IX School of Engineering

Russell A. Primrose, Dean
James L. McGraw, Associate Dean for Engineering Technology

The School of Engineering has as its purpose the preparation of men and women for professional careers in engineering and in technology in order that they may assume responsible positions of a technical or semi-technical nature in business, industry, education, and government. Of primary concern is the development of professional competencies and philosophies within the various engineering and technology disciplines as well as a broad outlook on the technical and social problems that confront society. Additionally, the engineering and technology programs provide excellent background for other career areas.

The engineering program in each of the fields of chemical, civil, electrical, and mechanical engineering is designed to lead to a bachelor's degree in a four-year period. While students pursue curricula they themselves have chosen according to their fields of interest, they all take certain core courses in mathematics, chemistry, physics, English, computer science, and engineering fundamentals. Each engineering program permits additional concentrations of study in such areas as energy conversion, industrial and systems engineering, environmental engineering, aerospace engineering, and materials science. Although emphasis is on fundamental theory, continued attention is paid to the solution of practical problems which the student will encounter in the practice of engineering. As an educational unit of a private university, the School of Engineering strongly emphasizes the counseling of students in order that they may achieve their educational objectives within the engineering program. Each student is assigned a faculty advisor. Academic counseling begins prior to the students' formal course work and continues as they progress toward their objectives.

The engineering technologist is concerned with the application of established scientific and engineering knowledge and methods. Therefore, engineering technology programs consist of courses especially designed to emphasize the use of engineering knowledge. The engineering technologist is usually involved in the design, testing, and sales of products and equipment; the design management of manufacturing systems; or the supervision of other technologists.

The Engineering Technology Division of the School of Engineering has as its objective the collegiate education of young men and women to be competent engineering and scientific technologists.

It is the philosophy of the Engineering Technology Division that this objective is best accomplished by

1. Providing specialized technical courses that emphasize rational thinking and the application of scientific principles to the practical solution of technological problems,
2. Providing courses in mathematics and basic science sufficient to support the technical courses and to prepare the student for future growth, and
3. Providing education to prepare students to communicate intelligently and to take their places in society as responsible, humane citizens.

The broader responsibilities of the engineering profession demand that the professional training of an engineer include a significant component of humanities, ethics, and social science studies in order that the student will become aware of the urgent problems of society and develop a deeper appreciation of the cultural achievements of humanity. Additionally such humanistic-social studies provide the proper framework to insure that scientific discoveries and developments by engineers may result in the real advancement of the human race.

TRANSFER STUDENTS

The engineering programs welcome transfer students from both community and senior colleges and work closely with many schools to facilitate transfers from pre-engineering programs. Students may complete the first two years of study in other accredited institutions and transfer to the University of Dayton with little or no loss of credit provided that they have followed programs similar to those prescribed by the University of Dayton School of Engineering.

The School of Engineering has dual degree arrangements with Wilberforce University and the College of Mount St. Joseph (Ohio) as well as curriculum agreements with Thomas More College, Brescia College, and Sinclair Community College.

The engineering technology programs welcome transfer students from associate degree programs in engineering technology who wish to pursue the Bachelor of Technology degree. Graduates of two-year associate degree programs in engineering technology should normally expect to undertake at least two additional years of work for the Bachelor of Technology.

OPTIONAL COOPERATIVE EDUCATION PROGRAM

Students majoring in chemical engineering, electrical engineering, mechanical engineering, chemical technology, electronic engineering technology, and mechanical engineering technology may participate in the Cooperative Education Program. To be eligible, they must have completed three semesters and have a cumulative grade point average of not less than 2.3. Those applying for the program will be accepted on the basis of grade point average, motivation, and attitude. The number of students placed depends on the availability of jobs. The Cooperative Education Program offers the student the opportunity to place classroom work into practical use while still in school, resulting in early career identification and greater motivation as well as providing a source of funds. See also Chapter X.

MINORS IN ENGINEERING

The student majoring in chemical, electrical, or mechanical engineering may choose a minor concentration area of technical study. The minors program in the School of Engineering provides an opportunity to specialize in a particular technical subarea while still pursuing a major program of study in one of the traditional and well recognized engineering disciplines. The minors program was designed in response to the needs of industry and government and to the educational needs and career objectives of students. Election of the minor is optional; it does not add extra courses or degree requirements for graduation.

The minor concentration is defined as 12 semester hours of work. It can be composed of any number of 1- to 3-semester-hour courses selected from the approved list of minor areas of study, which currently includes the following:

Aerospace Engineering
Automatic Control Systems
(Bio-Engineering)*
Chemical Processing
Circuit Analysis and Synthesis
Digital Systems
Dynamic Analysis of Mechanical Systems
Electromagnetics
Energy Conversion
Engineering and Public Policy
Environmental Engineering
Industrial and Systems Engineering
Magnetics
Materials Engineering
Structures
Thermal Engineering

Students, in conjunction with their faculty advisors, normally select the minor concentration in the second semester of the sophomore year. The minor concentration is designated on the student's transcript.

*Although the absence of a bio-engineering supporting department or departmental specialty curriculum prevents the offering of a bio-engineering minor, the courses constitute a preparation for bio-engineering graduate work. "Bio-Engineering preparation" would appear on the student's transcript.

ENGINEERING FRESHMAN REQUIREMENTS

Students who are recent high school graduates or who have earned fewer than 15 semester hours of collegiate credit are classified as new freshmen and must meet the common engineering program requirements as detailed below. Such credit requirements may be met in a number of ways, including (1) advanced college-level course work at the University of Dayton or other collegiate institutions; (2) CLEP, CEEB, or other advanced-standing testing; (3) departmental examination during the first term, or work experience equivalent; or (4) taking the prescribed courses as part of the freshman year. Each request for advanced standing by credit must be initiated by the student in consultation with the engineering faculty counselor to the office of the dean of engineering.

Students admitted as undeclared will be accepted into departments of their choice on a space-available basis.

REQUIRED FIRST-YEAR PROGRAM

Dept.	*No.*	*Courses*	*Semester Hours*
CPS	132	Engineering FORTRAN (EGR 132)	2
CHM	123	General Chemistry	4
EGM	101	Mechanics I	3
EGR	103	Introduction to Engineering[1]	2
ENG	111	College Composition I[2]	4
MTH	118-119	Analytic Geometry and Calculus I, II	8
MEE	106L	Engineering Design Graphics	2
PHY	206	General Physics I	3
—	—	Humanistic-social studies elective	3
—	—	Philosophy or religious studies	3
		Total first-year credit requirements	**34**

[1]An introduction to the School of Engineering, the profession and career areas of engineering, and engineering problem solution.

[2]Required of every student. ENG 111 credit may be granted for successful performance on CLEP or CEEB Advanced Placement. The ENG 111 requirement may be waived, but no credit granted, for successful performance on the TSWE part of SAT, ACT, or the University-administered placement test. Students who satisfy the ENG 111 requirement in either of these ways take ENG 112 in the freshman year, except chemical engineering students, who take CHM 124 and postpone ENG 112 until the sophomore year. Other chemical engineering students take CHM 124 in place of humanistic-social studies elective in the freshman year.

DEGREE REQUIREMENTS

A student enrolls in the curriculum prescribed for the academic year in which he or she is registered as a freshman at the University of Dayton or elsewhere. If for any reason it is necessary or desirable to change to a subsequently established curriculum, the student must meet all of the requirements of the new curriculum.

The degree—Bachelor of Chemical, Civil, Electrical, or Mechanical Engineering—is conferred at commencement if the following requirements have been fulfilled:

1. All prescribed courses outlined in the respective curricula must have been passed (with grades of D or better). Although courses may be scheduled in terms other than as listed, all prerequisites and corequisites must be met.

2. The cumulative quality-point average in the student's engineering curriculum must be at least 2.0 (C average).

3. The student must have attended the School of Engineering at the University of Dayton during the senior year, carrying at least 30 semester hours.

4. An Engineer-in-Training examination will be required of the student, but not counted toward graduation.

5. Proficiency in communication skills will be required.

The semester hours of credit required for graduation in each engineering curriculum administered by the School of Engineering are as follows:

Bachelor of Chemical Engineering	133
Bachelor of Civil Engineering	134
Bachelor of Electrical Engineering	136
Bachelor of Mechanical Engineering	134

5-YEAR COMBINED BACHELOR'S-MASTER'S ENGINEERING PROGRAM

The School of Engineering offers a combined 5-year program leading to both a bachelor's degree in a departmental major (chemical, civil, electrical, or mechanical engineering) and a master's degree. Physics majors (College of Arts and Sciences) may also participate. The program is designed for the qualified student who wishes to pursue either greater specialization in a major area or to

complement the undergraduate program with a related graduate-level concentration. Most students who would select the program would have received some advanced placement upon entry to engineering at the freshman level or would have taken occasional summer courses either at the University of Dayton or at universities near their homes.

The formal request for entrance into this program is made prior to the first semester of the student's junior year. Admission requirements include a minimum cumulative grade point average of 2.8 and permission from the chairperson of the department corresponding to the student's undergraduate major. Selection of the graduate (master's) program area is indicated below:

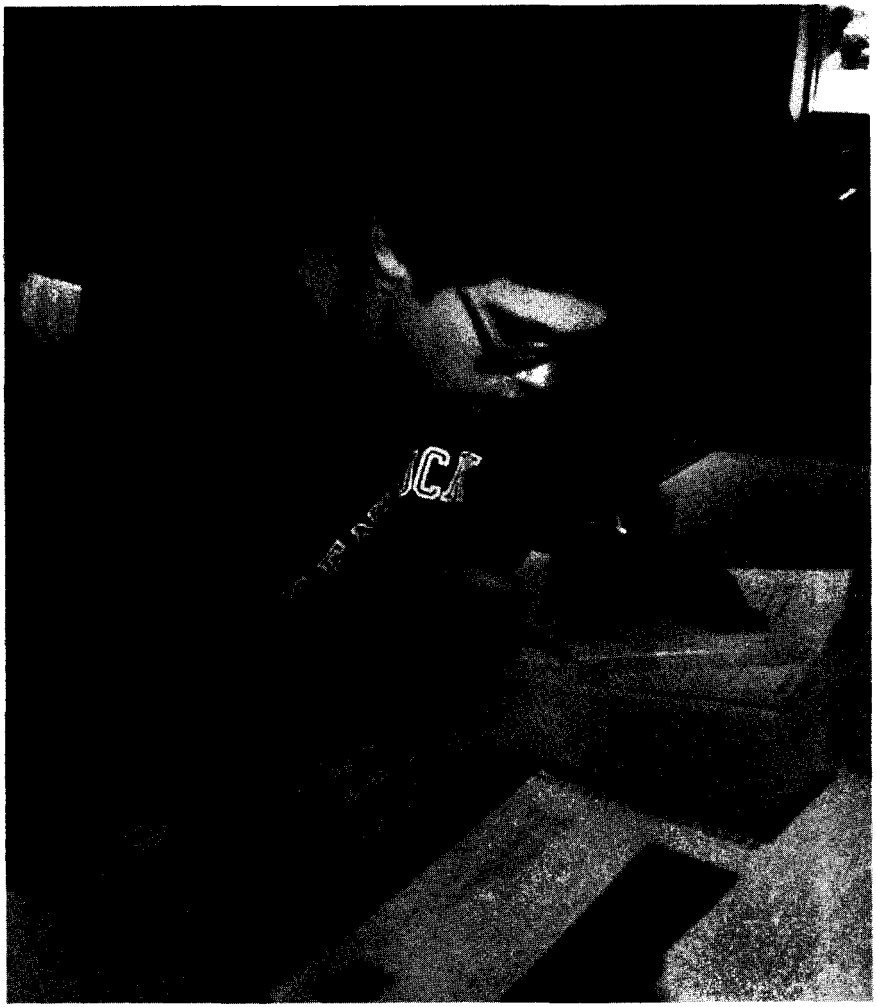
Undergraduate Program	*Graduate Program Selections*
Chemical Engineering	Aerospace Engineering Chemical Engineering Engineering Management Engineering Science Materials Engineering
Civil Engineering	Civil Engineering Engineering Management Engineering Science Materials Engineering
Electrical Engineering	Aerospace Engineering Electrical Engineering Engineering Management Engineering Science Materials Engineering
Mechanical Engineering	Aerospace Engineering Engineering Management Engineering Science Materials Engineering Mechanical Engineering
Physics	Materials Engineering

The department chairperson and the graduate program director serve as an advisory committee to the student in establishing the 5-year combined program requirements. The freshman, sophomore, and junior years follow the curriculum of the student's selected bachelor's program. The guideline curriculum requirements for the 4th and 5th years are given below.

A student who elects the 5-year combined program must satisfy both undergraduate and graduate degree requirements as to required cumulative grade point average for graduation. The graduate of the combined program will receive a bachelor's degree in the undergraduate major (e.g., Bachelor of Mechanical Engineering), and a master's degree in the graduate area (e.g., Master of Science in Materials Engineering). A student in the 5-year combined program who chooses not to complete the program must complete all the undergraduate major program requirements to receive the bachelor's degree.

PROGRAM—EN6: 5-YEAR BACHELOR'S-MASTER'S PROGRAM

Course Area	*Semester Hours*	
Senior Year	1st Term	2nd Term
Undergraduate department major	11	11
Undergraduate department or University requirement or electives	3	3
Graduate major (graduate credit)	3	3
	17	17
Fifth Year		
Graduate major (including thesis or project)	12	12



CHEMICAL ENGINEERING (CME)

Chemical engineering applies the principles of the physical sciences, economics, and human relations to fields that pertain to processes and process equipment in which matter is treated to effect a change in state, energy, or composition.

The first part of the chemical engineering curriculum provides a firm foundation in mathematics, physics, and chemistry. The chemistry background is stressed. Courses include general, organic, and physical chemistry. The second part of the curriculum stresses chemical engineering topics such as transport phenomena, thermodynamics, kinetics, unit operation and processes, process control, materials of construction, and design.

The Chemical Engineering Department offices are in the Kettering Building and the laboratories in Wohlleben Hall. Three stories of the north wing of Wohlleben Hall house the Unit Operations Laboratory. Experimental equipment includes units for the study of fluid flow, heat transfer, distillation, extraction, filtration, evaporation, and drying. The Process Control and Transport Phenomena Laboratories are on the second floor. The Thermal Combustion Laboratory is on the third floor. In addition, the department has a woodworking shop, a pipe-fitting shop, an analytical laboratory, and a darkroom.

The curriculum in chemical engineering serves as basic training for graduate study or for positions in diverse areas of the chemical industry.

Those interested in pursuing careers in medicine or biochemical engineering should contact the department chairperson.

PROGRAM—EN1: BACHELOR OF CHEMICAL ENGINEERING (CME)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Sophomore Year		
CME	203	Material and Energy Balances	3-0-3	
CME	204	Experimental Methods for Chemical Engineers		3-0-3
CHM	313-314	Organic Chemistry	3-3-4	3-3-4
ENG	112	College Composition II	3-0-3	
MTH	218	Analytic Geometry and Calculus III	4-0-4	
MTH	219	Applied Differential Equations		3-0-3
—	—	Philosophy or religious studies		3-0-3
PHY	207-208	General Physics II, III	3-0-3	3-0-3
			17	16
		Junior Year		
CME	305	Thermodynamics		3-0-3
CME	324-325	Transport Phenomena	3-0-3	3-0-3
CME	326L	Transport Phenomena Laboratory		0-3-1
CME	381	Applied Mathematics for Chemical Engineers	3-0-3	
CME	408B	Seminar	1-0-0	1-0-0
CHM	303-304	Physical Chemistry	3-3-4	3-0-3
ELE	321	Basic Electric Theory		3-0-3
—	—	Philosophy or religious studies	3-0-3	
—	—	Engineering elective		3-0-3
—	—	Humanistic-social studies elective	3-0-3	
			16	16

		Senior Year		
CME	306	Kinetics	3-0-3	
CME	408B-A	Seminar	1-0-0	1-0-1
CME	411-412	Unit Operations I, II	3-0-3	3-0-3
CME	413L-414L	Unit Operations Laboratory	0-5-2	0-5-2
CME	430-431	Chemical Engineering Design	3-0-3	3-0-3
CME	452	Process Control	3-0-3	
CME	453L	Process Control Laboratory		0-3-1
CME	—	Technical electives		3-0-3
—	—	Humanistic-social studies elective		3-0-3
—	—	Philosophy or religious studies	3-0-3	
			17	16

[1]For example: 3-0-3 means 3 class hrs., 0 lab. hrs., 3 sem. hrs. credit.

FACULTY

Edmund J. Rolinski, *Chairperson*
Professors: Primrose, Rolinski, Servais
Associate Professor: Lu
Assistant Professors: Sandhu, Sandy, Lee
Adjunct Associate Professor: Moon
Adjunct Assistant Professor: Kessler
Part-time Instructors: Fasano, Griffin

COURSES OF INSTRUCTION

CME 203. MATERIAL AND ENERGY BALANCES: Introduction to chemical engineering with lectures and problems on material and energy balances as applied to industrial processes. Prerequisites: CHM 123, MTH 118. First term, each year. *3 sem. hrs.*

CME 204. EXPERIMENTAL METHODS IN CHEMICAL ENGINEERING: Introduction to chemical engineering instrumentation, data analysis, experiment design, and report writing with applications in thermofluidmechanics. Prerequisites: CME 203, CHM 124L. Second term, each year. *3 sem. hrs.*

CME 305. THERMODYNAMICS: Development of the fundamental principles of thermodynamics, particularly with respect to chemical engineering processes. Prerequisite: MTH 218. *3 sem hrs.*

CME 306. KINETICS: Reaction kinetics, catalysis, and adsorption. Prerequisite: CME 305. First term, each year. *3 sem. hrs.*

CME 324. TRANSPORT PHENOMENA I: Viscosity, shell momentum balances, isothermal equations of change, thermal conductivity, shell energy balances, nonisothermal equations of change, diffusivity, concentration profiles. Prerequisite: MTH 219. Corequisite: CME 381. *3 sem. hrs.*

CME 325. TRANSPORT PHENOMENA II: Friction factor, dimensionless correlations, isothermal macroscopic balances, Bernoulli's Equation, heat transfer coefficients, heat transfer correlations, heat exchangers, nonisothermal macroscopic balances. Prerequisite: CME 324. Second term, each year. *3 sem. hrs.*

CME 326L. TRANSPORT PHENOMENA LABORATORY: Viscosity, velocity profiles, temperature profiles, heat transfer coefficients, diffusivity, compressibility factors for gases. Prerequisite: CME 324. Corequisite: CME 325. Second term, each year. *1 sem. hr.*

CME 381. ADVANCED MATHEMATICS FOR CHEMICAL ENGINEERS: Study of mathematics to support transport phenomena and process control. Vector calculus, solution of partial differential equations, and Laplace transforms. Prerequisite: MTH 219. First term, each year. *3 sem. hrs.*

CME 408A. SEMINAR: Presentation of lectures on contemporary chemical engineering subjects by students, faculty, and engineers in active practice. Registration required of all students in their last term prior to graduation. *1 sem. hr.*

CME 408B. SEMINAR: Presentation of lectures on contemporary chemical engineering subjects by students, faculty, and engineers in active practice. Registration required of all junior and senior students not registered in CME 408A. *no credit*

CME 411. UNIT OPERATIONS I: Fluid mechanics, transportation of fluids, flow of heat, evaporation, filtration, and mixing. Prerequisites: CME 324-325. First term, each year. *3 sem. hrs.*

CME 412. UNIT OPERATIONS II: Continuation of CME 411. Distillation, extraction, gas phase mass transfer, gas absorption, drying, and crystallization. Prerequisite: CME 411. Second term, each year. *3 sem. hrs.*

CME 413L. UNIT OPERATIONS LABORATORY: Unit operations equipment and its utilization. Prerequisite: CME 324. First term, each year. *2 sem. hrs.*

CME 414L. UNIT OPERATIONS LABORATORY: Continuation of CME 413L. Prerequisite: CME 325. Second term, each year. *2 sem. hrs.*

CME 430. CHEMICAL ENGINEERING DESIGN I: Study of the principles of process development, plant design, and economics. Corequisite: CME 411. First term, each year. *3 sem. hrs.*

CME 431. CHEMICAL ENGINEERING DESIGN II: Application of the principles of process development, plant design, and economics. Prerequisite: CME 430. Second term, each year. *3 sem. hrs.*

CME 440. SYNTHETIC FUELS: Principles of synthetic fuels technology such as pyrolysis, gasification, gas shift and synthesis, and direct liquefaction, with economic and environmental considerations. Departmental elective. Prerequisites: CHM 304, CME 305, 306. Second term, each year. *3 sem. hrs.*

CME 452. PROCESS CONTROL: Block diagrams, system transfer functions, feedback, transient and steady state response, root locus method, frequency response, Bode diagrams, analog computer. Prerequisite: CME 381. First term, each year. *3 sem. hrs.*

CME 453L. PROCESS CONTROL LABORATORY: Analog computer programming, analog solution of differential equations, frequency response, Bode diagrams, computer simulation, open and closed loop system response. Report writing emphasized. Prerequisite: CME 452. *1 sem. hr.*

CME 499. SPECIAL PROBLEMS IN CHEMICAL ENGINEERING: Particular assignments to be arranged and approved by chairperson of the department. *1-6 sem. hrs.*

CIVIL ENGINEERING (CIE)

The Department of Civil Engineering and Engineering Mechanics has designed a curriculum to provide a thorough education in the principles fundamental to the civil engineering profession.

During the first two years, emphasis is on those subjects underlying all engineering—English, mathematics, chemistry, physics, graphics, surveying, and mechanics. The third and fourth years are devoted principally to technical subjects relative to environmental, highway, hydraulic, sanitary, soils, structural, and traffic engineering.

Engineering projects, completed or under construction, are visited under the guidance of the instructors. The Student Chapter of the American Society of Civil Engineers is very active, and close association is maintained with the Dayton Section of the American Society of Civil Engineers.

At the end of the junior year, students who appear to be qualified for graduate study may elect to plan their programs so as to complete certain courses during their senior year for graduate credit. Thus it is possible to complete the requirements for the bachelor's degree and the master's degree in a total of five years. (See introduction to this chapter.)

PROGRAM—EN2: BACHELOR OF CIVIL ENGINEERING (CIE)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*	
		Sophomore Year			Summer
CIE	211	Surveying	3-0-3		
EGM	303	Strength of Materials	3-0-3		
ENG	112	College Composition II	3-0-3		
MTH	218	Analytic Geometry and Calculus III	4-0-4		
PHY	207-208	General Physics II, III	3-0-3	3-0-3	
CIE	408	Seminar I	1-0-0	1-0-0	
CHM	124	General Chemistry		3-3-4	
CIE	212	Highway Geometrics		3-0-3	
EGM	301	Dynamics		3-0-3	
GEO	218	Engineering Geology		3-0-3	
MEE	227L	Engineering Graphics II		0-3-1	
CIE	215L	Surveying Field Practice			0-0-3
			16	17	3
		Junior Year			
CIE	313	Hydraulics	3-3-4		
EGM	304	Advanced Strength of Materials	3-0-3		
MTH	219	Applied Differential Equations	3-0-3		
CIE	408	Seminar I	1-0-0	1-0-0	
—	—	Philosophy and/or religious studies	6-0-6	3-0-3	
CIE	310L	Civil Engineering Laboratory		0-3-1	
CIE	312	Soil Mechanics		3-3-4	
CIE	315	Theory of Structures		3-0-3	
CIE	333	Sanitary Engineering I		3-0-3	
—	—	Humanistic-social studies elective		3-0-3	
			16	17	

		Senior Year		
CIE	403	Transportation Engineering	3-0-3	
CIE	408	Seminar I	1-0-0	
CIE	415	Steel Structure Design	3-0-3	
CIE	417	Reinforced Concrete	3-0-3	
CIE	434	Sanitary Engineering II	3-0-3	
CIE	—	CIE electives	3-0-3	3-0-3
CIE	406	Indeterminate Structures		3-0-3
CIE	418	Structural Design Projects		1-6-3
CIE	428	Seminar II		1-0-1
ISE	402	Engineering Economy		3-0-3
—	—	Engineering elective		3-0-3
			15	16

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., 3 sem. hrs. credit.

FACULTY

Seymour J. Ryckman, *Acting Chairperson*
Professors: Ryckman, Thomson
Associate Professors: Payne, Phillips, G. Shaw, Weiss
Assistant Professor: Anessi
Instructor: Saliba
Adjunct Associate Professor: Palazotto

COURSES OF INSTRUCTION

CIE 211. SURVEYING: Theory of measurements, computation and instrumentation. Boundary and construction surveys, celestial observations, triangulation and level net adjustments, elementary geodesy, and state coordinate systems. Corequisite: MTH 118. First term, each year. *3 sem. hrs.*

CIE 212. HIGHWAY GEOMETRICS: Study of photogrammetry, circular and spiral curves, vertical curves, grade lines, earthwork and mass diagram, slope and grade stakes, contour grading, and use of aerial photographs. Prerequisite: CIE 211. Second term, each year. *3 sem. hrs.*

CIE 215L. SURVEYING FIELD PRACTICE: Field work and computation in topography, highway surveying, triangulation, level net, celestial observations, evaluation of errors, and preparation of plans. Five eight-hour days a week for three weeks. Prerequisite: CIE 212. Summer each year. *3 sem. hrs.*

CIE 310L. CIVIL ENGINEERING LABORATORY: Experiments and studies relating the engineering properties of certain building materials to their fundamental nature and composition. Prerequisite: EGM 303. Second term, each year. *1 sem. hr.*

CIE 312. SOIL MECHANICS: Principles of soil structures, classification, capillarity, permeability, flow nets, shear strength, consolidation, stress analysis, slope stability, lateral pressure, bearing capacity, and piles. Corequisites: CIE 312L, EGM 304. Second term, each year. *3 sem. hrs.*

CIE 312L. SOIL MECHANICS LABORATORY: Laboratory tests to evaluate and identify soil properties for engineering purposes. Design problems included. Corequisite: CIE 312. Second term, each year. *1 sem. hr.*

CIE 313. HYDRAULICS: Principles of liquid statics and fluid flow including similitude, measuring devices, channel and pipe flow, turbines, and pumps. Corequisites: CIE 313L, EGM 301. First term, each year. *3 sem. hrs.*

CIE 313L. HYDRAULICS LABORATORY: Laboratory experiments and problems associated with CIE 313. Corequisite: CIE 313. First term, each year. *1 sem. hr.*

CIE 315. THEORY OF STRUCTURES: Analysis of statically determinate trusses, beams, and frames subjected to fixed and moving loads. Prerequisite: EGM 303. Second term, each year. *3 sem. hrs.*

CIE 333. SANITARY ENGINEERING I: Integrated study of the principles of water sanitation, water supply, stream pollution abatement, and waste water disposal systems. Prerequisites: CIE 313, 313L. Second term, each year. *3 sem. hrs.*

CIE 390. ENVIRONMENTAL POLLUTION CONTROL: Study of environmental pollution problems relating to air, water, and land resources. Causes and effects of pollution; technology for solving the problems. Legal and political considerations. For juniors and seniors other than civil engineering students. Credit may not be applied toward civil engineering degree. Prerequisite: Some knowledge of chemistry. *3 sem. hrs.*

CIE 403. TRANSPORTATION ENGINEERING: Fundamentals of transportation engineering, including design, construction, maintenance, and economics of transportation facilities. Prerequisites: CIE 310L, 313. *3 sem. hrs.*

CIE 406. INDETERMINATE STRUCTURES: Analysis of statically indeterminate trusses, beams, and frames subjected to fixed and moving loads. Prerequisite: CIE 315. Second term, each year. *3 sem. hrs.*

CIE 408. SEMINAR I: Practice in the presentation and discussion of papers; lectures by staff and prominent engineers. Attendance required of all civil engineering sophomores, juniors, and nongraduating seniors. *No credit*

CIE 415. STEEL STRUCTURE DESIGN: Design and behavior of structural steel connections, columns, beams, and plate girders subjected to tension, compression, bending, shear, torsion, and composite action. Prerequisite: EGM 304. First term, each year. *3 sem. hrs.*

CIE 417. REINFORCED CONCRETE: Design and behavior of reinforced concrete slabs, beams, columns, walls, and footings subjected to tension, compression, bending, shear, and torsion. Prerequisites: CIE 310L, 315. First term, each year. *3 sem. hrs.*

CIE 418. STRUCTURAL DESIGN PROJECTS: Continuation of CIE 415 and 417, where the student applies knowledge of reinforced concrete and structural steel in designing and studying behavior of complete structures. Prerequisites: CIE 415, 417. Corequisite: CIE 406. Second term, each year. *3 sem. hrs.*

CIE 421. CONSTRUCTION ENGINEERING: Organization, planning, and control of construction projects, including a study of the use of machinery, economics of equipment, methods, materials, estimates, cost controls, and fundamentals of CPM and PERT. Departmental elective. Corequisite: CIE 403. *3-sem. hrs.*

CIE 428. SEMINAR II: Practice in the presentation and discussion of papers; lectures by staff and prominent engineers. Attendance required of civil engineering second-term seniors only. First and second terms, each year. *1 sem. hr.*

CIE 434. SANITARY ENGINEERING II: Continuation of CIE 333 with brief considerations of municipal and rural sanitation. Prerequisites: CHM 124, CIE 333. First term, each year. *3 sem. hrs.*

CIE 499. SPECIAL PROBLEMS IN CIVIL ENGINEERING: Particular assignments to be arranged and approved by chairperson of the department. Departmental elective. *1-6 sem. hrs.*

In addition to courses listed above, students may select with departmental approval civil engineering (CIE) and engineering mechanics (EGM) courses in the 500 series listed in the Graduate Issue of the Bulletin, including such courses as advanced structural analysis, structural analysis by computers, prestressed concrete, plastic design in steel, advanced soil mechanics, foundation design, traffic engineering, advanced sanitary engineering, industrial waste treatment, hydrology and seepage, advanced hydraulics, sanitary chemistry, experimental stress analysis, analytical dynamics, applied elasticity, theory of elasticity, and special problems in civil engineering.

ELECTRICAL ENGINEERING (ELE)

The curriculum of the Department of Electrical Engineering is planned with the primary objective of providing a thorough knowledge of the fundamental laws of electricity and the application of these laws in electrical engineering.

Courses are arranged to offer students an understanding of basic principles and practices common to the various fields of electrical engineering, so that they are prepared to begin specialization in their chosen fields or to pursue advanced study.

Proper attention is directed to an appreciation of the practical economic factors in the electrical world and to the cultural and social qualities necessary for a successful career in the engineering profession.

PROGRAM—EN3: BACHELOR OF ELECTRICAL ENGINEERING (ELE)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Sophomore Year		
ENG	112	College Composition II		3-0-3
ELE	231-232	Circuit Theory I, II	3-0-3[1]	3-0-3
ELE	233	Field Theory I		3-0-3
ELE	235	Digital System Design		3-0-3
MTH	218	Analytic Geometry and Calculus III	4-0-4	
MTH	219	Applied Differential Equations		3-0-3
—	—	Philosophy or religious studies	3-0-3	
PHY	207-208	General Physics II, III	3-0-3	3-0-3
—	—	Communication arts or speech elective	3-0-3	
			16	18
		Junior Year		
EGM	301	Dynamics	3-0-3	
ELE	312-313	Electronics I, II	3-0-3	3-0-3
ELE	314	Principles of Microcomputer Design		3-0-3
ELE	331	Circuit Theory III	3-0-3	
ELE	333	Field Theory II	3-0-3	
ELE	335L-336L	Electrical Engineering Laboratory I, II	0-2-1	0-2-1
ELE	338L	Electrical Engineering Laboratory III		0-2-1
ELE	340	Probability and Discrete Systems		3-0-3
ELE	410B	Seminar	1-0-0	1-0-0
—	—	Humanistic-social studies elective	2-0-2	
—	—	Philosophy or religious studies	3-0-3	
MTH	—	Mathematics elective[2]		3-0-3
—	—	Technical elective		3-0-3
			18	17
		Senior Year		
—	—	Engineering thermodynamics elective	3-0-3	
ELE	410B-A	Seminar	1-0-0	1-0-1
ELE	413	Communication Engineering	3-0-3	
ELE	431	Energy Conversion	3-0-3	
ELE	432	Automatic Control Systems		3-0-3
ELE	435L-436L	Electrical Engineering Laboratory IV, V	0-2-1	0-2-1
ELE	437L	Electrical Engineering Laboratory VI		0-2-1
—	—	Technical electives	3-0-3	3-0-3
—	—	Philosophy or religious studies	3-0-3	
—	—	Humanistic-social studies elective		3-0-3
—	—	Communication arts or speech elective		3-0-3
ISE	313	Engineering Law		2-0-2
			16	17

[1]For example: 3-0-3 means 3 class hrs., 0 lab. hrs., 3 sem. hrs. credit.
[2]Selected from list approved by the Department of Electrical Engineering.

FACULTY

Bernhard M. Schmidt, *Chairperson*
Professors: Lewis, Schmidt, Strnat, Thiele
Associate Professors: Evers, Kubach, Rogers
Assistant Professor: Williamson
Adjunct Assistant Professor: Mildrum

COURSES OF INSTRUCTION

ELE 231. CIRCUIT THEORY I: Principles of linear circuit theory. Analysis of resistive circuits having constant or time varying sources. Analysis of transient and steady state behavior of simple circuits containing R, L, and C. Introduction to ECAP. Corequisite: MTH 119. *3 sem. hrs.*

ELE 232. CIRCUIT THEORY II: Sinusoidal analysis: sinusoidal forcing function, phasor concept, steady-state response, resonance, average power and rms values, magnetically coupled circuits, polyphase circuits. Prerequisite: ELE 231. *3 sem. hrs.*

ELE 233. FIELD THEORY I: Vector calculus, static electric fields, conductors, dielectric materials, boundary conditions, field mapping, steady electric currents and their magnetic fields, motion of charged particles. Prerequisite: MTH 218. *3 sem. hrs.*

ELE 235. DIGITAL SYSTEM DESIGN: Logical variables and functions, combinational circuits, sequential circuits, controller design, simple computer design, microprocessors, input/output operations. Prerequisite: ELE 231. *3 sem. hrs.*

ELE 312. ENGINEERING ELECTRONICS I: A first course on the terminal behavior of electron devices. Qualitative physical descriptions, volt ampere curves, graphical solutions. Formulation of incremental and piecewise linear models. Analysis of simple amplifier circuits. Prerequisite: ELE 232 or 321. *3 sem. hrs.*

ELE 313. ENGINEERING ELECTRONICS II: Cascaded amplifiers, feedback amplifiers, linear integrated circuits; steady state and transient response. Oscillators. Digital and switching circuits. Prerequisite: ELE 312. Corequisite: ELE 331. *3 sem. hrs.*

ELE 314. PRINCIPLES OF MICROCOMPUTER DESIGN: Fundamentals of computer architecture. Representation of data and instructions. Methods of transforming information. Memory devices and structures. Interfacing to external devices. Applications and practical problems. Prerequisite: ELE 235, 312. *3 sem. hrs.*

ELE 321. BASIC ELECTRIC THEORY: Fundamental methods of analysis in DC and AC circuits. For chemical, civil, and mechanical engineering students. Prerequisites: PHY 207, MTH 218. *3 sem. hrs.*

ELE 331. CIRCUIT THEORY III: Analysis of transient and steady-state behavior of circuits containing R, L, and C. Use of Laplace transform techniques in circuit theory. Introduction to periodic phenomena and Fourier series analysis. Prerequisites: ELE 232, MTH 219. *3 sem. hrs.*

ELE 333. FIELD THEORY II: Magnetic fields, forces, energy storage; theory of magnetic materials, engineering materials, magnetic circuits; inductance, practical inductors; time varying fields; Maxwell's equations. Prerequisite: ELE 233. *3 sem. hrs.*

ELE 335L. ELECTRICAL ENGINEERING LABORATORY I: Experimental situations stressing familiarization with electrical engineering concepts, hardware, devices, instrumentation, and techniques. Corequisite: ELE 232. *1 sem. hr.*

ELE 336L. ELECTRICAL ENGINEERING LABORATORY II: Quantitative experiments dealing with resonance, coupled circuits, magnetic circuits, instrumentation, and measurements. Prerequisite: ELE 335L. *1 sem. hr.*

ELE 338L. ELECTRICAL ENGINEERING LABORATORY III: Electron devices, amplifiers, feedback circuits, switching circuits, power electronics. Prerequisite: ELE 312. *1 sem. hr.*

ELE 340. PROBABILITY AND DISCRETE SYSTEMS: Foundations of probability theory. Conditional probability, random variables, and distribution functions. Discrete system equations, simulation techniques, and difference equations. Discrete signal processing, sampling and reconstruction, digital filtering. Prerequisites: ELE 235, 331. *3 sem. hrs.*

ELE 343. ELECTROMAGNETICS: Device- and design-related electromagnetics for nonmajors who wish to develop significant electrical engineering design competence. Electric and magnetic forces; energy storage; magnetic circuits; transmission lines; radiation; charged particle dynamics; electro-optic, magneto-optic, and acousto-electric devices. Prerequisite: MTH 219. *3 sem. hrs.*

ELE 410A. SEMINAR: Presentation of papers on contemporary electrical engineering by students; lectures by engineers in active practice. Required for second-term seniors. *1 sem. hr.*

ELE 410B. SEMINAR: Presentation of papers on contemporary electrical engineering by students; lectures by engineers in active practice. Required for juniors and first-term seniors. *No credit*

ELE 413. COMMUNICATION ENGINEERING: Amplitude, angle, and pulse modulation systems. Generation, deletion, and analysis of modulated signals. Power and bandwidth considerations. Introduction to information theory. Prerequisite: ELE 340. *3 sem. hrs.*

ELE 415. MICROWAVE ENGINEERING: Design-oriented course in microwave engineering. Communication, radar, industrial, scientific, and measurement applications described. Operating principles and specifications of current building-block subsystems investigated in sufficient depth to enable engineering design of microwave systems. Departmental elective. Prerequisites: ELE 413, 442. *3 sem. hrs.*

ELE 431. ENERGY CONVERSION: Properties and theory of magnetic circuits as applied to electro-mechanical energy conversion. Nonlinear magnetic devices. Introduction to rotating machine analysis. Field and circuit concepts of rotating machines. Rotating fields. Direct current, synchronous, and induction machines. Prerequisites: ELE 331, 333. *3 sem. hrs.*

ELE 432. AUTOMATIC CONTROL SYSTEMS: Open- and closed-loop systems, mathematical models for control systems, representation of feedback control systems, servomechanism characteristics, stability analysis. Prerequisite: ELE 331. Corequisite: ELE 431. *3 sem. hrs.*

ELE 435L. ELECTRICAL ENGINEERING LABORATORY IV: Digital logic, passive and active filters, networks transmission lines. Prerequisites: ELE 313, 338L. *1 sem. hr.*

ELE 436L. ELECTRICAL ENGINEERING LABORATORY V: Modulation, detection, communication electronics, communication subsystems. Prerequisite: ELE 435L. *1 sem. hr.*

ELE 437L. ELECTRICAL ENGINEERING LABORATORY VI: Experiments dealing with operating and performance characteristics of electromechanical energy converters, application of electronic control to power machinery, and operating and performance characteristics of automatic control systems. Corequisite: ELE 431. *1 sem. hr.*

ELE 438L. PROJECTS LABORATORY: Project-oriented laboratory applying engineering skills in the design, development, and demonstration of electrical and electronic devices. Departmental elective. Prerequisite: Permission of project advisor. *1-3 sem. hrs.*

ELE 440. PHYSICAL ELECTRONICS: Introduction to wave mechanics; electron ballistics; theory of metals and semiconductors; electron emission, space charge flow; modern electron devices. Departmental elective. Prerequisite: MTH 219. *3 sem. hrs.*

ELE 441. PULSE AND DIGITAL CIRCUITS: Transmission networks, differentiating circuits, clippers, comparators, clampers, the transistor as a switch, logic circuits, multivibrators, time base generators, and pulse amplification. Emphasis on application of modern semiconductor devices. Departmental elective. Prerequisite: ELE 313. *3 sem. hrs.*

ELE 442. ENGINEERING ELECTROMAGNETICS: Processing Maxwell's equations and applying the predictions to the analysis and design of engineering systems that make use of electromagnetic energy. ELF through optical frequencies; propagation, radiation, interactions with matter, guided waves, antenna fundamentals. Departmental elective. Prerequisite: ELE 333. *3 sem. hrs.*

ELE 443. INTRODUCTION TO ELECTRO-OPTICS: Introductory overview of the field, starting with Maxwell's equations and leading to lasers, holography, and other timely applications. Departmental elective. Prerequisite: ELE 333. *3 sem. hrs.*

ELE 444. ADVANCED DIGITAL DESIGN: Systems approach to digital design. Structured top-down development process using simple and complex logic modules from various logic families. Application of microcomputer or controller as a flexible logic device. Practical design problems with team and individual projects. Departmental elective. Prerequisites: ELE 314, 340. *3 sem. hrs.*

ELE 499. SPECIAL PROBLEMS IN ELECTRICAL ENGINEERING: Particular assignments to be arranged and approved by chairperson of department. Departmental elective. *1-6 sem. hrs.*

INTERDISCIPLINARY STUDIES (ENI)

Information on engineering interdisciplinary (ENI) courses is available in the Office of the Dean of the School of Engineering.

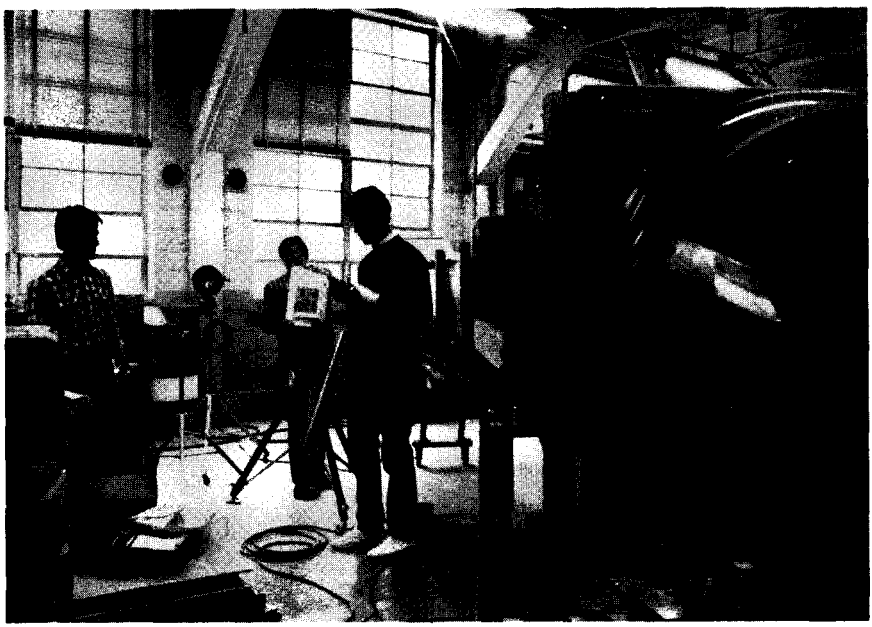
COURSES OF INSTRUCTION

ENI 310. SOCIETY AND TECHNOLOGY: For nonengineering students. The interaction of science, humanities, technology, and society. Study of current problems to which the interface between the liberal arts disciplines and the engineering disciplines may provide solutions. Interdisciplinary techniques for analyzing and decision making. No prerequisites. *3 sem. hrs.*

ENI 451. INTRODUCTION TO PUBLIC POLICY PLANNING: Introduction to public policy and program planning, the role of engineering in public policy formulation, systems approaches to complex decision making, introduction to interpretive structural modeling and its policy-oriented uses. *3 sem. hrs.*

ENI 455. SYSTEMS MODELING I: Introduction to the modeling of social systems, emphasizing feedback loops and their behavior; development of methods for understanding mechanisms underlying growth, stagnation, and cyclical fluctuations; formulation of models for industrial, economic, social, and ecological systems; laboratory digital simulation. *3 sem. hrs.*

ENI 456. SYSTEMS MODELING II: An individual or group project in guided research wth emphasis on modeling of economic, industrial, urban, ecological, and world systems. *3 sem. hrs.*



MECHANICAL ENGINEERING (MEE)

Mechanical engineering is an active, versatile branch of engineering. Mechanical engineers conceive, plan, design, and direct the manufacture of a wide variety of devices, machines, and systems used for purposes such as energy conversion, power generation, environmental control, transportation, and materials handling and processing. They are engaged in all of the engineering functions, including design, theoretical and applied research, development, sales engineering, and management.

The curriculum of the Department of Mechanical Engineering introduces the student to fundamental scientific and engineering theories and to the humanities, and provides training and practice in problem-solving techniques. It prepares the graduate engineer to apply these principles and methods to the solution of technological, social, and economic problems. The curriculum also provides the opportunity to continue study at the graduate level to complete the requirement for a master's degree in one additional year. The broad background provided by the mechanical engineering curriculum is often used as a basis for training in other fields, such as law, medicine, bio-engineering, and business management.

PROGRAM—EN4: BACHELOR OF MECHANICAL ENGINEERING (MEE)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Sophomore Year		
EGM	301	Dynamics	3-0-3[1]	
EGM	303	Strength of Materials	3-0-3	
ENG	112	College Composition II	3-0-3	
MTH	218	Analytic Geometry and Calculus III	4-0-4	
MEE	227L	Engineering Graphics II	0-3-1	
PHY	207-208	General Physics II, III	3-0-3	3-0-3
ELE	321	Basic Electric Theory		3-0-3
MTH	219	Applied Differential Equations		3-0-3
MEE	210L	Materials and Processes Laboratory[2]		1-4-2
MEE	301	Thermodynamics I		3-0-3
MEE	321	Theory of Machines		2-3-3
			17	17
		Junior Year		
MEE	302	Thermodynamics II	3-0-3	
MEE	308	Fluid Mechanics	3-0-3	
MEE	312	Engineering Materials	3-3-4	
MEE	315	Mechanical Engineering Analysis	4-0-4	
MEE	340L	Engineering Experimentation Laboratory[2]	0-4-2	
MEE	414B	Seminar	1-0-0	1-0-0
ELE	312	Engineering Electronics I		3-0-3
MEE	313	Manufacturing Processes		2-0-2
MEE	319	Mechanical Vibrations		3-0-3
MEE	410	Heat Transfer		3-0-3
—	—	Technical elective[3]		3-0-3
—	—	Philosophy or religious studies		3-0-3
			16	17

		Senior Year		
MEE	330	Engineering Economics	1-0-1	
MEE	402	Energy Conversion Systems	3-0-3	
MEE	423L	Mechanical Engineering Laboratory	0-9-3	
MEE	427	Mechanical Design I	3-3-4	
—	—	Fluid mechanics elective[4]	3-0-3	
MEE	435	Feedback Control Systems	3-0-3	
MEE	414B-A	Seminar	1-0-0	1-0-1
MEE	—	Mechanical engineering elective		3-0-3
—	—	Engineering elective		3-0-3
—	—	Free elective[5]		3-0-3
—	—	Philosophy and/or religious studies		6-0-6
			17	16

[1]For example: 3-0-3 means 3 class hrs., 0 lab. hrs., 3 sem. hrs. credit.

[2]One half of sophomore class takes MEE 210L first term; MEE 340L second term. One half of sophomore class takes MEE 340L first term; MEE 210L second term.

[3]Technical elective to be selected from engineering, mathematics, or science.

[4]To be selected from one of the following courses: MEE 418, 499 (topic in fluid mechanics only), 503, 532, 540, AEE 501.

[5]Course selected from University offerings with approval of advisor.

FACULTY

Howard E. Smith, *Chairperson*
Professors: Boehman, Bogner, Chuang, Minardi, Ray, Schauer, Smith, Wurst
Associate Professors: Doyle, Harmer
Assistant Professors: Havener, Jain
Instructor: Montgomery
Adjunct Professor: Weeks
Adjunct Assistant Professor: Endres

COURSES OF INSTRUCTION

MEE 106L. ENGINEERING DESIGN GRAPHICS I: Fundamentals of engineering graphics and the part that graphical communication plays in engineering. Application of these principles to the development of appropriate student team proposals and solutions of engineering design problems. Two hours lecture, four hours laboratory. *2 sem. hrs.*

MEE 209. MANUFACTURING PROCESSES: Casting processes, design of castings, casting defects; metal-working processes; metal shearing and forming; welding and allied processes, powder metallurgy. Prerequisites: CHM 123, MEE 106L, PHY 206. *1 sem. hr.*

MEE 210L. MATERIALS AND PROCESSES LABORATORY: Mechanics of metal cutting, study of machine tools and machining processes. Basic experiments in metal cutting and workshop metrology. Tensile testing of metals and polymers, creep and hardness testing, modulus of rupture. Industrial field trips. One hour lecture, four hours laboratory. Prerequisites: CHM 123, MEE 106L, PHY 206. *2 sem. hrs.*

MEE 227L. ENGINEERING GRAPHICS II: Training in the analysis and graphical solution of fundamental problems involving three dimensions and the applications of these solutions to engineering problems. Prerequisite: MEE 106L. *1 sem. hr.*

MEE 301. THERMODYNAMICS I: Concepts, definitions, and laws of thermodynamics. Properties of pure substances, introduction to use of thermodynamic property tables and equations of state. Applications of the laws of thermodynamics to processes, heat engines, and control volumes. Prerequisite: MTH 218. *3 sem. hrs.*

MEE 302. THERMODYNAMICS II: Gas and two-phase heating, cooling, and power cycles. Gas mixtures and air conditioning. Chemical reactions in combustion. Chemical equilibrium. Prerequisite: MEE 301. *3 sem. hrs.*

MEE 308. FLUID MECHANICS: Laws and theory relative to incompressible fluids, continuity, momentum, and energy relations in flow situations; internal and external flow in laminar and turbulent regimes. Prerequisites: MEE 301, MTH 219. *3 sem. hrs.*

MEE 310. ENGINEERING MATERIALS I: Electronic structure, bonding, metallic crystal structure, vacancies, dislocations, strengthening mechanisms, phase transformation, equilibrium diagrams, heat treatment, mechanical behavior of metals, metal selection. Prerequisite: MEE 210L or permission of instructor. *2 sem. hrs.*

MEE 311. ENGINEERING MATERIALS II: Crystal structures of ceramic materials, their manufacturing, mechanical properties, and applications. Polymer terminology, structures, manufacture, and properties. Mechanical properties of composite materials. Fundamentals of electrical, magnetic, optical, and thermal properties of engineering materials. Prerequisite: MEE 310. *2 sem. hrs.*

MEE 311L. MATERIALS LABORATORY: Determination of crystal structures, quantitative microscopy, equilibrium diagrams, crystallization, recovery, recrystallization and grain growth, heat treatment of ferrous and nonferrous alloys, corrosion. Corequisite: MEE 311. *1 sem. hr.*

MEE 312. ENGINEERING MATERIALS: Principles of the mechanical, electronic, magnetic, optical, and thermal behavior of metallic, ceramic, and polymeric materials. Introduction to fracture mechanics. Principles of corrosion. Prerequisite: EGM 303 or permission of instructor. Corequisites: MEE 210L, 312L. *3 sem. hrs.*

MEE 312L. MATERIALS LABORATORY: Experiments illustrating the behavior of metallic, ceramic, and polymeric materials. Strengthening mechanisms, crystallization, metallography, corrosion, thermal processing. Corequisite: MEE 312. *1 sem. hr.*

MEE 313. MANUFACTURING PROCESSES: Casting processes, design of castings, and casting defects; metal working processes; metal shearing and forming; welding processes; powder metallurgy; fabrication processes for plastics. Prerequisites: EGM 303, MEE 210L, 312. *2 sem. hrs.*

MEE 315. MECHANICAL ENGINEERING ANALYSIS: Problem formulation and mathematical modeling of engineering systems and control volumes. Development of computer skills; analysis and generalization of system responses. Introduction to vibration and heat transfer theory and to the application of Fourier series and partial differential equations to engineering problems. Prerequisites: CPS 132, MTH 219, MEE 301, PHY 207. *4 sem. hrs.*

MEE 316. MECHANICAL ENGINEERING ANALYSIS: Problem formulation and mathematical modeling of engineering systems and control volumes. Development of computer skills; analysis and generalization of system responses. Introduction to vibration and heat transfer theory and to the application of Fourier series and partial differential equations to engineering problems. Prerequisites: CPS 132, MTH 219, MEE 301, PHY 207. *3 sem. hrs.*

MEE 319. MECHANICAL VIBRATIONS: Undamped and damped, free and forced vibrations of single degree of freedom translational and rotational systems; vibration isolation and absorption; multi-degree of freedom systems, continuous system, transient vibration, approximate and numerical solution. Prerequisites: CPS 132, EGM 301, MTH 219. Corequisite: EGM 303. *3 sem. hrs.*

MEE 321. THEORY OF MACHINES: Kinematic and dynamic analysis of mechanisms and machines; study of machine elements such as linkages, cams, gears, gear trains, and differentials. Prerequisite: EGM 301. Corequisite: MEE 321L. *2 sem. hrs.*

MEE 321L. THEORY OF MACHINES LABORATORY: Laboratory exercises based on principles covered in MEE 321. Prerequisite: EGM 301. Corequisite: MEE 321. *1 sem. hr.*

MEE 330. ENGINEERING ECONOMICS: Basic principles and techniques of economic analysis of engineering projects. Prerequisite: MTH 119. *1 sem. hr.*

MEE 340L. ENGINEERING EXPERIMENTATION LABORATORY: Design of experiments; use of instrumentation; data acquisition and processing; error and statistical analysis; comparison to theory; oral presentation; technical report writing. Measurement of basic engineering properties including temperature, pressure, flow rate, power, frequency, displacements, friction, stress, voltage. Prerequisites: ENG 112, PHY 207. Corequisite: MTH 219. *3 sem. hrs.*

MEE 402. ENERGY CONVERSION SYSTEMS: Introduction to global energy concerns; fossil and nuclear fuels; energy consumption analysis; solar energy and alternative energy concepts; nuclear power plants, steam power plants, industrial gas turbines, and total energy power plants; energy management and conservation techniques. Prerequisite: MEE 302 or CME 305 or MTI 232. *3 sem. hrs.*

MEE 410. HEAT TRANSFER: Fundamentals of conduction, convection, and thermal radiation energy transfer. Conduction of heat in steady and unsteady state. Principles of boundary layer theory applicable to free and forced convection heat transfer for internal and external flows. Radiation analysis with and without convection and conduction. Prerequisite: MEE 308. *3 sem. hrs.*

MEE 414A. SEMINAR: Presentations on contemporary mechanical engineering subjects by students, faculty, and engineers in active practice. Registration required of all students in their last term prior to graduation. *1 sem. hr.*

MEE 414B. SEMINAR: Presentations on contemporary mechanical engineering subjects by students, faculty, and engineers in active practice. Registration required of all junior and senior students not registered in MEE 414A. *No credit*

MEE 417. INTERNAL COMBUSTION ENGINES: Combustion and energy release processes. Applications to spark and compression ignition, thermal jet, rocket, and gas turbine engines. Emphasis on air pollution problems caused by internal combustion engines. Idealized and actual cycles studied in preparation for laboratory testing of I. C. engines. Departmental elective. Prerequisite: MEE 301 or permission of instructor. *3 sem. hrs.*

MEE 418. ADVANCED FLUID MECHANICS: Application of the basic thermodynamic and fluid motion laws of a system to the solution of engineering problems in fluid mechanics. Use of differential and integral equations for internal and external flow of viscous and compressible fluids with friction and heat transfer. Isentropic flow; adiabatic flow; normal and oblique shocks; Fanno and Rayleigh line flow. Prerequisites: MEE 308, 316. *3 sem. hrs.*

MEE 420. HEATING AND AIR CONDITIONING: Theory and methods of maintaining comfortable industrial and residential environments. Psychrometrics; effects of solar radiation; heat transmission through solid boundaries and transparent materials; heating and cooling load calculations; sizing of equipment; energy conservation and energy management concepts. Departmental elective. Corequisite: MEE 410 or permission of instructor. *3 sem. hrs.*

MEE 423L. MECHANICAL ENGINEERING LABORATORY: Three-hour laboratory session and three-hour out-of-class group session each week. Analysis, modeling, testing, and oral and written technical presentation of studies in power generation, heat transfer, and fluid dynamic systems. Prerequisites: MEE 302, 309, 340L, 410. *3 sem. hrs.*

MEE 426L. MECHANICAL ENGINEERING LABORATORY: Analysis, modeling, testing, and technical presentation of studies in power generation, heat transfer, thermodynamics fluid flow, and combinations thereof. Turbo-machinery, internal combustion engines, heat transfer and refrigeration systems, and fluid dynamic systems; aerodynamics, aero-optical measurements, and turbulence. Prerequisites: MEE 308, 340L, 410. *2 sem. hrs.*

MEE 427. MECHANICAL DESIGN I: Stress and deflection analysis of machine components; theories of failure; fatigue failure of metals; design and analysis of mechanical components such as spur gears, shafts, springs, fasteners. Prerequisites: EGM 303, MEE 321. Corequisite: MEE 427L. *3 sem. hrs.*

MEE 427L. MECHANICAL DESIGN LABORATORY I: Design projects applying principles covered in MEE 427. Solution of complex problems with emphasis on synthesis and design of mechanical systems. Corequisite: MEE 427. *1 sem. hr.*

MEE 428. MECHANICAL DESIGN II: Advanced topics in stress and deflection analysis; analysis and design of mechanical elements such as gears, clutches, brakes, belts, chains, and journal bearings; machinery construction principles. Departmental elective. Prerequisite: MEE 427. Corequisite: MEE 428L. *2 sem. hrs.*

MEE 428L. MECHANICAL DESIGN LABORATORY II: Projects related to principles covered in MEE 427 and 428, encompassing all aspects of a typical design project from development of a proposal to evaluation of the design. Departmental elective. Corequisite: MEE 428. *1 sem. hr.*

MEE 435. FEEDBACK CONTROL SYSTEMS: Introduction to analysis and design of automatic control systems, steady-state operations, time domain analysis, Laplace transforms, characteristic function, root-locus, frequency-response. System performance using Nyquist stability criterion, lag-lead compensation, and feedback. Prerequisite: MEE 319. *3 sem. hrs.*

MEE 436. VEHICLE PERFORMANCE ANALYSIS: Ground, air, water, space vehicles. Development of force, moment, and kinematic equations. Advanced applications including stability, control, performance evaluations for selected vehicles. Vehicle simulation. Analog computation. Departmental elective. Prerequisite: MEE 308 or permission of instructor. *3 sem. hrs.*

MEE 499. SPECIAL PROBLEMS IN MECHANICAL ENGINEERING: Particular assignments to be arranged and approved by departmental chairperson. Departmental elective. *1-6 sem. hrs.*

In addition to the courses listed above, students may select as undergraduate electives mechanical engineering (MEE) courses from the 500 series listed in the Graduate Issue of the Bulletin.

SERVICE COURSES FOR ENGINEERING (EGR, EGM, ISE)

COURSES OF INSTRUCTION—EGR

EGR 103. INTRODUCTION TO ENGINEERING: Introductory-level course with emphasis on engineering problem definition, methods, and solution; engineering units and terminology; engineering career areas; and utilization of computers in engineering. *2 sem. hrs.*

EGR 132. ENGINEERING FORTRAN: Fundamentals of computer programming including algorithms, program structure, and library routines; debugging and program verification. Computer solutions of problems from engineering using FORTRAN. Prerequisite: MTH 118. *2 sem. hrs.*

EGR 320. SYSTEMS-DESIGN—HONORS: Systems-design experience to emphasize the basic problem-solving approach and philosophy of engineering for students of varied background. By permission only. *3 sem. hrs.*

EGR 399. PROFESSIONAL DEVELOPMENT: Development of students' self-concepts as professional engineers with strong personal career directions based on individual strengths, interests, and technical abilities. *0-3 sem. hrs.*

EGR 498. HONORS THESIS: Selection, design, investigation, and completion of an independent, original research study resulting in a document prepared for submission as a potential publication and a completed undergraduate thesis. Restricted to students in Honors Program. *3-6 sem. hrs.*

EGR 499. SPECIAL PROBLEMS IN ENGINEERING: Particular assignments to be arranged and approved by the dean of engineering. *1-6 sem. hrs.*

COURSES OF INSTRUCTION—EGM

Engineering Mechanics (EGM) courses are taught and administered by the Department of Civil Engineering and Engineering Mechanics.

EGM 101. MECHANICS I: The principles of mechanics; force systems, free body diagrams, resultants and equilibrium, centroids and centers of gravity; application to trusses, frames, machines, and beams; friction; moments of inertia. Corequisite: MTH 119. *3 sem. hrs.*

EGM 301. DYNAMICS: Kinematics, including translation, rotation, plane motion, and relative motion; kinetics of particles and bodies by the methods of force-mass-acceleration, work-energy, and impulse-momentum. Prerequisite: EGM 101. *3 sem. hrs.*

EGM 303. STRENGTH OF MATERIALS: The study of stresses, strains, and deflections in tension, compression, shear, flexure, and torsion; shear and moment diagrams; analysis of columns. Prerequisite: EGM 101. Each term. *3 sem. hrs.*

EGM 304. ADVANCED STRENGTH OF MATERIALS: Stresses and strains at a point; shear center; unsymmetrical bending; curved beams; flat plates; torsion of noncircular bars; beams on elastic support; buckling. Prerequisite: EGM 303. First and second terms each year. *3 sem. hrs.*

COURSES OF INSTRUCTION—ISE

ISE 313. ENGINEERING LAW: Legal principles applied to engineering. *2 sem. hrs.*

ISE 369. PROBABILITY AND STATISTICS FOR ENGINEERS: Conceptual development of probability and statistics with engineering applications. Random variables, probability distributions, Bayes theorem, central limit theorem, population and sample moments, point and interval estimates, hypothesis testing, regression analysis. Prerequisite: MTH 119. *3 sem. hrs.*

ISE 402. ENGINEERING ECONOMY: Basic principles and techniques of economic analysis of engineering projects. Time value of money, short- and long-term investments, replacement analysis, depreciation methods, cost allocation, and measures of cost effectiveness. Prerequisite: MTH 119. *1-3 sem. hrs.*

ISE 421. RELIABILITY AND MAINTAINABILITY: Application of probability and statistical theory to engineering reliability design and analysis; reliability of components and assemblies; design of systems for reliability and maintainability. Prerequisites: MTH 368 or ISE 369; CPS 132. *3 sem. hrs.*

ISE 423. QUALITY ASSURANCE: Principles of statistical quality control. Application of attributes and variable acceptance sampling plans; control charts; design of quality control systems and procedures. Prerequisites: MTH 368 or ISE 369; CPS 132. *3 sem. hrs.*

ISE 428. DESIGN AND ANALYSIS OF ENGINEERING EXPERIMENTS: Application of statistical methods to engineering experimentation; analysis of experimental response through statistical methods. Prerequisites: MTH 368 or ISE 369; CPS 132. *3 sem. hrs.*

ISE 451. PRODUCTION AND INVENTORY PLANNING AND CONTROL: Analysis and design of systems of personnel and machines for production processes. Forecasting, scheduling, production and inventory control. Prerequisites: MTH 368 or ISE 369; CPS 132. *3 sem. hrs.*

ISE 452-453. OPERATIONS RESEARCH I AND II: Applications and elementary theory of selected topics such as linear programming, transportation and assignment problems, network analysis, game theory, nonlinear programming, queueing theory, and Markov processes. Prerequisites: MTH 368 or ISE 369; CPS 132. *3 sem. hrs. each*

ISE 455. PRINCIPLES OF SYSTEMS: Basic concepts of structure in dynamic systems; starting point for systems approach to dynamic systems in multidisciplinary courses in urban, ecological, corporate, or other social systems. Prerequisites: MTH 368 or ISE 369; CPS 132. *3 sem. hrs.*

ISE 499. SPECIAL PROBLEMS IN SYSTEMS: Particular assignments to be arranged and approved. *1-6 sem. hrs.*

ENGINEERING TECHNOLOGY PROGRAMS

The engineering technology programs lead to either the Bachelor of Technology or the Associate in Technology in any of a number of technical areas. The Bachelor of Technology is a 4-year degree designed to give the student excellent preparation in the major field as well as to provide sufficient breadth in both technical and nontechnical areas so that the graduate may work effectively with persons with other educational backgrounds. The significant number of technical electives permits the student to explore technical areas other than the major and thus to become more versatile.

The associate degree program is a 2½-year course of studies designed to prepare students to be engineering technicians in their chosen fields. All courses in the associate degree are applicable toward the Bachelor of Technology in the same major if the student should desire to continue.

BIO-ENGINEERING TECHNOLOGY (BEI)

Typically, graduates from the Bio-Engineering Technology Program engage in the definition, selection, and operational management of medical instrumentation and hardware. They often work with equipment such as heart-lung machines, patient-monitoring devices, and pacemakers. To perform efficiently in this interdisciplinary field, one must have a background in human anatomy and physiology, physics, and chemistry, as well as electrical and mechanical engineering technology.

PROGRAM—T1: ASSOCIATE IN TECHNOLOGY WITH A MAJOR IN BIO-ENGINEERING TECHNOLOGY (BEX)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
CTI	125	Inorganic Chemistry	3-3-4	
ETI	104	Introduction to Electronic Engineering Technology	3-0-3	
STI	151	Introduction to Engineering Technology	3-0-3	
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
ETI	110	Electrical Circuits I		3-3-4
BIO	151	Concepts of Biology		3-0-3
—	—	Philosophy or religious studies		3-0-3
			17	16
		Sophomore Year		
CTI	210	Organic Chemistry	3-0-3	
ETI	111	Electrical Circuits II	3-3-4	
MTI	220	Statics and Dynamics	3-0-3	
STI	134	Effective Speaking	2-0-2	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
EDD	305-306	Human Anatomy and Physiology	3-0-3	3-0-3
MTI	231	Fluid Mechanics		3-0-3
ETI	206	Electron Devices I		3-3-4
MTI	221	Strength of Materials		3-0-3
			18	16
		Junior Year		
MTI	400	Biomechanics	3-0-3	
ETI	455	Biotechnology I	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
STI	301	The Technological Society I	3-0-3	
STI	334	Technical Writing	2-0-2	
CPS	144	FORTRAN	3-0-3	
			17	

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

PROGRAM—T2: BACHELOR OF TECHNOLOGY WITH A MAJOR IN BIO-ENGINEERING TECHNOLOGY (BEI)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
CTI	125	Inorganic Chemistry	3-3-4	
ETI	104	Introduction to Electronic Engineering Technology	3-0-3	
STI	151	Introduction to Engineering Technology	3-0-3	
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
—	—	Philosophy or religious studies		3-0-3
ETI	110	Electrical Circuits I		3-3-4
BIO	151	Concepts of Biology I		3-0-3
			17	16
		Sophomore Year		
ETI	111	Electrical Circuits II	3-3-4	
MTI	220	Statics and Dynamics	3-0-3	
CTI	210	Organic Chemistry	3-0-3	
EDD	305-306	Human Anatomy and Physiology	3-0-3	3-0-3
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
BIO	—	Biology elective		3-0-3
ETI	206	Electron Devices I		3-3-4
PHY	203	Modern Technical Physics		3-2-4
			16	17
		Junior Year		
STI	306	Engineering Technology Mathematics V	3-0-3	
CPS	144	FORTRAN	3-0-3	
MTI	221	Strength of Materials	3-0-3	
MTI	103L	Technical Drawing	0-6-2	
STI	301-302	The Technological Society I, II	3-0-3	3-0-3
—	—	Philosophy or religious studies	3-0-3	3-0-3
—	—	Technical electives		6-0-6
MTI	231	Fluid Mechanics		3-0-3
STI	334	Technical Writing		2-0-2
			17	17
		Senior Year		
ETI	455	Biotechnology I	3-0-3	
MTI	400	Biomechanics	3-0-3	
STI	499	Seminar	1-0-1	
—	—	Technical electives	9-0-9	6-0-6
—	—	Philosophy or religious studies		3-0-3
—	—	Humanities or social science elective		3-0-3
ITI	315	Organization and Management		3-0-3
STI	134	Effective Speaking		2-0-2
			16	17

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

CHEMICAL TECHNOLOGY (CTI)

Graduates of the Chemical Technology Programs are prepared to fill positions in the chemical process industries engaged in the production and distribution of commodities such as petroleum products, pharmaceuticals, paper, plastics, chemicals, and metals. Recipients of the associate degree are suited for positions in technical sales and for technician responsibilities in analytical laboratories or production units. Graduates with bachelor's degrees would fill supervisory positions in process operations, maintenance management, quality assurance, or sales. The program includes studies in the basic and engineering sciences, chemical technology, communications, and nontechnical subjects essential to a balanced education.

PROGRAM—T3: ASSOCIATE IN TECHNOLOGY WITH A MAJOR IN CHEMICAL TECHNOLOGY (CTX)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
CTI	125	General Chemistry	3-3-4	
STI	151	Introduction to Engineering Technology	3-0-3	
MTI	103L	Technical Drawing	0-6-2	
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
CTI	212	Quantitative Analysis		2-5-4
ETI	201	Fundamentals of Electronic Technology		3-0-3
—	—	Philosophy or religious studies		3-0-3
			16	16
		Sophomore Year		
MTI	220	Statics and Dynamics	3-0-3	
STI	134	Effective Speaking	2-0-2	
STI	334	Technical Writing	2-0-2	
CTI	210	Organic Chemistry	3-3-4	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
STI	301-302	The Technological Society I, II	3-0-3	3-0-3
MTI	232	Thermodynamics		3-0-3
PHY	203	Modern Technical Physics		3-2-4
CTI	305	Materials Science		3-0-3
			17	16
		Junior Year		
CTI	313	Topics in Physical Chemistry	3-0-3	
CTI	316	Analytical Instrumentation	3-3-4	
CTI	320	Chemical Process Industries	3-0-3	
ITI	315	Organization and Management	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
			16	

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

PROGRAM—T4: BACHELOR OF TECHNOLOGY WITH A MAJOR IN CHEMICAL PROCESS TECHNOLOGY (CTI)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
CTI	125	Inorganic Chemistry	3-3-4	
STI	151	Introduction to Engineering Technology	3-0-3	
MTI	103L	Technical Drawing	0-6-2	
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
CTI	212	Quantitative Analysis		2-5-4
ETI	201	Fundamentals of Electronic Technology		3-0-3
—	—	Philosophy or religious studies		3-0-3
			16	16
		Sophomore Year		
MTI	220	Statics and Dynamics	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
ITI	315	Organization and Management	3-0-3	
CTI	210	Organic Chemistry	3-3-4	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
MTI	231	Fluid Mechanics		3-0-3
PHY	203	Modern Technical Physics		3-2-4
MTI	232	Thermodynamics		3-0-3
STI	134	Effective Speaking		2-0-2
			16	15
		Junior Year		
STI	306	Engineering Technology Mathematics V	3-0-3	
CTI	316	Analytical Instrumentation	3-3-4	
CPS	144	FORTRAN	3-0-3	
CTI	313	Topics in Physical Chemistry	3-0-3	
STI	301-302	The Technological Society I, II	3-0-3	3-0-3
STI	334	Technical Writing		2-0-2
CTI	305	Materials Science		3-0-3
—	—	Philosophy or religious studies		3-0-3
—	—	Technical elective		3-0-3
MTI	221	Strength of Materials		3-0-3
			16	17
		Senior Year		
CTI	320	Chemical Process Industries	3-0-3	
STI	499	Seminar	1-0-1	
—	—	Philosophy or religious studies	3-0-3	
—	—	Technical electives	6-0-6	6-0-6
CTI	401-402	Process Operations I, II	3-3-4	3-3-4
CTI	420	Instrumentation and Control		3-0-3
—	—	Humanities or social science elective		3-0-3
			17	16

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

FACULTY

David I. Gross, *Chairperson*
Professor: C. Shaw
Assistant Professor: Gross
Instructor: Anduze

COURSES OF INSTRUCTION

CTI 122. GENERAL CHEMISTRY: Survey of the general principles of chemistry including elements and their simpler compounds. Emphasis on topics of importance in industrial activities. *3 sem. hrs.*

CTI 122L. GENERAL CHEMISTRY LABORATORY: To accompany CTI 122. Three hours of laboratory a week. *1 sem. hr.*

CTI 125. INORGANIC CHEMISTRY: Comprehensive treatment of the fundamentals of general chemistry, with emphasis on their application to the essential groups of elements in the periodic table. *3 sem. hrs.*

CTI 125L. INORGANIC CHEMISTRY LABORATORY: Semi-micro qualitative analysis to accompany CTI 125. Three hours of laboratory a week. *1 sem. hr.*

CTI 210. ORGANIC CHEMISTRY: Study of aliphatic, aromatic, and heterocyclic compounds, including reactions, properties, and applications of organic substances. Prerequisite: CTI 122 or 125. *3 sem. hrs.*

CTI 210L. ORGANIC CHEMISTRY LABORATORY: To accompany CTI 210. Three hours of laboratory a week. *1 sem. hr.*

CTI 212. QUANTITATIVE ANALYSIS: Fundamental principles and techniques involved in exact analysis. Gravimetric, volumetric, and colorimetric analyses; techniques such as weighings and separations. Prerequisite: CTI 122 or 125. *2 sem. hrs.*

CTI 212L. QUANTITATIVE ANALYSIS LABORATORY: To accompany CTI 212. Five hours of laboratory a week. *2 sem. hrs.*

CTI 305. MATERIALS SCIENCE: Introduction to engineering materials and their properties and behavior. Emphasis on physical metallurgy, metals, alloys. Some coverage of ceramics, cements and aggregates, wood, glasses, and plastics. *3 sem. hrs.*

CTI 313. TOPICS IN PHYSICAL CHEMISTRY: Consideration of several topics pertinent to physical chemistry: thermodynamics, states of matter, solutions, electrochemistry, nuclear chemistry, absorption. Prerequisite: CTI 122 or 125. *3 sem. hrs.*

CTI 316. ANALYTICAL INSTRUMENTATION: Study of analytical instruments available to the research laboratory and to the manufacturing process. Insofar as possible, students operate the instruments, or see them in operation, and interpret the resulting spectra and data. Tour of a neighboring laboratory usually arranged with possible demonstrations of analytical equipment not currently available on campus. Prerequisites: CTI 210, 212. *3 sem. hrs.*

CTI 316L. ANALYTICAL INSTRUMENTATION LABORATORY: To accompany CTI 316. Three hours of laboratory a week. *1 sem. hr.*

CTI 320. CHEMICAL PROCESS INDUSTRIES: Directed readings in industrial methods of producing key chemical products. Emphasis on flow diagrams, unit operations, and classic processes of commercial importance to include basic chemicals, petrochemicals, gas and coal products, fertilizers, pharmaceuticals, pulp and paper. Prerequisite: CTI 210. *3 sem. hrs.*

CTI 400. SELECTED CHEMICAL TOPICS: Investigation and discussion of current technical topics in chemical technology. May be taken more than once. Prerequisite: Permission of the department chairperson. *1-4 sem. hrs.*

CTI 401. PROCESS OPERATIONS I: Study and application of scientific and engineering principles and methods which underlie chemical processes operations. Material and energy balances, fluid flow, heat transfer, evaporation, drying, and filtration. Prerequisites: MTI 231, 232, CTI 313. *3 sem. hrs.*

CTI 402. PROCESS OPERATIONS II: Continuation of Process Operations I, emphasizing mass transfer operations and kinetics. Humidification, distillation, liquid-liquid extraction, striping, adsorption, absorption, and ion exchange. Prerequisite: CTI 401. *3 sem. hrs..*

CTI 401L, 402L. PROCESS OPERATIONS LABORATORY I, II: To accompany CTI 401, 402. Three hours of laboratory a week. *1 sem. hr. each*

CTI 420. INSTRUMENTATION AND CONTROL: Survey of devices for detecting and signaling the state of process control variables. Principles and practices of automatic process control. Control modes, controllers, feedback and feed forward operations, response analysis, balancing methods, data acquisition, and computer-centered control systems. *3 sem. hrs.*

CTI 437. INTRODUCTION TO NUCLEAR TECHNOLOGY: Selected principles of atomic and nuclear physics, radioactivity, reactor theory, fuels, power plants and cycles, shielding, safety considerations. Prerequisite: MTI 232 or equivalent. *3 sem. hrs.*

CTI 452. POLLUTION CONTROL I: Study of air pollution, its origins and effects; regulatory efforts; methods of pollution abatement. Emphasis on control mechanisms and industrial control equipment and operations. Prerequisite: CTI 122. *3 sem. hrs.*

CTI 453. POLLUTION CONTROL II: Study of water pollution, its occurrence, causes, effects; regulatory provisions. Municipal water and wastewater processes, equipment, and methods; typical industrial waste sources and control provisions. Solid waste control methods addressed briefly. Prerequisites: CTI 112, MTI 231. *3 sem. hrs.*

CTI 452L, 453L. POLLUTION CONTROL LABORATORIES I, II: Three hours, once a week. Experiments to afford familiarity with methods of sampling and analyzing for air and water pollutants. Plant trips planned to reinforce associated course areas. Prerequisite: CTI 316L. *1 sem. hr. each*

CTI 462. POLYMERS: Introduction to addition, condensation, cellulosic, and natural polymers, their processing, properties, and uses, including casting, extrusion, and composites. Prerequisite: CTI 122 or 125. *3 sem. hrs.*

ELECTRONIC ENGINEERING TECHNOLOGY (ETI)

The Department of Electronic Engineering Technology prepares students for service as engineering technicians (Associate in Technology) or engineering technologists (Bachelor of Technology) in the industrial world. Emphasis is on the fundamentals of circuit theory, electronics, digital electronics, measurements, and communications in addition to related courses in mathematics, physics, and chemistry. The Associate in Technology graduate is prepared to serve a research and development team in implementing basic designs, constructing circuits, and performing electronic circuit evaluations. The Bachelor of Technology graduate is prepared to perform basic designs in electronics, digital electronics, and communications or to serve in engineering sales of electronic systems and supervision for electrical or electronic manufacturers.

The Bachelor of Technology with a major in Electronic Engineering Technology is accredited by The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

PROGRAM—T5: ASSOCIATE IN TECHNOLOGY WITH A MAJOR IN ELECTRONIC ENGINEERING TECHNOLOGY (ETX)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
ETI	104	Introduction to Electronic Engineering Technology	3-0-3	
STI	151	Introduction to Engineering Technology	3-0-3	
ENG	111	College Composition I[2]	4-0-4	
—	—	Philosophy or religious studies	3-0-3	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
CTI	122	General Chemistry		3-3-4
ETI	110	Electrical Circuits I		3-3-4
ITI	315	Organization and Management		3-0-3
			16	17
		Sophomore Year		
ETI	111	Electrical Circuits II	3-3-4	
MTI	220	Statics and Dynamics	3-0-3	
ETI	223	Schematics and Diagrams	1-0-1	
STI	134	Effective Speaking	2-0-2	
ETI	207	Electrical Measurements	3-3-4	
ETI	300	Seminar	1-0-0	1-0-0
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
ETI	206	Electron Devices I		3-3-4
ETI	208	Cathode Ray Oscilloscope		1-0-1
ETI	340L	Electronic Instrumentation		0-3-1
PHY	203	Modern Technical Physics		3-2-4
STI	301	The Technological Society I		3-0-3
			17	16

		Junior Year	
ETI	300	Seminar	1-0-0
ETI	306	Electron Devices II	3-3-4
ETI	324	Digital Computer Fundamentals	3-3-4
ETI	327	Pulse Circuit Fundamentals	3-3-4
ETI	328	Electronic Communications	3-3-4
STI	334	Technical Writing	2-0-2
			18

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112.

PROGRAM—T6: BACHELOR OF TECHNOLOGY WITH A MAJOR IN ELECTRONIC ENGINEERING TECHNOLOGY (ETI)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
ETI	104	Introduction to Electronic Engineering Technology	3-0-3	
STI	151	Introduction to Engineering Technology	3-0-3	
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
—	—	Philosophy or religious studies	3-0-3	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
CTI	122	General Chemistry		3-3-4
ETI	110	Electrical Circuits I		3-3-4
			16	17
		Sophomore Year		
ETI	111	Electrical Circuits II	3-3-4	
ETI	207	Electrical Measurements	3-3-4	
ETI	223	Schematics and Diagrams	1-0-1	
MTI	220	Statics and Dynamics	3-0-3	
STI	134	Effective Speaking	2-0-2	
ETI	300	Seminar	1-0-0	1-0-0
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
ETI	206	Electron Devices I		3-3-4
ETI	208	Cathode Ray Oscilloscope		1-0-1
ETI	324	Digital Computer Fundamentals		3-3-4
PHY	203	Modern Technical Physics		3-2-4
			17	16
		Junior Year		
CPS	144	FORTRAN	3-0-3	
ETI	306	Electron Devices II	3-3-4	
ETI	457	Microprocessors	3-0-3	
STI	306	Engineering Technology Mathematics V	3-0-3	
ETI	300	Seminar	1-0-0	1-0-0
—	—	Technical electives	3-0-3	3-0-3
ETI	—	Electronic engineering technology elective		3-0-3
ETI	328	Electronic Communications		3-3-4
ETI	340L	Electronic Instrumentation		0-3-1
ITI	315	Organization and Management		3-0-3
STI	301	The Technological Society I		3-0-3
			16	17

		Senior Year		
ETI	327	Pulse Circuit Fundamentals	3-3-4	
ETI	___	Electronic engineering technology elective	3-0-3	
STI	334	Technical Writing	2-0-2	
STI	499	Seminar	1-0-1	
ETI	300	Seminar	1-0-0	1-0-0
___	___	Philosophy or religious studies	3-0-3	3-0-3
___	___	Technical electives	3-0-3	3-0-3
ETI	330	Special Electronic Projects		1-0-1
___	___	Humanities or social science elective		3-0-3
STI	302	The Technological Society II		3-0-3
			16	13

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

FACULTY

Richard R. Hazen, *Chairperson*
Professors: Farren, Hanneman, Hazen, Rooney
Associate Professor: Iselin

COURSES OF INSTRUCTION

ETI 104. INTRODUCTION TO ELECTRONIC ENGINEERING TECHNOLOGY: Topics in electronic engineering technology including circuits, electron devices, measurements, computers, power, and machinery. Corequisite: STI 110. *3 sem. hrs.*

ETI 110. ELECTRICAL CIRCUITS I: Practical concepts of D.C. circuits: resistance, resistivity, power, and magnetism. Circuit calculations using basic formulas. Prerequisite: ETI 104. Corequisite: STI 111. *3 sem. hrs.*

ETI 110L. ELECTRICAL CIRCUITS I LABORATORY: To accompany ETI 110. *1 sem. hr.*

ETI 111. ELECTRICAL CIRCUITS II: Practical concepts of A.C. circuits: inductance, capacitance, reactance, impedance, phase, poker, and power factor. Circuit calculations utilizing vectors and complex quantities. Prerequisite: ETI 110. Corequisite: STI 210. *3 sem. hrs.*

ETI 111L. ELECTRICAL CIRCUITS II LABORATORY: To accompany ETI 111. Three hours of laboratory a week. *1 sem. hr.*

ETI 201. FUNDAMENTALS OF ELECTRONIC TECHNOLOGY: Selected topics from D.C. and A.C. circuits, measurements, and electron devices for non-electronic technology students. Corequisite: STI 110. *3 sem. hrs.*

ETI 206. ELECTRON DEVICES I: Fundamentals of transistors (bipolar and field effect), vacuum tubes, gas tubes, semi-conductor diodes, and their associated circuits. Prerequisite: ETI 111. Corequisite: STI 211. *3 sem. hrs.*

ETI 206L. ELECTRON DEVICES I LABORATORY: To accompany ETI 206. Three hours of laboratory a week. *1 sem. hr.*

ETI 207. ELECTRICAL MEASUREMENTS: Application of direct and alternating current circuit analysis to electrical measuring methods and techniques with emphasis on industrial problems and considerations. Corequisite: ETI 111. *3 sem. hrs.*

ETI 207L. ELECTRICAL MEASUREMENTS LABORATORY: To accompany ETI 207. Three hours of laboratory a week involving circuit design for electrical measurements. *1 sem. hr.*

ETI 208. CATHODE RAY OSCILLOSCOPE: To study the design, operation and application of the cathode ray oscilloscope. Prerequisite: ETI 111. *1 sem. hr.*

ETI 210. ELECTRICAL MACHINERY: Fundamentals of the construction and application of direct current and alternating current machines and apparatus to industrial uses. Prerequisite: ETI 111. *3 sem. hrs.*

ETI 210L. ELECTRICAL MACHINERY LABORATORY: To accompany ETI 210. Three hours of laboratory a week. *1 sem. hr.*

ETI 211. MOTOR CONTROL: Industrial uses of standard controllers for electric motors. Prerequisite: ETI 210. *3 sem. hrs.*

ETI 211L. MOTOR CONTROL LABORATORY: To accompany ETI 211. Three hours of laboratory a week. *1 sem. hr.*

ETI 223. SCHEMATICS AND DIAGRAMS: Procedures, standards, and symbols used on electronic circuit diagrams. *1 sem. hr.*

ETI 226. INTRODUCTION TO ANALOG COMPUTERS AND SERVOMECHANISMS: Fundamentals and design of synchros and related error detectors, rate generators, magnetic amplifiers, and friction dampers. Prerequisite: ETI 206. *3 sem. hrs.*

ETI 226L. ANALOG COMPUTER AND SERVOMECHANISM LABORATORY: To accompany ETI 226. Three hours of laboratory a week. *1 sem. hr.*

ETI 300. SEMINAR: Exchange of ideas in electronics, to include student lectures, guest lectures, and industrial visitations. Required of all ETI students who are enrolled in, or have taken, ETI 111. *No credit*

ETI 306. ELECTRON DEVICES II: Fundamentals of integrated circuits, operational amplifiers, transistors, photoelectric devices, silicon-controlled rectifiers, and their associated circuits. Prerequisite: ETI 206. Corequisite: STI 306. *3 sem. hrs.*

ETI 306L. ELECTRON DEVICES II LABORATORY: To accompany ETI 306. Three hours of laboratory a week. *1 sem. hr.*

ETI 324. DIGITAL COMPUTER FUNDAMENTALS: Fundamental theory and techniques of electronic data processing to include binary arithmetic, switching theory (Boolean algebra), and basic circuitry (gates, adders, registers, and memory). Corequisite: ETI 206. *3 sem. hrs.*

ETI 324L. DIGITAL COMPUTER FUNDAMENTALS LABORATORY: To accompany ETI 324. Three hours of laboratory a week. *1 sem. hr.*

ETI 327. PULSE CIRCUITS: Selected topics relating to radar, television, and computer circuits including integrators, differentiators, blocking oscillators, multivibrators, and time-base generators utilizing Laplace transform analysis. Prerequisites: ETI 324, STI 306. *3 sem. hrs.*

ETI 327L. PULSE CIRCUITS LABORATORY: To accompany ETI 327. Three hours of laboratory a week. *1 sem. hr.*

ETI 328. ELECTRONIC COMMUNICATIONS: Principles of operation of filters, modulators, demodulators, and converters. Corequisite: ETI 306. *3 sem. hrs.*

ETI 328L. ELECTRONIC COMMUNICATIONS LABORATORY: To accompany ETI 328. Three hours of laboratory a week. *1 sem. hr.*

ETI 330. SPECIAL ELECTRICAL PROJECTS: Laboratory work and reading associated with a phase of electricity selected by the student and approved by department chairperson. Prerequisite: ETI 206. *1 sem. hr.*

ETI 340L. ELECTRONIC INSTRUMENTATION: Three hours of laboratory a week to provide a knowledge of the operation of and the interpretation of data taken from complex electronic measurement and test equipment. Prerequisite: ETI 111. *1 sem. hr.*

ETI 400. SELECTED ELECTRONIC TOPICS: Investigation and discussion of current technical topics in electronic engineering technology. May be taken more than once. Prerequisite: Permission of department chairperson. *1-4 sem. hrs.*

ETI 450. MICROELECTRONICS: Study of the principles, design techniques, and fabrication processes utilized in the construction of thick film, thin film, and integrated circuits. Prerequisite: ETI 206. *3 sem. hrs.*

ETI 451. ADVANCED INSTRUMENTATION: Unstructured laboratory study of modern instrumentation. Independent projects including CRT system, integrating DVM, acoustical equipment, and advanced standards. Prerequisites: ETI 207, 208. *2-3 sem. hrs.*

ETI 452. FEEDBACK CONTROLS: Study of signal flow, circuit stability, Nyquist criteria, Bode plots, oscillators, amplifiers, and electromechanical devices. Prerequisite: ETI 306. *3 sem. hrs.*

ETI 453. ANTENNAS: Study of basic antenna types and their application to arrays and other systems. Prerequisite: ETI 328. *3 sem. hrs.*

ETI 454. ENVIRONMENTAL NOISE CONTROL: Study of noise, noise measurement, physiological effects of noise, federal regulations, and design criteria for noise reduction. Prerequisite: Junior status. *3 sem. hrs.*

ETI 455. BIOTECHNOLOGY I: An engineering technology approach to the medical field including resistance analogy, storage analogy, and biological systems analysis. Student participation at local hospitals. Prerequisite: ETI 206. *3 sem. hrs.*

ETI 456. BIOTECHNOLOGY II: A continuation of Biotechnology I with emphasis on biomedical instrumentation. Prerequisite: ETI 455. *3 sem. hrs.*

ETI 457. MICROPROCESSORS: Study of microprocessor architecture, hardware, software, and applications. Prerequisite: ETI 324. *3 sem. hrs.*

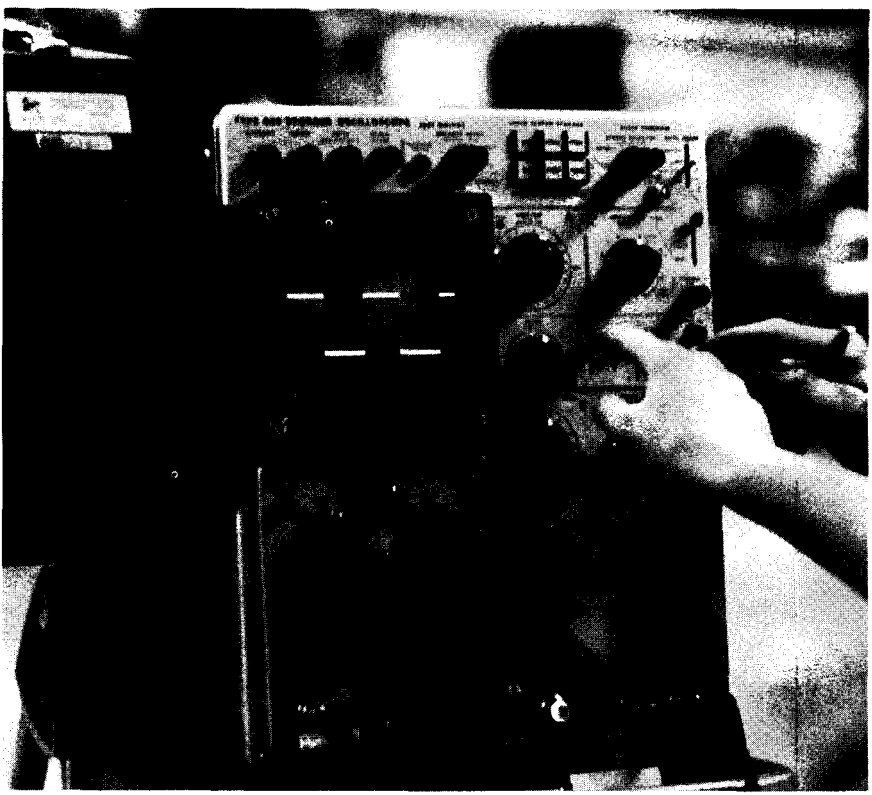
ETI 458. MICROPROCESSORS II: Advanced studies in microprocessor software design, mass storage systems, and applications. Prerequisites: CPS 144, ETI 457. *3 sem. hrs.*

ETI 459. MICROPROCESSOR SYSTEMS DESIGN: Introduction to industrial design procedures for microprocessor-based control systems. Emphasis on the integration of microcomputer hardware and software. Prerequisite: ETI 458. *3 sem. hrs.*

ETI 460. SIXTEEN-BIT MICROPROCESSORS: Study of a sixteen-bit microprocessor family and its application to systems. Applications include single and multiprocessor design. Prerequisite: ETI 457. *3 sem. hrs.*

ETI 461. POWER DISTRIBUTION AND CONTROL: Study of power distribution systems including components, basic operation, and characteristics. Emphasis on the generation of electric power, its transmission and control. Prerequisite: ETI 111 or 201. *3 sem. hrs.*

ETI 462. TELECOMMUNICATIONS TECHNOLOGY: Study of the theoretical and practical electronic structures involved in the telecommunications industry. Applications to data transmission, satellite communications, telephony, and television. Prerequisites: ETI 328, 328L. *3 sem. hrs.*



ENVIRONMENTAL ENGINEERING TECHNOLOGY (EEI)

Graduates of the Environmental Engineering Technology Programs are prepared for responsibilities in both the private and public sectors wherein the effects and control of pollution are of major concern. Associate degree holders are prepared to enter industrial or regulatory agency positions as laboratory or operating technicians. Bachelor's degree recipients are well suited to oversee waste treatment operations, to conduct pollution control programs, or to implement and monitor regulatory provisions for public or private agencies. The program of studies seeks to provide a fundamental knowledge of pollution origins and effects, regulatory provisions, and control equipment and practices.

PROGRAM—T7: ASSOCIATE IN TECHNOLOGY WITH A MAJOR IN ENVIRONMENTAL ENGINEERING TECHNOLOGY (EEX)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
CTI	125	Inorganic Chemistry	3-3-4	
STI	151	Introduction to Engineering Technology	3-0-3	
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
—	—	Philosophy or religious studies	3-0-3	3-0-3
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
CTI	212	Quantitative Analysis		2-5-4
ETI	201	Fundamentals of Electronic Technology		3-0-3
			17	16
		Sophomore Year		
MTI	103L	Technical Drawing	0-6-2	
MTI	220	Statics and Dynamics	3-0-3	
STI	134	Effective Speaking	2-0-2	
BIO	151	Concepts of Biology I	3-0-3	
CTI	210	Organic Chemistry	3-3-4	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
BIO	350	Applied Microbiology		3-0-3
MTI	231	Fluid Mechanics		3-0-3
GEO	218	Engineering Geology		3-0-3
PHY	203	Modern Technical Physics		3-2-4
			17	16
		Junior Year		
STI	301	The Technological Society I	3-0-3	
ITI	315	Organization and Management	3-0-3	
CTI	452	Pollution Control I	3-3-4	
ETI	454	Environmental Noise Control	3-0-3	
CTI	316	Analytical Instrumentation	3-3-4	
			17	

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

PROGRAM—T8: BACHELOR OF TECHNOLOGY WITH A MAJOR IN ENVIRONMENTAL ENGINEERING TECHNOLOGY (EEI)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
CTI	125	Inorganic Chemistry	3-3-4	
STI	151	Introduction to Engineering Technology	3-0-3	
MTI	103L	Technical Drawing	0-6-2	
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
CTI	212	Quantitative Analysis		2-5-4
ETI	201	Fundamentals of Electronic Technology		3-0-3
—	—	Philosophy or religious studies		3-0-3
			16	16
		Sophomore Year		
MTI	220	Statics and Dynamics	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
BIO	151	Concepts of Biology I	3-0-3	
CTI	210	Organic Chemistry	3-3-4	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
BIO	350	Applied Microbiology		3-0-3
MTI	231	Fluid Mechanics		3-0-3
STI	134	Effective Speaking		2-0-2
STI	334	Technical Writing		2-0-2
PHY	203	Modern Technical Physics		3-2-4
			16	17
		Junior Year		
STI	306	Engineering Technology Mathematics V	3-0-3	
CTI	316	Analytical Instrumentation	3-3-4	
ITI	315	Organization and Management	3-0-3	
MTI	232	Thermodynamics	3-0-3	
STI	301-302	The Technological Society I, II	3-0-3	3-0-3
GEO	218	Engineering Geology		3-0-3
—	—	Technical elective		3-0-3
CPS	144	FORTRAN		3-0-3
—	—	Philosophy or religious studies		3-0-3
			16	15
		Senior Year		
ETI	454	Environmental Noise Control	3-0-3	
STI	499	Seminar	1-0-1	
—	—	Philosophy or religious studies	3-0-3	
CTI	452-453	Pollution Control I, II	3-3-4	3-3-4
—	—	Technical electives	6-0-6	6-0-6
CTI	420	Instrumentation and Control		3-0-3
—	—	Humanities or social science elective		3-0-3
			17	16

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

INDUSTRIAL ENGINEERING TECHNOLOGY (ITI)

The Industrial Engineering Technology Program has as its objective providing specialized education to prepare students primarily for technological services to management in such industrial engineering areas as production, operations, and control. The curriculum also covers the essentials of management with which supervisors and administrative personnel in general are concerned. Emphasis is on courses in motion and time study, production control, plant layout, quality control, and cost control.

The Bachelor of Technology with a major in Industrial Engineering Technology is accredited by The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

PROGRAM—T9: ASSOCIATE IN TECHNOLOGY WITH A MAJOR IN INDUSTRIAL ENGINEERING TECHNOLOGY (ITX)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
MTI	103L	Technical Drawing	0-6-2	
STI	151	Introduction to Engineering Technology	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
ITI	104	Industrial Materials and Processes		3-0-3
ITI	315	Organization and Management		3-0-3
CTI	122	General Chemistry		3-3-4
			15	16
		Sophomore Year		
ITI	108	Production Methods and Control	3-0-3	
MTI	106L	Dimensional Measurements	0-3-1	
MTI	108L	Manufacturing Processes Laboratory	0-3-1	
MTI	220	Statics and Dynamics	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
—	—	Technical elective	3-0-3	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
ITI	225	Elements of Cost Control		3-0-3
ITI	230	Motion and Time Study I		2-3-3
STI	301	The Technological Society I		3-0-3
—	—	Humanities or social science elective		3-0-3
			17	15
		Junior Year		
ITI	217	Industrial Economic Analysis	3-0-3	
ITI	331	Motion and Time Study II	2-3-3	
MTI	213	Industrial Mechanisms	3-0-3	
ETI	201	Fundamentals of Electronic Technology	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
STI	334	Technical Writing	2-0-2	
			17	

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

PROGRAM—T10: BACHELOR OF TECHNOLOGY WITH A MAJOR IN INDUSTRIAL ENGINEERING TECHNOLOGY (ITI)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
MTI	103L	Technical Drawing	0-6-2	
STI	151	Introduction to Engineering Technology	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
ITI	104	Industrial Materials and Processes		3-0-3
ITI	315	Organization and Management		3-0-3
CTI	122	General Chemistry		3-3-4
			15	16
		Sophomore Year		
ITI	108	Production Methods and Control	3-0-3	
MTI	106L	Dimensional Measurements	0-3-1	
MTI	108L	Manufacturing Processes Laboratory	0-3-1	
MTI	220	Statics and Dynamics	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
—	—	Technical elective	3-0-3	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
ITI	225	Elements of Cost Control		3-0-3
ITI	230	Motion and Time Study I		2-3-3
STI	301	The Technological Society I		3-0-3
STI	334	Technical Writing		2-0-2
—	—	Humanities or social science elective		3-0-3
			17	17
		Junior Year		
ITI	217	Industrial Economic Analysis	3-0-3	
ITI	331	Motion and Time Study II	2-3-3	
MTI	213	Industrial Mechanisms	3-0-3	
ETI	201	Fundamentals of Electronic Technology	3-0-3	
—	—	Philosophy or religious studies	3-0-3	
STI	134	Effective Speaking	2-0-2	
ITI	216	Quantitative Methods in Industrial Engineering Technology		3-0-3
ITI	318	Statistical Quality Control		3-0-3
STI	302	The Technological Society II		3-0-3
PHY	203	Modern Technical Physics		3-2-4
—	—	Technical elective		3-0-3
			17	16
		Senior Year		
ITI	332	Plant Layout	2-3-3	
ITI	418	Cost Estimating	3-0-3	
STI	499	Seminar	1-0-1	
—	—	Philosophy or religious studies	3-0-3	
—	—	Technical elective	6-0-6	6-0-6
ITI	305	Labor and Wage Administration		3-0-3
ITI	420	Industrial and Environmental Safety		3-0-3
CPS	144	FORTRAN		3-0-3
			16	15

[1]For example, 3-0-3 means 3 class hrs., 0 lab. hrs., and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

FACULTY

Raymond B. Puckett, *Director*
Professors: McGraw, Puckett
Assistant Professor: Staudter

COURSES OF INSTRUCTION

ITI 104. INDUSTRIAL MATERIALS AND PROCESSES: A study of modern industrial materials with emphasis on their chemical and physical properties, and methods by which they may be processed. *3 sem. hrs.*

ITI 108. PRODUCTION METHODS AND CONTROL: Principles and the techniques used in production; current practices in production planning, routing, scheduling, and dispatching; study of production standards, labor efficiency, and costs; quantity and quality control. Prerequisite: ITI 104. *3 sem. hrs.*

ITI 216: QUANTITATIVE METHODS IN INDUSTRIAL ENGINEERING TECHNOLOGY: Introduction to the application of mathematics to decision making in industry. Prerequisite: STI 210. *3 sem. hrs.*

ITI 217. INDUSTRIAL ECONOMIC ANALYSIS: Introduction to the economics of tools, equipment, and machinery, including an elementary study of compound interest and depreciation. Prerequisite: STI 210. *3 sem. hrs.*

ITI 225. ELEMENTS OF COST CONTROL: Survey of the methods of breakdown and cost analysis of labor, material, and overhead used in manufacturing organizations. *3 sem. hrs.*

ITI 230. MOTION AND TIME STUDY I: Fundamentals of work simplification and motion economy using the techniques of motion and time study for the development of effective methods of production. Prerequisite: STI 210. *2 sem. hrs.*

ITI 230L. MOTION AND TIME STUDY LABORATORY I: To accompany ITI 230. Three hours of laboratory a week. *1 sem. hr.*

ITI 305. LABOR AND WAGE ADMINISTRATION: Brief history of labor unionism and labor legislation. Survey of collective bargaining contracts, grievances, and arbitration. Wage administration including job evaluation, wage structures, wage incentives, and employee evaluation. *3 sem. hrs.*

ITI 315. ORGANIZATION AND MANAGEMENT: Study of the structure of industrial organizations and the responsibilities and duties of a supervisor in developing an effective production team. *3 sem. hrs.*

ITI 318. STATISTICAL QUALITY CONTROL: Introduction to the techniques of industrial process control using statistical methods. Prerequisite: STI 210. *3 sem. hrs.*

ITI 331. MOTION AND TIME STUDY II: Study of techniques in work measurement and in setting time standards, including stop-watch time study and work sampling. Introduction to predetermined time systems and standard data. Prerequisite: ITI 230. *2 sem. hrs.*

ITI 331L. MOTION AND TIME STUDY LABORATORY II: To accompany ITI 331. Three hours of laboratory a week. *1 sem. hr.*

ITI 332. PLANT LAYOUT: Study of the economical arrangement of stocks, machines, and aisles for efficient material handling and production. Prerequisites: ITI 108 and MTI 103L. *2 sem. hrs.*

ITI 332L. PLANT LAYOUT LABORATORY: To accompany ITI 332. Three hours of laboratory a week. *1 sem. hr.*

ITI 400. SELECTED INDUSTRIAL TOPICS: Investigation and discussion of current technical topics in industrial engineering technology. May be taken more than once. Prerequisite: Permission of department chairperson. *1-4 sem. hrs.*

ITI 415. INDUSTRIAL ENGINEERING TECHNOLOGY SEMINAR: Summary of the most commonly used tools to solve manufacturing production problems. *3 sem. hrs.*

ITI 418. COST ESTIMATING: Study of the fundamentals involved in job estimating for manufacturing plants. *3 sem. hrs.*

ITI 420. INDUSTRIAL AND ENVIRONMENTAL SAFETY: Study of the OSHA regulations as they apply to industry and the environment. *3 sem. hrs.*

MECHANICAL ENGINEERING TECHNOLOGY (MTI)

The Mechanical Engineering Technology Program is designed to give the student a practical knowledge of the fundamental principles of mechanical engineering technology as they are applied in industrial and scientific endeavor. Emphasis is on applied mechanics, strength of materials, mechanisms, thermodynamics, fluid mechanics, fluid power, machine design, and design for manufacturing, and on basic courses such as technical drawing, physics, mathematics, and chemistry. Career opportunities are in mechanical design, product development, design of processes and systems, manufacturing engineering, technical sales, field service, fluid power and controls, supervision, and management.

The Bachelor of Technology with a major in Mechanical Engineering Technology is accredited by The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

PROGRAM—T11: ASSOCIATE IN TECHNOLOGY WITH A MAJOR IN MECHANICAL ENGINEERING TECHNOLOGY (MTX)

Dept.	*No.*	*Courses*	*1st Term*[1]	*2nd Term*
		Freshman Year		
STI	151	Introduction to Engineering Technology	3-0-3	
—	—	Philosophy or religious studies	3-0-3	3-0-3
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
MTI	103L-104L	Technical Drawing I, II	0-6-2	0-6-2
MTI	108L	Manufacture Processes Laboratory		0-3-1
ITI	104	Industrial Materials and Processes		3-0-3
			15	15
		Sophomore Year		
MTI	106L	Dimensional Measurements	0-3-1	
MTI	215	Statics	3-0-3	
ITI	315	Organization and Management	3-0-3	
CTI	122	General Chemistry	3-3-4	
—	—	Humanities or social science elective	3-0-3	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
STI	334	Technical Writing		2-0-2
MTI	217	Dynamics		3-0-3
MTI	221	Strength of Materials		3-0-3
MTI	231	Fluid Mechanics		3-0-3
ETI	201	Fundamentals of Electronic Technology		3-0-3
			17	17
		Junior Year		
MTI	213	Industrial Mechanisms	3-0-3	
MTI	232	Thermodynamics	3-0-3	
MTI	332	Design for Manufacturing	2-0-2	
MTI	333L	Measurements II	0-3-1	
MTI	336	Fluid Power	3-3-4	
—	—	Technical elective	3-0-3	
			16	

[1]For example, 3-0-3 means 3 class hours, 0 lab. hours, and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.

PROGRAM—T12: BACHELOR OF TECHNOLOGY WITH A MAJOR IN MECHANICAL ENGINEERING TECHNOLOGY (MTI)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Freshman Year		
STI	151	Introduction to Engineering Technology	3-0-3	
—	—	Philosophy or religious studies[3]	3-0-3	3-0-3
ENG	111-112	College Composition I, II[2]	4-0-4	3-0-3
STI	110-111	Engineering Technology Mathematics I, II	3-0-3	3-0-3
MTI	103L-104L	Technical Drawing I, II	0-6-2	0-6-2
MTI	108L	Manufacturing Processes Laboratory		0-3-1
ITI	104	Industrial Materials and Processes		3-0-3
			15	15
		Sophomore Year		
MTI	106L	Dimensional Measurements	0-3-1	
MTI	215	Statics	3-0-3	
ITI	315	Organization and Management	3-0-3	
CTI	122	General Chemistry	3-3-4	
—	—	Humanities or social science elective[3]	3-0-3	
STI	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
STI	334	Technical Writing[3]		2-0-2
MTI	217	Dynamics		3-0-3
MTI	221	Strength of Materials		3-0-3
MTI	231	Fluid Mechanics		3-0-3
ETI	201	Fundamentals of Electronic Technology[3]		3-0-3
			17	17
		Junior Year		
STI	306	Engineering Technology Mathematics V	3-0-3	
MTI	213	Industrial Mechanisms	3-0-3	
MTI	232	Thermodynamics	3-0-3	
MTI	332	Design for Manufacturing	2-0-2	
MTI	333L	Measurements II	0-3-1	
MTI	336	Fluid Power	3-3-4	
MTI	330	Design of Machine Elements		3-0-3
—	—	Philosophy or religious studies[3]		3-0-3
CPS	144	FORTRAN		3-0-3
PHY	203	Modern Technical Physics		3-2-4
—	—	Technical elective[3]		3-0-3
			16	16
		Senior Year		
MTI	335	Mechanical Design	1-0-1	
STI	134	Effective Speaking[3]	2-0-2	
STI	499	Seminar[3]	1-0-1	
—	—	Philosophy or religious studies[3]	3-0-3	
STI	301-302	The Technological Society I, II[3]	3-0-3	3-0-3
—	—	Technical electives[3]	3-0-3	9-0-9
MTI	—	Mechanical engineering technology electives[3]	3-0-3	3-0-3
			16	15

[1]For example, 3-0-3 means 3 class hours, 0 lab. hours, and 3 sem. hrs. of credit.
[2]Students testing out of ENG 111 will take ENG 112 and a 200-level ENG elective.
[3]While the listing gives the recommended order for scheduling courses, these courses can be interchanged.

FACULTY

Robert L. Mott, *Chairperson*
Professors: Mott, Smilg, Wilder, Wolff
Assistant Professor: Kretzler
Adjunct Associate Professor: Wendeln

COURSES OF INSTRUCTION

MTI 103L. TECHNICAL DRAWING I: Introduction to technical drawing with emphasis on orthographic projection and conventional industrial practices in producing technical sketches and completed drawings. Six hours of laboratory a week. *2 sem. hrs.*

MTI 104L. TECHNICAL DRAWING II: Descriptive geometry drawing problems involving points, lines, planes, and geometric shapes presented and solved in orthographic projection form. Machine drawing. Six hours of laboratory a week. Prerequisite: MTI 103L. *2 sem. hrs.*

MTI 106L. DIMENSIONAL MEASUREMENTS: Theory and practice of precision dimensional metrology. Three hours of laboratory a week. Prerequisite: STI 111. *1 sem. hr.*

MTI 108L. MANUFACTURING PROCESSES LABORATORY: Basic metal removal processes, metal cutting theory, and production machines, such as lathes, grinders, milling machines, and drill presses. Three hours of laboratory a week. *1 sem. hr.*

MTI 213. INDUSTRIAL MECHANISMS: Motions, displacements, velocities, cams, linkages, and gears with applications to selected machines or devices. Prerequisite: MTI 220 or 217. *3 sem. hrs.*

MTI 215. STATICS: Force systems, resultants and equilibrium, centroids of areas and centers of gravity of bodies, trusses, frames, beams, friction, and moments of inertia of areas and bodies. Prerequisite: STI 111. *3 sem. hrs.*

MTI 217. DYNAMICS: Principles of applied engineering dynamics, including kinetics, kinematics, conservation of energy, conservation of momentum, and introduction to mechanical vibrations. Prerequisite: MTI 215. *3 sem. hrs.*

MTI 220. STATICS AND DYNAMICS: Principles of applied engineering mechanics. Prerequisite: STI 111. *3 sem. hrs.*

MTI 221. STRENGTH OF MATERIALS: Principles of applied strength of materials primarily with reference to mechanical design. Prerequisites: MTI 220 or 215; STI 210. *3 sem. hrs.*

MTI 231. FLUID MECHANICS: Properties of fluids, hydrostatic and buoyant forces, Bernoulli's equation, energy equation, flow of real fluids in pipes, friction losses, measurement of flow. Prerequisite: STI 111. *3 sem. hrs.*

MIT 232. THERMODYNAMICS: General laws of thermodynamics, properties and processes of gases, vapor and gas-vapor mixtures, cycles, and the flow of fluids, application of thermodynamics to machines. Prerequisite: STI 210. *3 sem. hrs.*

MTI 330. DESIGN OF MACHINE ELEMENTS: Analytical design of springs, shafts, couplings, bearings, gears; applying laws governing simple, variable, and combined stresses. Prerequisites: MTI 213, 221. *3 sem. hrs.*

MTI 332. DESIGN FOR MANUFACTURING: Basic principles of the design of tools for material removal, pressworking, casting, and joining processes; material selection and torque, thrust, horsepower, pressures required. Corequisite: MTI 221. *2 sem. hrs.*

MTI 333L. MEASUREMENTS II: Laboratory experiences in selected physical measurements and evaluations: typical selections from pressure, temperature, flow, power, stress, and strain. Three hours of laboratory a week. Prerequisites: ITI 104; MTI 220 or 217; MTI 231. *1 sem. hr.*

MTI 335. MECHANICAL DESIGN: Bringing analytical and graphical techniques from previous courses together to accomplish the design of complete mechanisms or other types of mechanical devices. Prerequisite: MTI 330. *1 sem. hr.*

MTI 336. FLUID POWER: Study of hydraulic and pneumatic fluid power systems and components as used in industrial, mobile, and aerospace applications. Analytical design of circuits, components, and basic control devices. Prerequisite: MTI 231. Corequisite: MTI 336L. *3 sem. hrs.*

MTI 336L. FLUID POWER LABORATORY: Laboratory to accompany MTI 336. Evaluation of fluid power components, circuits, and control devices accomplished from physical measurements and visual inspections. Graphical design and further analytical design of circuits and systems. Three hours of laboratory a week *1 sem. hr.*

MTI 400. SELECTED MECHANICAL TOPICS: Investigations and discussion of current technical topics in mechanical engineering technology. May be taken more than once. Prerequisite: Permission of the department chairperson. *1-4 sem. hrs.*

MTI 423. DESIGN OF MECHANICAL SYSTEMS: Synthesis of mechanical devices and system. Emphasis on the integration of various machine elements into a single unit. Original team design projects required. Prerequisite: MTI 330. *3 sem. hrs.*

MTI 430. DESIGN OF FLUID POWER SYSTEMS: Design of fluid power systems using graphical and analytical optimizing techniques. Open and closed loop circuit studies. Original design projects Prerequisite: MTI 331 or 336. *3 sem. hrs.*

MTI 431. FLUID POWER CONTROLS: Study of pneumatic fluid power and control systems including moving and non-moving fluid logic, logic theory, servo and electric controls, and power components. Prerequisite: MTI 331 or 336. *3 sem. hrs.*

MTI 432. HEAT POWER: Applications of the fundamentals of thermodynamics, emphasizing energy transfer systems such as internal combustion engines, gas turbines, steam power plants, and reversed cycle devices. Introduction to nuclear energy and direct conversion techniques. Prerequisite: MTI 232. *3 sem. hrs.*

MTI 434. INTRODUCTION TO NUMERICAL CONTROL: Manual programming for basic N.C. machines; introduction to computer programming languages; geometric terms, N.C. machines and applications, economic justification. Prerequisite: STI 111. *3 sem. hrs.*

MTI 438. THERMAL CONTROL: Elements of heat transfer: conduction, convection, and radiation; heat transmission through walls, applications to industry and building construction. Prerequisite: MTI 231. *3 sem. hrs.*

MTI 440. APPLIED VIBRATIONS: Vibration of single degree of freedom systems, reciprocating machinery, and rotating machinery; balancing; vibration damping; isolation; applications to noise reduction. Prerequisites: MTI 217, STI 306. *3 sem. hrs.*

SERVICE (STI) AND INTERDISCIPLINARY (TII) COURSES FOR ENGINEERING TECHNOLOGY

FACULTY—STI

Professor: Strange
Assistant Professors: Fehlmann, Staub

COURSES OF INSTRUCTION

STI 101. INDUSTRIAL MATHEMATICS: Review of introductory algebra and other selected mathematical topics. Prerequisite for the Engineering Technology Program. *3 sem. hrs.*

STI 110. ENGINEERING TECHNOLOGY MATHEMATICS I: Fundamental processes of algebra including factoring, fractions, exponents and radicals, linear and quadratic equations, determinants, logarithms, inequalities, arithmetic and geometric progressions. *3 sem. hrs.*

STI 111. ENGINEERING TECHNOLOGY MATHEMATICS II: Introduction to trigonometry including angular measure, interpolation, identities, graphs, right and oblique triangle, functions of composite angles. Topics of analytic geometry including straight lines and conic sections. Prerequisite: STI 110. *3 sem. hrs.*

STI 134. EFFECTIVE SPEAKING: Organization and presentation of spoken materials with emphasis on voice and physical delivery and audience reaction. *2 sem. hrs.*

STI 151. INTRODUCTION TO ENGINEERING TECHNOLOGY: The environment of engineering technology, an introduction to problem-solving techniques and to the design process. *3 sem. hrs.*

STI 210. ENGINEERING TECHNOLOGY MATHEMATICS III: Introduction to the basic concepts of differential and integral calculus. The derivative, maxima and minima, differentials, the antiderivative, applications. The definite integral, integration, areas, volumes, centroids, work. Prerequisite: STI 111. *3 sem. hrs.*

STI 211. ENGINEERING TECHNOLOGY MATHEMATICS IV: The derivative and antiderivative formulas for composite functions: chain rule, exponential and logarithmic functions, trigonometric functions, integration techniques. Introduction of partial derivatives and multiple integrals. Prerequisite: STI 210. *3 sem. hrs.*

STI 301. THE TECHNOLOGICAL SOCIETY I: History of technology as a revolutionary social force and the interrelationships between technology, politics, and economics. *3 sem. hrs.*

STI 302. THE TECHNOLOGICAL SOCIETY II: Continuation of STI 301 with emphasis on the sociology of technology; criticism and defense of technology as a social force. Prerequisite: STI 301. *3 sem. hrs.*

STI 306. ENGINEERING TECHNOLOGY MATHEMATICS V: Selected topics from ordinary differential equations with emphasis on operational methods for solving problems encountered in engineering technology. Prerequisite: STI 211 or 207. *3 sem. hrs.*

STI 334. TECHNICAL WRITING: Comprehensive treatment of the fundamentals of writing effective technical documentation for industry, including use of technical illustrations and tables. *2 sem. hrs.*

STI 400. SPECIAL TOPICS IN ENGINEERING TECHNOLOGY: Investigation and discussion of current topics in engineering technology. May be taken more than once. Prerequisite: Permission of instructor. *1-4 sem. hrs.*

STI 499. SEMINAR: Selected technical and occupational topics. Required of all Bachelor of Technology students in the senior year. *1 sem. hr.*

ENGINEERING TECHNOLOGY INTERDISCIPLINARY (TII)

Students should consult with the Associate Dean for Engineering Technology.

COURSE OF INSTRUCTION

TII 401. DESIGN OF SYSTEMS: An interdisciplinary course in which a team of students solves a complex problem using a three-phased systems approach. Projects vary from term to term, but all are concerned with societal problems, such as transportation, energy, or environment. *3 sem. hrs.*