Experiments (3-0-3)**

Prerequisite: C or better in EGR 252.

Advanced model designs (fractional factorials, Latin squares, nested, etc.) Estimation of model parameters and model adequacy checking. Multiple regression. Response surface methodology and Taguchi methods.

**ISE 362. Production Planning and Control (3-0-3)**

Prerequisite: ISE 302.

Development and application of scheduling and inventory theory; including an introduction to modern manufacturing concepts such as aggregate planning, MRP, JIT, Lean Manufacturing, Theory of Constraints, Continuous Improvement, etc.

**ISE 370. Manufacturing Processes (3-0-3)**

Prerequisites: EGR 312 or equivalent, C or better in EGR 252 or equivalent.

Pre/corequisite: MAE 305L or permission of instructor.

Introduction to manufacturing systems. Manufacturing processes: casting, metal cutting, welding and joining processes, and plastic materials and processes. Introduction to geometric dimensioning and tolerancing, metrology and testing, numerical control, and process automation. Integrated laboratory assignments.

**ISE 403. Modeling and Simulation (3-0-3)**

Prerequisites: C or better in EGR 252 or MAT 126, MAT 191 or MAT 141 or equivalent.

Applications of and theory behind queuing models and the application of discrete event simulation to model service and manufacturing systems.

**ISE 412. Human Factors Engineering (3-0-3)**

Prerequisite: ISE 311.

Human-machine systems modeling and design for human interaction with complex systems such as nuclear power plants, aircraft, and automated manufacturing systems. Models of human information processing, perception, memory, deci-

sion making and error generation. Design of interfaces for complex systems, including human-computer interfaces.

**ISE 424. Computer Assisted Manufacturing Systems (3-0-3)**

Prerequisite: ISE 370.

Introduction to computer assisted manufacturing, product specification, geometric tolerancing, and computer-aided design. Geometric modeling, process engineering, and tooling and fixturing. Programmable logic controllers. Data communication and LANs in manufacturing. Fundamentals of numerical control and numerical control programming. Rapid prototyping and industrial robotics.

**ISE 424L. Computer Assisted Manufacturing Systems Lab (0-3-1)**

Corequisites: ISE 424

Laboratory work involving CAE and CAD/CAM integration. CNC machining operations, numerically controlled devices, and robots. Measurements using coordinate measuring machine(CMM). Use of G-codes and one or more commercially available CAD/CAM software packages. Projects illustrating computer aided design and manufacturing, programming robots, and design of work cells.

**ISE 427. Reliability and Quality Assurance (3-0-3)**

Prerequisite: ISE 327.

Design and management of reliability programs and quality assurance systems; mathematics of reliability.

**ISE 428. Quality Engineering (3-0-3)**

Prerequisite: IDM 355 or ISE 327.

Statistical decision making. Cost of Quality. Six Sigma. Lean Enterprise in Service and Manufacturing. Quality Function Development. Failure Modes and Effects Analysis. Management's role in assuring quality. Case studies in design and implementation of quality systems.

**ISE 429. Robotics (3-0-3)**

Prerequisite: ISE 370 or permission of instructor.

Introduction to robotics. Robot arm kinematics and dynamics. Trajectory planning and control of robot manipulators. Sensing and vision capabilities of robots. Robot programming languages. Robot intelligence and task planning. Integrated laboratory assignments.

**ISE 460. Facilities Planning and Design (3-0-3)**

Prerequisite: ISE 370.

Corequisite: ISE 403.

Comprehensive design of industrial production systems. Determination of requirements, generation and evaluation of alternatives, process design, materials handling, and location analysis.

**ISE 480. Introduction to Senior Design (0-1-0)**

Corequisites: TCO 341, ISE 302, ISE 311, ISE 327, and ISE 370.

Course will provide guidance for the selection of team members and topic for the senior design project to be completed in ISE 487 and ISE 488. To successfully complete the course, a student must belong to a team (3 to 4 persons) and briefly outline the project goals to be implemented in ISE 487 and ISE 488. A seminar series will be conducted to facilitate student introduction to potential industrial clients and projects. Seminar attendance is required to obtain a satisfactory course grade. This course is graded S/U.

### **ISE 482. Industrial Engineering Capstone Design Experience (3-0-3)**

Prerequisites: TCO 341, ISE 302, ISE 311, ISE 327, and ISE 370.

Corequisites: ISE 403 and ISE 424.

Synthesis and integration of the common techniques and methods of industrial engineering to solve “real” world or “quasi-real” world problems. Emphasis on team solutions and communications.

### **ISE 487. Engineering Design Exhibit I (0-6-2)**

Prerequisites: TCO 341, ISE 302, ISE 311, ISE 327, ISE 370, and ISE 480. Must have completed all required 100- and 200-level engineering, mathematics, and science courses.

Corequisites: ISE 403 and ISE 424.

Multi-disciplinary design projects with substantial ISE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

### **ISE 488. Engineering Design Exhibit II (0-6-2)**

Prerequisite: ISE 487.

Continuation of ISE 487 multi-disciplinary design projects with substantial ISE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

SPECIAL COURSES: ISE 491, 492, 493, 498, 499 for variable credit. May be repeated for credit with approval of academic advisor and department chair.

### **ISE 491-492-493. Special Topics (1-6 hours)**

### **ISE 498. Professional Seminar (1-6 hours)**

### **ISE 499. Independent Study (1-6 hours)**

## **Mechanical Engineering Specialization**

The mechanical engineering profession involves the practical application of engineering science and design to areas as diverse as the generation, conversion, transmission, and use of thermal and mechanical energy; the production of tools, machines, and consumer products; the design and optimization of mechanical, thermodynamic, and fluid systems; and materials selection and processing. It is virtually impossible to name a manufactured product that has not been touched in some way by a mechanical engineer. Research, design, production, operation, administration, and economics are functional aspects of mechanical engineering. Mechanical engineers are responsible for the design and application of transportation systems, medical devices, automated manufacturing systems, robotics, power generation, cooling of electronic components, and automatic control systems. Within the broad scope of these systems, the mechanical engineer is concerned with a challenging and diverse array of design and development problems.

In modern society, mechanical engineers must extend their interest beyond the strictly technical aspects of their positions to include economic, safety, ethical, and environmental considerations. Today's mechanical engineers must be a creative problem solvers with a broad scope of capabilities-including the ability to communicate their ideas effectively.

## **Academic Requirements for BSE, Mechanical Engineering Specialization**

The student choosing to specialize in mechanical engineering must satisfy all of the retention, graduation, and academic requirements of the University and the School of Engineering. In addition, the student must achieve grades of C or better in EGR 232 (Statics/Solid Mechanics), EGR 233 (Dynamics), and EGR 235 (Thermodynamics). A student may not enroll or remain enrolled in a course for which one of these courses is a prerequisite without satisfying this requirement. Students must also maintain a minimum cumulative grade point average of 2.0 in courses with the MAE prefix. Mechanical engineering students must complete all required 200-level and 300-level MAE courses (except MAE 302L) and all required 100 and 200 level engineering, mathematics, and science courses before enrolling in Senior Design (MAE 487).

## **Departmental Honors for BSE, Mechanical Engineering Specialization**

Each year, the mechanical engineering faculty determines the graduating mechanical engineering student who has best distinguished himself or herself and recognizes this student as the Outstanding Graduate in Mechanical Engineering.

## **The Mechanical Engineering BSE Curriculum**

The undergraduate curriculum covers the fundamentals of engineering, emphasizes basic principles, and educates the student in the use of these principles to reach optimal design solutions for engineering problems. Successful completion of this curriculum prepares the student for a career in one of the many phases of the mechanical engineering profession or for advanced education in graduate school.

## **Bachelor of Science in Engineering (BSE) Degree Requirements: Mechanical Engineering Specialization**

1. UNV 101 .....1 hour
2. Engineering Core .....61 hours
3. Additional Mathematics .....3 hours  
MAT 293. Multivariable Calculus
4. General Education Requirements .....15 hours
5. Required MAE Courses .....40 hours  
MAE 205. Visualization and Graphics  
MAE 302L. Mechanical Engineering Laboratory I  
MAE 305L. Manufacturing Practices  
MAE 310. Engineering Analysis for Mechanical Engineers  
MAE 320. Solid Mechanics  
MAE 322. Machine Design  
MAE 330. Fluid Mechanics  
MAE 335. Thermodynamics II  
MAE 362. Structure and Properties of Materials  
MAE 402L. Mechanical Engineering Laboratory II  
MAE 422. Dynamics of Mechanical Systems

- MAE 430. Heat Transfer
- MAE 435. Thermal Systems Analysis
- MAE 460. Engineering Materials
- MAE 480. Introduction to Senior Design
- MAE 487. Engineering Design Exhibit I
- MAE 488. Engineering Design Exhibit II

6. Technical Electives . . . . .9 hours  
 This specialization requires nine hours of technical elective courses, chosen with the approval of the student, faculty advisor, and specialization chair. The student must take at least six hours in MAE technical electives. The remaining technical elective hours can be satisfied by any non-required 300-level or 400-level course in BME, ECE, EGR, EVE, ISE, MAE, CHM, CSC, MAT, or PHY.

Total Semester Hours Required . . . . .129 hours

### Mechanical Engineering

#### Freshman Year

Fall Semester				Spring Semester			
EGR 108	Professional Practices			EGR 108	Professional Practices		
<i>Or</i>		3	0 3	<i>Or</i>		3	0 3
EGR 126	Programming for Engr			EGR 126	Programming for Engr		
MAT 191	Calculus I	4	0 4	EGR 107	Intro to Engr Design	2	3 3
CHM 111	General Chemistry I	3	3 4	MAT 192	Calculus II	4	0 4
UNV 101	Freshman Experience	1	0 1	PHY 161	General Physics I	3	0 3
XXX	Gen Ed I	3	0 3	PHY 121	General Physics I Lab	0	3 1
				XXX	Gen Ed II	3	0 3
		14	3 15			15	6 17

#### Sophomore Year

Fall Semester				Spring Semester			
EGR 232	Statics/Solid Mech	3	0 3	EGR 236	Dynamics	3	0 3
EGR 244	Electrical Fund I	3	2 4	EGR 235	Thermodynamics	3	0 3
MAT 330	Intro to Diff Eqns	3	0 3	EGR 245	Electrical Fund II	3	0 3
PHY 162	General Physics II	3	0 3	EGR 246L	Electrical Fund Lab	0	3 1
PHY 162L	General Physics II Lab	0	3 1	EGR 252	Prob & Stats for Engr	3	0 3
XXX	Gen Ed III	3	0 3	MAE 205	Visual and Graphics	0	6 2
				MAT 293	Multivariable Calculus	3	0 3
		15	5 17			15	9 18

#### Junior Year

Fall Semester				Spring Semester			
MAE 305L	Manuf Practices Lab	0	6 2	EGR 312	Engineering Economy	3	0 3
MAE 310	Engr Analysis for ME	3	0 3	EGR 386	Feedback Control	3	0 3
MAE 320	Solid Mechanics II	3	0 3	MAE 302L	Mech Engr Lab I	1	3 2
MAE 330	Fluid Mechanics	3	0 3	MAE 322	Machine Design	3	0 3
MAE 335	Thermodynamics II	3	0 3	MAE 362	Struct & Prop of Material	3	0 3
TCO 341	Technical Communication	3	0 3	MAE 430	Heat Transfer	3	0 3
				MAE 480	Intro to Senior Design	0	1 0
		15	6 17			16	4 17

### Senior Year

<b>Fall Semester</b>			<b>Spring Semester</b>		
MAE 402L	Mech Engr Lab II	0 3 1	MAE 422	Dyn of Mech Systems	3 0 3
MAE 435	Thermal Sys Analysis	3 0 3	MAE 488	Engr Design Exhibit II	0 6 2
MAE 460	Engineering Materials	2 0 2	MAE 4XX	Technical Elective	3 0 3
MAE 487	Engr Design Exhibit II	0 6 2	XXX	Technical Elective	3 0 3
MAE 4XX	Technical Elective	3 0 3	XXX	Gen Ed V	3 0 3
XXX	Gen Ed IV	3 0 3			
		11 9 14			12 6 14

### **Integrated Bachelor of Science in Engineering/ Master of Science in Engineering in Mechanical Engineering**

Students who complete the first three years of the Bachelor of Science in Engineering with a specialization in Mechanical Engineering with grades which qualify them for graduate study may directly pursue the Master of Science in Engineering during their fourth and fifth years of study. A full calendar year, including one additional summer term, is needed to complete the Master of Science in Engineering in Mechanical Engineering degree. See the graduate studies section near the back of this catalog for more information about the master of science in engineering programs.

#### Senior Year (Integrated Bachelor of Science in Engineering/ Master of Science in Engineering students only)

<b>Fall Semester</b>			<b>Spring Semester</b>		
MAE 402L	Mech Engr Lab II	0 3 1	MAE 422	Dyn of Mech Systems	3 0 3
MAE 460	Engineering Materials	2 0 2	MAE 480	Intro to Senior Design	0 1 0
XXX	Gen Ed IV	3 0 3	XXX	Gen Ed V	3 0 3
EGR XXX	Graduate Course	3 0 3	EGR XXX	Graduate Course	3 0 3
MAE 6XX	Graduate Course	3 0 3	MAE 6XX	Graduate Course	3 0 3
		11 3 12			12 1 12

#### Summer Semester (Integrated BSE/MSE students only)

MAE 6XX	Graduate Course	3 0 3
		3 0 3

#### Graduate Year (Integrated BSE/MSE students only)

<b>Fall Semester</b>			<b>Spring Semester</b>		
MAE 435	Thermal Sys Analysis	3 0 3	MAE 488	Engr Design Exhibit II	0 6 2
MAE 487	Engr Design Exhibit I	0 6 2	MAE XXX	Technical Elective	3 0 3
MAE 4XX	Technical Elective	3 0 3	XXX 4XXX	Technical Elective	3 0 3
MAE 6XX	Graduate Course	3 0 3	MAE 6XX	Graduate Course	3 0 3
EGR XXX	Graduate Course	3 0 3	EGR XXX	Graduate Course	3 0 3
		12 6 14			12 6 14

#### Summer Semester (Integrated BSE/MSE students only)

MAE 6XX	Graduate Course	3 0 3
		3 0 3

See the graduate section of this catalog for more information about the Integrated Bachelor of Science in Engineering/Master of Science in Engineering Program.

## **MAE Courses**

### **MAE 205. Visualization and Graphics (0-6-2)**

An introduction to engineering graphics and component visualization. Sketching, line drawing, and an introduction to computer assisted drafting. Utilization of drawings in a manufacturing environment.

### **MAE 302L. Mechanical Engineering Laboratory I (1-3-2)**

Prerequisites: EGR 252, MAE 320, MAE 335.

Corequisite: MAE 430.

Application of basic measurement techniques and instrumentation to the experimental investigation of mechanical engineering systems-refrigeration systems, flow and heat transfer devices, and mechanical systems. Identification of experimental objectives, planning of experimental processes and procedures, collection and evaluation of experimental data, and analysis of experimental results. Reports of experimental investigation, including descriptions of study objectives, procedures and methods, analysis methods, results, and conclusions.

### **MAE 305L. Manufacturing Practices (0-6-2)**

Prerequisites: PHY 141 (IDM majors) or EGR 232 (MAE specialization: C or better), MAE 205.

Theory and applications of metal working machinery. Industrial safety. Engineering and technological aspects of joining operations. Interpretation of engineering drawings. Introduction to design of simple jigs and fixtures.

### **MAE 310. Engineering Analysis for Mechanical Engineers (3-0-3)**

Prerequisites: EGR 126, MAT 293, MAT 330.

Introduction to the solution of partial differential equations and numerical methods in mechanical engineering. Separation of variables, root finding, systems of simultaneous equations, numerical integration, matrix methods, finite difference methods.

### **MAE 320. Solid Mechanics II (3-0-3)**

Prerequisites: C or better in EGR 232, MAT 192.

Stress, strain, axial deformation of statically determinate and indeterminate systems. Generalized Hooke's Law. Torsion, beam bending, shear stresses in beams, stress and strain transformation, beam deflections. Energy methods. Static and fatigue failure theories. Design of structural members: beams, columns, etc.

### **MAE 322. Machine Design (3-0-3)**

Prerequisites: C or better in EGR 232, C or better in EGR 236, MAE 320.

Application of the principles of solid mechanics, materials science, and statistics to the design and analysis of specific machine components such as screws, bearings, gears, welded joints, springs, etc.

### **MAE 330. Fluid Mechanics (3-0-3)**

Prerequisites: C or better in EGR 235 and EGR 236, MAT 293, MAT 330.

Fluid properties, statics and dynamics of ideal and real fluids. Continuity, momentum, and energy equations. Potential flow. Dimensional analysis. Pipe flow. Laminar and turbulent incompressible flows. Boundary layer analysis. Lift and drag.

### **MAE 335. Thermodynamics II (3-0-3)**

Prerequisite: C or better in EGR 235.

Corequisite: MAT 293.

Second law analysis. Power and refrigeration cycles. Application of basic princi-

ples to engineering problems involving ideal gas mixtures, psychrometrics, real gas mixtures, and combustion.

**MAE 362. Structure and Properties of Materials (3-0-3)**

Prerequisites: CHM 111, MAT 330.

Mechanical behavior of materials, atomic concepts, properties of crystalline and non crystalline solids. Materials in design.

**MAE 402L. Mechanical Engineering Laboratory II (0-3-1)**

Prerequisites: MAE 330, MAE 302L.

Corequisites: MAE 430, MAE 460.

Design of experiments. Multiple experimental projects focused on analysis of materials and materials processing, thermal systems, and/or mechanical systems.

**MAE 406. Introduction to Finite Element Analysis (3-0-3)**

Prerequisites: MAE 310, MAE 320.

Introduction to the theory of finite element analysis. Solutions for stress analysis, dynamic analysis, and heat transfer in two dimensions. Computer implementation. Modeling and applications.

**MAE 422. Dynamics of Mechanical Systems (3-0-3)**

Prerequisites: C or better in EGR 236, MAE 310.

Planar kinetics of rigid bodies: force and acceleration, work and energy, and impulse and momentum. Three dimensional kinematics of rigid bodies. Three dimensional kinetics of rigid bodies: force and acceleration. Introduction to vibrations. Design of systems to produce different types of motion.

**MAE 425. Vibrations (3-0-3)**

Prerequisites: C or better in EGR 236, MAT 330.

Elements of vibrating systems. One degree of freedom systems: free and forced, and damped and undamped. Multi-degree of freedom systems: free and forced, and damped and undamped. Vibration of continuous systems. Design of vibration systems.

**MAE 427. Solid Mechanics III (3-0-3)**

Prerequisites: MAE 310, MAE 320.

Three dimensional stress at a point, compatibility equations, strain energy, plane stress, plane strain, mechanical behavior of materials, beam bending, torsion of prismatic bars, elastic foundations, elastic stability, energy methods.

**MAE 430. Heat Transfer (3-0-3)**

Prerequisites: MAT 330, C or better in EGR 235, MAE 310, MAE 330.

Conduction, convection, and radiation and their use in engineering applications. Steady and transient heat transfer; analytical, graphical, and numerical solutions. Normalization of the boundary layer equations. Convective correlations for external and internal flows. Introduction to radiation.

**MAE 435. Thermal Systems Analysis (3-0-3)**

Prerequisites: MAE 330, MAE 335, MAE 430.

Introduction to heat exchangers and heat exchanger design. Design and optimization of thermal systems, including modeling, simulation, and economics. Component design. Examples from power generation systems, heat exchanger/recovery, HVAC.

**MAE 436. Turbomachinery (3-0-3)**

Prerequisites: MAE 330, MAE 335.

Introduction to the theory, analysis, and design of turbomachinery. Incompressible flow devices: pumps, fans, and hydraulic turbines. Gas turbine engines for aircraft and industrial power generation. Radial and axial flow configurations.

**MAE 437. Internal Combustion Engines (3-0-3)**

Prerequisite: MAE 335.

Theory, design, and operation of spark-ignition and compression-ignition engines. Combustion analysis, efficiencies, and performance. Knock phenomena, exhaust-gas analysis, and air pollution.

**MAE 439. Heating, Ventilation, and Air Conditioning Design (3-0-3)**

Prerequisites: MAE 335, MAE 430.

Comfort and health requirements for space conditioning. Psychrometrics. Heating and cooling load calculations. Solar heating and cooling systems. Systems design. Computer applications.

**MAE 444. Flight Structures (3-0-3)**

Prerequisite: MAE 320.

Loads, fatigue, minimum weight design, stress analysis of semi-monocoque structures, and design of members in tension, bending, and torsion.

**MAE 460. Engineering Materials (2-0-2)**

Prerequisite: MAE 362.

Corequisites: MAE 402L, MAE 430.

Engineering applications of irons, steels and other metals. Properties and uses of plastics and composites. Materials selection for mechanical designs.

**MAE 480. Introduction to Senior Design (0-1-0)**

Corequisites: TCO 341, MAE 305L, MAE 322, MAE 335, and MAE 362.

Course will provide guidance for the selection of team members and topic for the senior design project to be completed in MAE 487 and MAE 488. To successfully complete the course, a student must belong to a team (3 to 4 persons) and briefly outline the project goals to be implemented in MAE 487 and MAE 488. A seminar series will be conducted to facilitate student introduction to potential industrial clients and projects. Seminar attendance is required to obtain a satisfactory course grade. This course is graded S/U.

**MAE 487. Engineering Design Exhibit I (0-6-2)**

Prerequisites: TCO 341, MAE 305L, MAE 322, MAE 335, and MAE 362. Must have completed all 100- and 200-level engineering, mathematics, and science courses.

Corequisites: MAE 302L, MAE 430.

Multi-disciplinary design projects with substantial MAE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

**MAE 488. Engineering Design Exhibit II (0-6-2)**

Prerequisite: MAE 487.

Continuation of MAE 487 multi-disciplinary design projects with substantial MAE content. Small groups design, build, and test realistic engineering systems under faculty supervision. Projects include safety, economic, environmental, and ethical considerations and require written and oral reports.

SPECIAL COURSES: MAE 491, 492, 493, 498, 499 for variable credit. May be repeated for credit with approval of academic advisor and department chair.

**MAE 491-492-493. Special Topics** (1-6 hours)

**MAE 498. Professional Seminar** (1-6 hours)

**MAE 499. Independent Study** (1-6 hours)

## **Bachelor of Science Degree Program**

Students who wish to pursue a liberal education with strong emphasis on engineering topical areas may pursue one of two Bachelor of Science degree programs in the School of Engineering. Graduates of these programs are prepared to pursue engineering related careers or to pursue advanced degrees that require a strong foundation in the sciences. These programs are not accredited as engineering programs and graduates are not qualified to become licensed as professional engineers.

The following majors are available: Industrial Management and Technical Communication. Curricula and requirements for each of these majors are presented later in this document.

### **Industrial Management**

Today's business world requires managers who are knowledgeable of and comfortable with technology. This is true not only in manufacturing but also in service industries such as banking, hospital management, and a host of others that are increasingly turning toward the use of the computer and other tools to manage.

To meet these needs the School of Engineering, in cooperation with the Stetson School of Business and Economics and the Department of Psychology of the College of Liberal Arts, has designed the Bachelor of Science (BS) in Industrial Management degree program. The program produces graduates who are skilled in "traditional" managerial disciplines such as accounting and finance and, in addition, are adept at applying a number of engineering tools to management decisions. This program appeals to students who like mathematics but are not interested in the entire rigor of an engineering program. These students also prefer more emphasis on quantitative approaches than is generally found in a business program. One should realize that this is not an engineering program, and, in general, graduates would not be able to pursue a graduate degree in engineering or secure a license as a professional engineer.

The main areas of emphasis in the program are: psychology, quantitative methods of management, economics, accounting, and management information systems. This basic foundation will allow the graduate to advance successfully through the ranks of management in any company that is technology driven.

### **Academic Requirements for BS, Industrial Management Major**

In addition to the retention, graduation, and academic requirements of the University and the School of Engineering, the industrial management student must achieve a grade of C or better in ECN 150, ECN 151, MAT 126, PSY 101, PSY 235, and a grade point average in excess of 2.0 for all IDM and ISE courses.

## Departmental Honors for BS, Industrial Management Major

Each year, the industrial management faculty determines the graduating industrial management student who has best distinguished himself or herself and recognizes this student as the Outstanding Graduate in Industrial Management.

## The Industrial Management BS Curriculum

The program educational objectives that have been established for the Bachelor of Science in Industrial Management are as follows. Graduates are prepared to be practicing managers with the knowledge and skills needed to: (1) identify, formulate, and solve management problems through analysis and design using the principles of science and mathematics, (2) work effectively in a variety of contexts using superior communication skills, knowledge of contemporary issues with a commitment to professional ethics and lifelong learning, (3) pursue additional graduate or professional education, and (4) participate in their local and global communities through sustaining service and leadership.

The program outcomes that have been established for the Bachelor of Science in Industrial Management are as follows. Students at the time of graduation will know and be able to do the following: (1) apply quantitative techniques to the solution of Management problems, (2) analyze managerial problems in the context of cost accounting and modern economic theory, (3) apply principles of industrial psychology and human resource control in practice, (4) design, analyze, and implement manufacturing, management, information and quality systems, (5) function on interdisciplinary teams, (6) communicate to both specialized and public audiences in a variety of modes, i.e., writing, presentation, etc., (7) relate the practice of industrial management to global contemporary issues, to professional ethics, and to the need for lifelong learning, and (8) contribute to sustaining and improving community.

## Bachelor of Science (BS) Degree Requirements Industrial Management Major

1. UNV 101 .....1 hour
2. Mathematical Foundation .....11 hours  
MAT 126. Elementary Statistical Methods  
MAT 133. Precalculus  
MAT 191. Calculus I
3. Basic Sciences .....12 hours  
CHM 111. General Chemistry I  
PHY 141. Introductory Physics I  
PHY 121L. Introductory Physics I Lab  
PHY 142. Introductory Physics II  
PHY 142L. Introductory Physics II Lab
4. General Education Requirements .....15 hours
5. Psychology .....6 hours  
PSY 101. Introduction to Psychology  
PSY 235. Industrial Psychology
6. Management Courses .....36 hours  
MGT 429 and ACC 377 are offered by the Stetson School of Business and Economics on an irregular schedule. Students should be prepared to

schedule these two courses at their first offering after prerequisites have been completed.

- BUS 346. Legal Environment of Business
- FIN 362. Principles of Finance
- IDM 355. Quality Management
- IDM 404. Industrial Management Case Studies
- IDM 470. Management Information Systems I
- ISE 302. Management Science I/Operations Research
- ISE 362. Production Planning and Control
- ISE 370. Manufacturing Processes
- MGT 363. Principles of Management
- MGT 423. Organizational Behavior
- MGT 429. Human Resource Management
- MKT 361. Principles of Marketing

7. Accounting Courses .....9 hours  
ACC 377 and MGT 429 are offered by the Stetson School of Business and Economics on an irregular schedule. Students should be prepared to schedule these two courses at their first offering after prerequisites have been completed.

- ACC 204. Introduction to Financial Accounting
- ACC 205. Introduction to Managerial Accounting
- ACC 377. Cost Accounting

8. Foundations in Economics .....9 hours  
ECN 150. Microeconomics  
ECN 151. Macroeconomics  
ECN 301. Money, Banking and Credit

9. Computers, Communications, and Engineering .....21 hours  
EGR 107. Introduction to Engineering Design  
EGR 108. Professional Practices  
EGR 126. Programming for Engineers  
IDM 288. Introduction to Industrial Management & Manufacturing Engineering  
IDM 480. Introduction to Senior Design  
IDM 487. Senior Design Exhibit I  
IDM 488. Senior Design Exhibit II  
MAE 205. Visualization and Graphics  
MAE 305L. Manufacturing Practices  
TCO 341. Technical Communication

10. Technical and Free Electives .....9 hours  
The Industrial Management student must take six hours of electives from courses that are closely allied to the discipline. The student should work closely with his/her advisor to select these technical electives. In addition, the student must select one additional course, a free elective, from any of the offerings from the entire University.

Total Semester Hours Required .....129 hours

## Industrial Management

### Freshman Year

#### Fall Semester

UNV 101	Freshman Experience	1	0	1
EGR 108	Professional Practice	3	0	3
<i>Or</i>				
EGR 126	Programming for Engr	3	0	3
ECN 150	Microeconomics	3	0	3
MAT 133	Pre-Calculus	4	0	4
MAE 205	Visual and Graphics	0	6	2
PSY 101	Intro to Psychology	3	0	3
XXX	Gen Ed I	3	0	3
		14	6	16

#### Spring Semester

EGR 108	Professional Practices	3	0	3
<i>Or</i>				
EGR 126	Programming for Engr			
EGR 107	Intro to Engr Design	2	3	3
MAT 191	Calculus I	4	0	4
PHY 141	Intro Physics I	3	0	3
PHY 121L	Intro Physics I Lab	0	3	1
XXX	Gen Ed I	3	0	3
		15	6	17

### Sophomore Year

#### Fall Semester

ACC 204	Intro to Financial Acct	3	0	3
CHM 111	General Chemistry I	3	3	4
ECN 151	Macroeconomics	3	0	3
MAT 126	Elem Stat Methods	3	0	3
XXX	Gen Ed II	3	0	3
		15	3	16

#### Spring Semester

ACC 205	Intro to Managerial Acct	3	0	3
IDM 288	Intro to IDM and Mfg	0	3	1
MAE 305L	Mfg. Practice Lab	0	6	2
MGT 363	Prin of Management	3	0	3
PHY 142	Intro to Physics II	3	0	3
PSY 235	Industrial Psychology	3	0	3
PHY 142L	Intro to Physics II Lab	0	3	1
		12	12	16

### Junior Year

#### Fall Semester

ACC 377	Cost Accounting	3	0	3
IDM 355	Quality Management	3	0	3
ISE 302	Mgt Science/OR	3	0	3
MKT 361	Principles of Marketing	3	0	3
TCO 341	Technical Comm	3	0	3
XXX	Gen Ed III	3	0	3
		18	0	18

#### Spring Semester

FIN 362	Principles of Finance	3	0	3
ECN 301	Money/Banking/Credit	3	0	3
IDM 480	Intro to Senior Design	0	1	0
ISE 362	Prod Planning & Ctrl	3	0	3
ISE 370	Manuf Processes	3	0	3
MGT 429	Human Resource Mgt	3	0	3
XXX	Technical Elective	3	0	3
		18	1	18

### Senior Year

#### Fall Semester

IDM 470	Mgt Info Sys	3	0	3
IDM 487	Senior Design Exhibit I	0	6	2
MGT 423	Organ Behavior	3	0	3
XXX	Technical Elective	3	0	3
XXX	Free Elective	3	0	3
XXX	Gen Ed IV	3	0	3
		15	6	17

#### Spring Semester

BUS 346	Legal Env of Bus	3	0	3
IDM 404	IDM Case Studies	3	0	3
IDM 488	Senior Design Exhibit II	0	6	2
XXX	Technical Elective	3	0	3
XXX	Gen Ed V	3	0	3
		12	6	14

## **IDM Courses**

### **IDM 288. Introduction to Industrial Management and Manufacturing (0-3-1)**

Prerequisite: Sophomore standing.

An overview of the concepts important to industrial management and manufacturing. Topics include operations research, facility design, manufacturing, quality control, information systems, economic analysis, management concepts, and human factors.

### **IDM 302. Industrial Management I (3-0-3)**

Prerequisite: IDM 288.

Specific problems associated with managing a factory or industrial firm. Establishment of the organization, plant location, layout, facilities of production, employee's work and wages, control of product quality and cost.

### **IDM 355. Quality Management (3-0-3)**

Prerequisite: C or better in EGR 252 or C or better in MAT 126.

An investigation into the application of quantitative methods and human resources to improve all of the business processes and systems within an organization in order to provide superior customer value. Use of a disciplined approach which integrates fundamental management techniques, existing improvement efforts, and technical tools to achieve customer focus, total participation, and continual improvement over a wide range of applicability.

### **IDM 404. Industrial Management Case Studies (3-0-3)**

Prerequisites: IDM 355, ISE 302, and ISE 370.

Systematic problem solving utilizing actual and theoretical cases involving all areas of management and production. Detailed oral and written presentations.

### **IDM 407. Plant Development (3-0-3)**

Prerequisite: IDM 302.

Plant design and layout procedures; materials handling analysis, equipment arrangements and line-balancing requirements.

### **IDM 409. Manufacturing Scheduling and Control (3-0-3)**

Prerequisite: IDM 407.

The design of scheduling systems for various levels of production to meet aggregate demand for products and services. Lecture and case studies.

### **IDM 410. Safety Programs and Administration (3-0-3)**

Prerequisite: Junior standing.

Elements of administering a comprehensive hazards control program: management controls, hazard recognition, accident prevention, work environments and OSHA regulations.

### **IDM 414. Industrial Safety (3-0-3)**

Prerequisite: IDM 410.

Industrial safety management and administration including economic factors such as direct and indirect costs, workmen's compensation, accident prevention. Survey of safety regulations and programs.

### **IDM 470. Management Information Systems I (3-0-3)**

Prerequisite: EGR 126.

Analysis and synthesis of computer-based information systems emphasizing a

management approach. Planning, development, implementation, operation, evaluation, and control phases of the MIS life cycle.

**IDM 480. Introduction to Senior Design (0-1-0)**

Corequisites: TCO 341, IDM 355, ISE 302, and ISE 370.

Course will provide guidance for the selection of team members and topic for the senior design project to be completed in IDM 487 and IDM 488. To successfully complete the course, a student must belong to a team (3 to 4 persons) and briefly outline the project goals to be implemented in IDM 487 and IDM 488. A seminar series will be conducted to facilitate student introduction to potential industrial clients and projects. Seminar attendance is required to obtain a satisfactory course grade. This course is graded S/U.

**IDM 487. Senior Design Exhibits I (0-6-2)**

Prerequisites: TCO 341, IDM 355, IDM 480, ISE 302, and ISE 370. Must have completed all 100- and 200-level engineering, mathematics, and science courses. Corequisite: ISE 403.

Project design of a manufacturing facility encompassing market analysis, budget development, plant requirements and layout, production equipment, and work-force analysis. Oral and written presentations.

**IDM 488. Senior Design Exhibits II (0-6-2)**

Prerequisite: IDM 487.

Continuation of IDM 487 with project design of a manufacturing facility encompassing market analysis, budget development, plant requirements and layout, production equipment, and work-force analysis. Oral and written presentations.

SPECIAL COURSES: IDM 491, 492, 493, 498, 499 for variable credit. May be repeated for credit with permission of advisor.

**IDM 491-492-493. Special Topics (1-4 hours)**

**IDM 498. Processional Seminar (1-4 hours)**

**IDM 499. Independent Study (1-4 hours)**

## **Technical Communication**

Technical communication is a relatively new professional field of study that is gaining prominence as society becomes more and more immersed in technology. Technical communicators serve as information architects; as translators of technical information for nonspecialist users; as bridges between people in different businesses, cultures, or disciplines; and as user advocates on design teams. They are skilled in writing, speaking, designing documents, using advanced information technologies, working with people, and solving complex problems of communicating information using technology.

The Bachelor of Science (BS) in Technical Communication degree program draws upon the resources of several disciplines to provide a foundation in sciences, mathematics and technology, together with strong emphasis on communication skills. This program enables students to enter a wide variety of career fields. The technical communication degree program emphasizes mastery of the theoretical, rhetorical background of communication, while providing practical, hands-on experience. In the same way that engineering applies the principles of mathematics and science to real-world problems, so technical communication applies the principles of communication to real-world problems in technical settings.

Graduates are well prepared for entry-level positions in technical writing and editing, documentation, publications design management, advertising and marketing for technical fields, training, web design, instructional design, and many others. Majors are encouraged to join professional organizations, such as Mercer's Student Chapter of the Society for Technical Communication. A number of graduate programs in technical communication are available for advanced study, including Mercer's Master of Science in Technical Communication Management, offered via distance learning.

Students are encouraged to enter internships for practical experience, and they are expected to work as members of design teams at several levels. Students may, by careful planning, earn a major both in technical communication and in another discipline.

The minor in technical communication provides an attractive component for many degree programs (see description below).

Technical communication courses are open to any students, regardless of their college or major, who have the prerequisites and/or appropriate experience.

### **Academic Requirements for BS, Technical Communication Major**

In addition to the general academic requirements of the University and the School of Engineering, technical communication students must maintain a grade point average of at least 2.0 in all courses carrying a TCO prefix or counted as part of the TCO major.

### **Departmental Honors for BS, Technical Communication Major**

Each year, the technical communication faculty determines the graduating technical communication student who has best distinguished himself or herself academically and whose undergraduate career best exemplifies the standards of the profession and recognizes this student as the Outstanding Graduate in Technical Communication.

### **TCO Scholarships**

The Jeffrey Mavro TCO Scholarship provides financial awards for selected Undergraduates majoring in Technical Communication. Consult University Admissions or the Chair of the Technical Communication Department for more information.

The David C. Leonard Scholarship provides funds for selected graduate students in the Master of Science Program. Consult the department chair for information, or see [www.mercer.edu/mstco](http://www.mercer.edu/mstco).

### **The Technical Communication BS Curriculum**

The program educational objectives that have been established for the Bachelor of Science in Technical Communication are as follows. Graduates are prepared to be professionals with the knowledge and skills needed to: (1) analyze the audience for any communication, define its purpose, and design an appropriate communication product to meet the needs, (2) write and speak clearly for various audiences, present information accurately and persuasively, use a variety of media appropriately, and work successfully in a team environment, and (3) serve as the user advocate on design teams, focusing attention on design alternatives that respect the needs of the users and add value to technical products.

The program outcomes that have been established for the Bachelor of

Science in Technical Communication are as follows. Students at the time of graduation will know and be able to do the following: (1) apply basic principles of mathematics, science, communication, information design, and technology to the solution of technical problems, (2) apply appropriate breadth and depth of skills in audience analysis, document design, and rhetorical purpose to solving technical communication problems, (3) design and conduct user/task analyses, expert interviews, and usability tests; gather, analyze, and use data to design effective informational products, (4) communicate effectively to both specialized and public audiences in a variety of modes, using a variety of media appropriate to the projects assigned, (5) relate the practice of technical communication to global contemporary issues, to professional ethics, and to the need for lifelong learning, (6) demonstrate the ability to lead and manage projects and participate in interdisciplinary teams, and (7) contribute to sustaining and improving community.

## **Bachelor of Science (BS) Degree Requirements**

### **Technical Communication Major**

1. UNV 101 .....1 hour
2. Engineering, Mathematics, and Science Core .....Approx. 31 hours  
(Depending upon placement; may substitute higher-level courses)
  - EGR 107. Introduction to Engineering Design
  - EGR 108. Professional Practices
  - EGR 126. Programming for Engineers [or CSC 204]
  - MAT 126. Elementary Statistical Methods
  - MAT 133. Precalculus
  - MAT 141. Calculus for the Social Sciences
  - Three courses (at least 1 Physics and Lab) from these:
    - PHY 115. Descriptive Astronomy
    - PHY 141. Intro. Physics I
    - PHY 121L. Intro. Physics I Lab
    - PHY 142. Intro. Physics II
    - PHY 142L. Intro. Physics II Lab
    - EES 150. Introduction to Environmental Science
    - EES 210. Environmental Geology
    - EES 105. Geology
    - EES 110. Meteorology
    - CHM 108. Concepts of Chemistry
    - CHM 111. General Chemistry I
    - CHM 112. General Chemistry II
    - BIO 205. Intro. To Biology for Biomedical Engineers
    - BIO 211. Introduction to Biology I
3. Required TCO Courses .....19 hours
  - TCO 285. Document and Web Design
  - TCO 341. Technical Communication
  - TCO 361. Usability
  - TCO 363. Instructional Design
  - TCO 421. Technical Editing
  - TCO 480. Introduction to Senior Design
  - TCO 487. Senior Design Project I
  - TCO 488. Senior Design Project II

**Or**

TCO 496. Technical Communication Internship, plus  
TCO 498. Graduation Exhibit

4. TCO Electives . . . . .24 hours  
(Minimum, with at least 4 courses numbered 300 or above)  
TCO 325. Multimedia  
TCO 345. Communication in Management  
TCO 351. Reports & Proposals  
TCO 376. Visual Communication  
TCO 476. Communication in High-Tech Environments  
TCO 491. Special Topics: (subtitle)  
TCO 492. Special Topics: (subtitle)  
ART 354. Digital Imaging  
CTA 276. Video Production  
CTA 370. Public Relations: Theory and Methods  
CTA 400. Senior Seminar in CTA: Ethics  
CSC 206. Visual Programming  
IDM 470/BUS 349. Management Information Systems  
IST 220. Introduction to Databases  
IST 221. Introduction to Networks  
IST 276. Introduction to Internet Programming  
PHO 221. Art of Photography

5. General Education Requirements . . . . .15 hours  
BS students in Technical Communication select from the same General Education Requirements as BSE students. Please refer to the BSE General Education section of this catalog.

6. Professional Area Electives . . . . .15 hours  
Students must select one of the Professional Areas outlined below. These courses are designed to develop strength in a corollary discipline compatible with the student's career plans. In some departments, this professional elective may be called a minor and be so listed on the transcript.

At least three courses should be selected from courses numbered 300 or above. Consult the faculty advisor for best fit with career plans.

(1) Computer Science or Information Science Technology  
A large percentage of technical communication careers involve the computer industry; having a grasp of computer science and information technology is an asset for technical communicators. See the College of Liberal Arts section of the catalog for descriptions of minors in CSC and IST.

(2) Business Minors  
Understanding the business environment is a great help in working in corporate settings. The Stetson School of Business & Economics offers minors to non-BBA students in Accounting, Business Administration, and Economics. See the SSBE section of this catalog for requirements.

(3) Foreign Language  
Many companies are international, and having skills in a language will be an asset. Courses leading to a minor in French, Spanish, or German will involve at least two courses numbered 300 or above. The total number of courses will depend upon the student's earlier preparation and fluency.

Please see the Foreign Languages and Literatures Department in the College of Liberal Arts and consult the catalog.

(4) Engineering Emphasis

Preparation for working in engineering environments helps open doors within highly technical companies. Working with the chair of the chosen specialization area, the student selects at least 15 hours from the specialization. Students must meet the prerequisites of the courses selected and approved for the Professional Area.

(5) Communication and Theatre Arts or Media Studies

Concepts in communication, mass media, journalism, speaking, and video are relevant courses for technical communicators. See the description of the minors in CTA in the College of Liberal Arts section of this catalog.

(6) Individualized

Students may individualize their choices, providing they select at least 15 hours making a coherent, logical set of courses, with at least 3 courses numbered 300 or above. Consult with your advisor and get approval from the chair of Technical Communication.

7. Free Electives .....Variable  
Students will take free electives as needed to gain the 129 hours required for graduation. These electives are entirely open for student choice.

Total Semester Hours Required .....129 hours

### **Double and/or Second Majors**

Students are encouraged to investigate the possibility of combining another major with the technical communication major, especially when preferred career directions are clear early in their academic programs. This option may provide opportunities to combine fields of interest, even widely dissimilar ones.

### **Minor in Technical Communication**

Students wishing to earn a minor in technical communication should select at least 15 hours of course work in technical communication courses, including TCO 285, TCO 341 and at least two other courses above 300. The student should consult with the chair of his/her major academic unit to get approval for selected courses and then formally declare the TCO minor.

### **Sample 4-Year Curriculum**

The Bachelor of Science in Technical Communication degree may be completed in four years. This sample curriculum shows one possible configuration of courses, but will vary according to each student's circumstances (for example, students who exempt MAT 133 will have 4 more hours of free electives).

## Technical Communication

### Freshman Year

<b>Fall Semester</b>				<b>Spring Semester</b>					
UNV 101	Freshman Experience	1	0	1	EGR 107	Intro to Engr Design	2	3	3
EGR 108	Professional Practices	3	0	3	EGR 126	Programming for Engr	3	0	3
MAT 133	Pre-Calculus	4	0	4	MAT 141	Calc for Soc Science	3	0	3
XXX	Science course w/Lab	3	3	4	PHY 1XX	Science course w/Lab	3	3	4
XXX	Gen Ed I	3	0	3	XXX	Gen Ed II	3	0	3
		14	3	15			14	6	16

### Sophomore Year

<b>Fall Semester</b>				<b>Spring Semester</b>					
TCO 285	Document & Web Design	3	0	3	TCO 325	Multimedia	3	0	3
MAT 126	Elem. Statis. Methods	3	0	3	XXX	Gen Ed IV	3	0	3
XXX	Science course w/Lab	3	3	4	TCO XXX	(TCO Elective)	3	0	3
XXX	Gen Ed III	3	0	3	XXX	Prof. Area Elective	3	0	3
TCO XXX	(TCO Elective)	3	0	3	XXX	Gen Ed V	3	0	3
XXX	Elective	3	0	3	XXX	Elective	3	0	3
		18	3	19			18	0	18

### Junior Year

<b>Fall Semester</b>				<b>Spring Semester</b>					
TCO 341	Tech Comm.	3	0	3	TCO 361	Usability	3	0	3
TCO XXX	(TCO Elective)	3	0	3	TCO XXX	(TCO Elective)	3	0	3
TCO XXX	(TCO Elective)	3	0	3	XXX	Prof. Area Elective III	3	0	3
XXX	Elective	3	0	3	XXX	Elective	3	0	3
XXX	Prof. Area Elective II	3	0	3	XXX	Elective	3	0	3
		15	0	15	TCO 480	Intro to Senior Design or Internship	0	1	0
							15	1	15

### Senior Year

<b>Fall Semester</b>				<b>Spring Semester</b>					
TCO 363	Instructional Design	3	0	3	TCO 496	Internship*	1	0	3
TCO XXX	(TCO Elective)	3	0	3	TCO 498	Graduation Exhibit*	1	0	1
XXX	Prof. Area Elective IV	3	0	3	TCO 421	Tech Editing	3	0	3
XXX	Elective	3	0	3	TCO XXX	(TCO Elective)	3	0	3
XXX	Elective	3	0	3	XXX	Prof. Area Elective V	3	0	3
		15	0	15	XXX	Elective**	3	0	3
							14	0	16

\*Or Senior Design 487-488

\*\*Number of Free Electives will vary; must reach total hours of 129

## TCO Courses

### TCO 285. Document and Web Design (3-0-3)

Designing effective print and web documents for varying audiences and purposes. Includes basic design principles, integration of visuals, analysis of multiple documents, production issues, and introduction to computer software for desktop publishing and web design. Requires additional lab time outside of class.

**TCO 325. Multimedia** (3-0-3)

Prerequisite: TCO 285.

An introduction to the technical aspects of computer-based multimedia. Technical and hardware issues as well as theory and design concepts will be covered. Students will analyze the audience and purpose for multimedia, consider advantages and disadvantages of different technologies, and design, build and test multimedia products. Recommended for TCO majors and minors. Includes laboratory exercises and design projects.

**TCO 341. Technical Communication** (3-0-3)

Prerequisites: EGR 108 or equivalent, junior standing.

Introduction to forms and processes of technical communication, including letters and memos, reports, instructions, and proposals. Includes oral presentations, peer reviews, collaborative efforts. Emphasis is on determining audience and purpose, especially within organizational contexts, and on designing effective documents. Introduction to resume and data gathering.

**TCO 345. Communication in Management** (3-0-3)

Prerequisite: TCO 341, or permission of instructor.

Study of the role of communication in management of publications, projects, and people. Includes information specification and planning, quality standards, tracking systems, production, and evaluation. Emphasis on understanding organizational structures, building teams, and adapting to rapidly changing technologies and expectations.

**TCO 351. Reports and Proposals** (3-0-3)

Prerequisite: TCO 341.

Covers the principles involved in preparing scientific or technical reports and proposals for various audiences. Audience analysis, clarification of communication purposes, and presentational skills are included. Attention is given to research skills, individual and collaborative writing processes, review and editing procedures, layout and document design, and styles of reports and proposals.

**TCO 361. Usability** (3-0-3)

Prerequisites: TCO 285, TCO 341.

Theory and practice of designing usable information for different audiences and purposes (document usability, interface design, web usability, etc.). Students participate in a major course project introducing planning and project management, user and task analysis, document and interface design, usability testing. Includes laboratory exercises and design projects.

**TCO 363. Instructional Design** (3-0-3)

Prerequisites: TCO 285, TCO 341.

Theory and practice of designing information products for teaching or training; includes concepts of adult learning theory, delivery in various models (face to face, online, on CD, etc.), and evaluation of learning. Students participate in a major course project including planning and project management, instructional design, and training.

**TCO 376. Visual Communication** (3-0-3)

Prerequisite: TCO 285 or permission of instructor.

Introduction to theoretical and applied principles of visual communication. The course explores theories of visual communication which help us understand the structure and organization of the visual world, and explores practical applications

of these principles in planning and designing visual systems for new, emerging media. Includes laboratory exercises and design projects.

**TCO 421. Technical Editing (3-0-3)**

Prerequisite: TCO 341.

A workshop course covering the essential tasks performed by technical editors, including editing for grammar, style, form, and content; organizational principles for reader-centered texts; integrated use of art, figures, and numbers in layout; indexing; and managing people and processes in all phases of document preparation. Attention is given to the editor's role in dealing with authors, audiences and purpose, and to the complex analytical skills required for technical editors.

**TCO 476. Communication in High-Tech Environments (3-0-3)**

Prerequisite: TCO 341.

This senior capstone course focuses on a topic of significance in the future of technical communication. Through research and presentations, students generate a body of knowledge and identify critical issues related to the future of technical communication.

**TCO 480. Introduction to Senior Design or Internship (0-1-0)**

Prerequisites: TCO 341 and at least two additional required TCO Core Courses. Course provides guidance for selecting either Senior Design or Internship options. To successfully complete the course, students will either (a) establish a team and select a design project, or (b) find an appropriate full-time internship. Seminars will be conducted to assist students in creating portfolios, defining projects, creating an action plan, and interviewing with potential clients or employers. Seminar attendance is required to obtain a satisfactory course grade. Graded S/U.

**TCO 487, 488. Senior Design Exhibit I, II (1-3-2, 1-3-2)**

Prerequisites: TCO 341, senior standing, permission of chair of TCO department. Technical communication design project in small groups; plan, design, produce, test, and revise a technical document or product under faculty supervision. Prepare presentations at both proposal and final phases. Students must design document(s) or products appropriately for audience and purpose; master technical content, organization, and layout; use appropriate technology; and write with clarity and precision. Professional presentational skills are expected. TCO 488 includes Graduation Exhibit.

**TCO 496. Technical Communication Internship (1-0-3)**

Prerequisite: permission of chair of TCO department.

Corequisite: TCO 498.

This full-time, semester-long internship is the preferred option for TCO majors. Provides the student with practical experience in a technical communication setting, under the supervision of a faculty member. A journal and written report will be submitted, along with documents produced in the internship, if applicable. Interns will deliver a seminar for faculty and students on their internship experience (see TCO 498). Graded S/U

**TCO 498. Graduation Exhibit (1-0-1)**

Prerequisite: senior status.

Corequisite: TCO 496.

Public presentation of portfolio, seminar, or other senior capstone exhibits. Required for students selecting TCO 496, Internship, rather than TCO 487-488, Senior Design Project.

SPECIAL COURSES: TCO 491, 492, 493, 499 for variable credit. May be repeated for credit with approval of academic advisor and department chair.

**TCO 491-492-493. Special Topics (1-6 hours)**

**TCO 499. Independent Study (1-6 hours)**