IX School of Engineering

Joseph Lestingi, Dean
Patrick J. Sweeney, Assistant Dean for Undergraduate Engineering
Robert L. Mott, Associate Dean for Engineering Technology
Ruth L. Kelly, Assistant to the Dean

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 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. All of the programs permit additional specialization (as an overload) in minors and concentrations such as aerospace, engineering mechanics, digital systems, structures, and industrial engineering in the School of Engineering and music, languages, and political science in other divisions of the University. 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 before the students begin their 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 and 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 studies provide the proper framework to insure that scientific discoveries and developments by engineers may result in the true 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 Science in Engineering Technology. 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's degree.

OPTIONAL COOPERATIVE EDUCATION

All students majoring in engineering and 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. Cooperative education offers the student the opportunity to put 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, civil, electrical, or mechanical engineering may choose a minor 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 may require additional courses for completion.

The minor 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)[1]
Chemical Processing
Digital Systems
Dynamic Analysis of Mechanical Systems
Energy Conversion
Engineering Mechanics
Environmental Engineering
Industrial and Systems Engineering
Materials Engineering
Mechanics of Engineering Systems
Structures
Thermal Engineering

A 15-semester-hour concentration in aerospace engineering is also available to mechanical engineering students. Additional minors from outside the School of Engineering are available in many subject areas.

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

[1]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" will appear on the student's transcript.

ENGINEERING FIRST-YEAR REQUIREMENTS

Students who are recent high school graduates or who have earned fewer than 15 semester hours of collegiate credit are classified as first-year students 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) advanced placement examinations; (3) departmental examinations during the first term, or work experience equivalent; or (4) taking the prescribed courses as part of the first 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.

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

REQUIRED FIRST-YEAR PROGRAM[1]

Dept.	*No.*	*Courses*	*Semester Hours*
CPS	132	Computer Programming for Engineering and Science	3
CHM	123	General Chemistry	4
ENG	101-102	College Composition I, II	6
MTH	168-169	Analytic Geometry and Calculus I, II	8
MEE	104L	Computer Graphics I[2]	1
PHY	206	General Physics I	3
SPE	101	Fundamentals of Oral Communication[2]	3
—	—	General education requirements[3,4]	6
		Total first-year requirements	34

[1]All departments have orientation sessions for first-year students.

[2]Chemical engineering students may take CHM 124 and postpone this requirement.

[3]See General Education Requirements, Chapter V. Some general education requirements are specified in the program; others are to be chosen from the listing of approved courses. Consult advisor.

[4]Civil engineering and mechanical engineering students will take PHL 103 in the first term as a general education requirement.

DEGREE REQUIREMENTS

A student enrolls in the curriculum prescribed for the academic year in which he or she is registered as a first-year student 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.

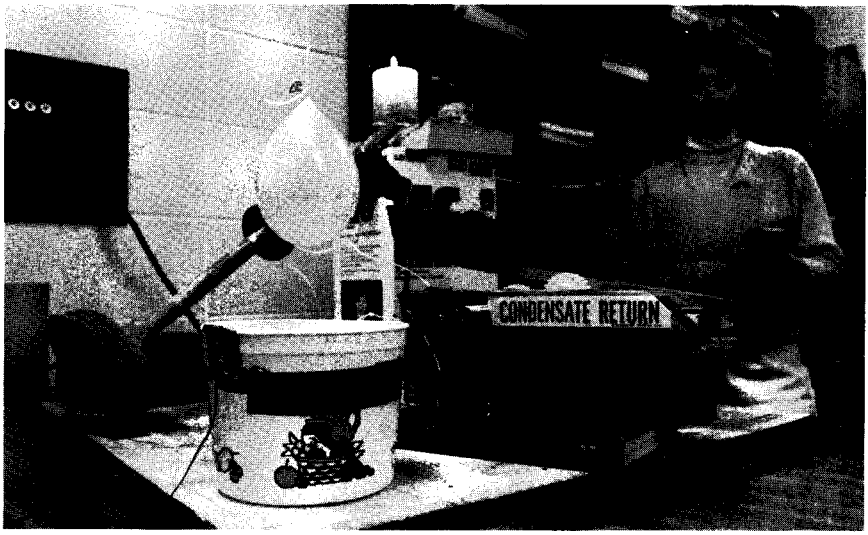
2. All students in the School of Engineering must register under Grade Option 1 for *all* courses in engineering, mathematics, and science except those offered only under Grade Option 2.

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

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

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	135
Bachelor of Civil Engineering	136
Bachelor of Electrical Engineering	134
Bachelor of Mechanical Engineering	135



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, content, or composition.

The majority of chemical engineers are involved in the chemical process industries that produce many of the materials and items needed in everyday life. These include medicine, food, fertilizers, plastics, synthetic fibers, petroleum, petrochemicals, ceramics, and pulp and paper products. A chemical engineer may pursue a professional career in many other fields, such as energy conversion, pollution control, medical research, and materials development in aerospace and electronic industries. Chemical engineers are employed in research, development, design, production, sales, consulting, and management positions. They are also found in government and education. Many use a chemical engineering education as a stepping stone to law, medicine, or corporate management.

The curriculum in chemical engineering serves as basic training for positions in these diverse areas of the manufacturing industry or for graduate study leading to advanced degrees. 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 and reactor design, unit operations, process control, and process design.

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

PROGRAM EN1: BACHELOR OF CHEMICAL ENGINEERING (CME)[1]

Dept.	*No.*	*Course*	*1st Term*[2]	*2nd Term*
		Sophomore Year		
CME	203	Material and Energy Balances	3-0-3	
CME	204	Experimental Methods in Chemical Engineering		3-0-3
CHM	313-314	Organic Chemistry	3-3-4	3-3-4
MTH	218	Analytic Geometry and Calculus III	4-0-4	
MTH	219	Applied Differential Equations		3-0-3
MEE	104L	Computer Graphics I		0-3-1
PHY	207-208	General Physics II, III	3-0-3	3-0-3
SPE	101	Fundamentals of Oral Communication	3-0-3	
—	—	General education requirement[3]		3-0-3
			17	17
		Junior Year		
CME	305	Thermodynamics		3-0-3
CME	324-325	Transport Phenomena I, II	3-0-3	3-0-3
CME	326L	Transport Phenomena Laboratory		0-3-1
CME	381	Applied Mathematics for Chemical Engineers	3-0-3	
CHM	303-304	Physical Chemistry	3-3-4	3-3-4
EGM	201	Statics	3-0-3	
ELE	321	Basic Electric Theory		3-0-3
—	—	General education requirements[3]	3-0-3	3-0-3
			16	17

		Senior Year		
CME	406	Chemical Reaction Kinetics and Engineering	3-0-3	
CME	408A-B	Seminar	1-0-0	1-0-1
CME	411-412	Unit Operations I, II	3-0-3	2-0-2
CME	413L	Unit Operations Laboratory	0-5-2	
CME	430-431	Chemical Engineering Design I, II	3-0-3	3-0-3
CME	452	Process Control	3-0-3	
CME	453L	Process Control Laboratory		0-5-2
CME	—	Technical elective[4]		3-0-3
—	—	General education requirements[3]	3-0-3	6-0-6
			17	17

[1]All chemical engineering courses must be taken under Grading Option 1.

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

[3]See General Education Requirements, Chapter V. Some general education requirements are specified in the program (e.g., PHY 208); others are to be chosen from the listing of approved courses. Consult advisor.

[4]Select from list approved by the Department of Chemical and Materials Engineering.

FACULTY

James A. Snide, *Chairperson, Department of Chemical and Materials Engineering*
Professors: Eylon, Sandhu, Servais, Snide, Whitney
Associate Professors: Lee, Lu, Myers, T. Saliba
Assistant Professor: Flach

COURSES OF INSTRUCTION

CME 101. INTRODUCTION TO CHEMICAL ENGINEERING: Introduction to the chemical engineering faculty, facilities, and curriculum; survey of career opportunities in chemical engineering. *No credit.*

CME 203. MATERIAL AND ENERGY BALANCES: Introductory course on the application of mass and energy conservation laws in solving problems typically encountered in chemical process industries. Prerequisites: CHM 123, MTH 168. First term, each year. *3 sem. hrs.*

CME 204. EXPERIMENTAL METHODS IN CHEMICAL ENGINEERING: Introduction to experimental methods, instrumentation, digital data acquisition, data analysis, and report writing. Emphasis on use of digital computer. Prerequisites: CME 203, CHM 124L, CPS 132. Second term, each year. *3 sem. hrs.*

CME 305. THERMODYNAMICS: Development of the fundamental principles of thermodynamics, particularly with respect to chemical engineering processes. Prerequisites: CME 204, MTH 218. *3 sem. hrs.*

CME 324. TRANSPORT PHENOMENA I: Viscosity, shell momentum balances, isothermal equations of change, thermal conductivity, shell energy balances, non-isothermal equations of change, diffusivity, concentration profiles. Prerequisites: CME 204, MTH 219. Corequisite: CME 381. *3 sem. hrs.*

CME 325. TRANSPORT PHENOMENA II: Multidimensional transport, dimensionless parameters, turbulence, and numerical solution methods. Prerequisites: CME 324, 381. Second term, each year. *3 sem. hrs.*

CME 326L. TRANSPORT PHENOMENA LABORATORY: Viscosity, conductivity, diffusion coefficient measurements, velocity, temperature, concentration profiles, engineering instrumentation, and experimental error analysis. Prerequisite: CME 324. Corequisite: CME 325. Second term, each year. *1 sem. hr.*

CME 381. ADVANCED MATHEMATICS FOR CHEMICAL ENGINEERS: Study of analytical and numerical techniques to support upper-level chemical engineering classes. Vector analysis, matrices, differential equations, numerical integration and differentiation, root finding, and curve fitting. Prerequisite: MTH 219. First term, each year. *3 sem. hrs.*

CME 406. CHEMICAL REACTION KINETICS AND ENGINEERING: Chemical kinetics, ideal reactor analysis and design, and heterogeneous catalysis. Prerequisite: CME 305. 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 first-term senior students only. First term, each year. *No credit*

CME 408B. SEMINAR: Presentation of lectures on contemporary chemical engineering subjects by students, faculty, and engineers in active practice. Registration required of second-term senior students only. Second term, each year. *1 sem. hr.*

CME 409. INTRODUCTION TO POLYMER ENGINEERING: Introduction to the chemistry, structure, and properties of polymers; polymer synthesis and processing. Prerequisites: CME 305; CHM 303, 314. *3 sem. hrs.*

CME 411. UNIT OPERATIONS I: Staged separation techniques, distillation, evaporation, extraction, adsorption, drying, and filtration. Prerequisites: CME 305, 324. First term, each year. *3 sem. hrs.*

CME 412. UNIT OPERATIONS II: Fluid mechanics, transportation and metering of fluids, agitation and mixing, heat transfer and its applications. Prerequisites: CME 305, 324. Second term, each year. *2 sem. hrs.*

CME 413L. UNIT OPERATIONS LABORATORY: Unit operations equipment and its utilization. Corequisite: CME 411. First 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 452. PROCESS CONTROL: Mathematical models, Laplace transform techniques, and process dynamics. Feedback control systems, hardware, and instrumentation. Introduction to frequency response, advanced techniques, and digital control systems. Prerequisite: CME 381. First term, each year. *3 sem. hrs.*

CME 453L. PROCESS CONTROL LABORATORY: Project-oriented study of process dynamics and control using computer-based data acquisition and control systems. Prerequisites: CME 413L, 452. Second term, each year. *2 sem. hrs.*

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)

Civil engineering is the profession in which a knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgement to develop ways to utilize the materials and forces of nature economically in improving and protecting the environment and providing structures and facilities for community, industry, and transportation for the progressive well-being of humanity.

Civil engineers, leading users of high technology in wide-ranging applications in both the public and the private sectors, are essential to the continued improvement of society. Civil engineers can enter traditional fields such as construction, bridge and building design and analysis, highway design and traffic control, water treatment and distribution, environmental control, hydraulics, and geotechnics. However, their broad education also prepares them for materials engineering, engineering management, and the aerospace and automotive industries. Civil engineering has applications in conceptual and detail design, field operations, computers, and consulting.

The civil engineering curriculum prepares the graduate to function not only within the civil and aerospace communities but also with other engineering disciplines and nontechnical components of society. The first and second years build a sound foundation in mathematics, physics, chemistry, and basic engineering science. The junior and senior years focus on technical subjects related primarily to civil engineering, with electives available to permit either specialization or preparation for graduate study.

Members of the student chapter of the American Society of Civil Engineers have the opportunity to meet regularly with practicing engineers in the Dayton community.

PROGRAM EN2: BACHELOR OF CIVIL ENGINEERING (CIE)

Dept.	*No.*	*Course*	*1st Term*[2]	*2nd Term*	
		Sophomore Year			Summer
CIE	213	Surveying	2-0-2		
CIE	220L	Civil Computation Laboratory	0-3-1		
CHM	124	General Chemistry II	3-3-4		
EGM	201	Statics	3-0-3		
MTH	218	Analytic Geometry and Calculus III	4-0-4		
PHY	207	General Physics II	3-0-3		
CIE	408	Seminar I	1-0-0	1-0-0	
CIE	214	Highway Geometrics		2-0-2	
EGM	202	Dynamics		3-0-3	
EGM	303	Strength of Materials		3-0-3	
MTH	219	Applied Differential Equations		3-0-3	
—	—	General education requirements[2]		6-0-6	
CIE	215L	Surveying Field Practice			3-0-3
			17	17	3
		Junior Year			
CIE	313	Hydraulics	3-3-4		
CIE	316	Analysis of Determinate Structures	3-0-3		
CIE	320	Civil Engineering Analysis	3-0-3		
CIE	420	Engineering Economics	1-0-1		

GEO	218	Engineering Geology	3-0-3	
PHL	316	Engineering Ethics	3-0-3	
CIE	408	Seminar I	1-0-0	1-0-0
CIE	310L	Civil Engineering Laboratory		0-3-1
CIE	312	Soil Mechanics		3-3-4
CIE	317	Analysis of Indeterminate Structures		3-0-3
CIE	333	Water and Waste Water Collection and Distribution		3-0-3
—	—	Engineering or science elective[3]		3-0-3
—	—	General education requirement[2]		3-0-3
			17	17
		Senior Year		
CIE	403	Transportation Engineering	3-0-3	
CIE	408	Seminar I	1-0-0	
CIE	411	Design of Steel Structures	3-0-3	
CIE	412	Design of Concrete Structures	3-0-3	
CIE	434	Water and Waste Water Treatment Processes	3-0-3	
CIE	—	Civil engineering electives[3]	3-0-3	3-0-3
CIE	428	Seminar II		1-0-1
CIE	450	Civil Engineering Design		3-0-3
HST	467	History of Civil Engineering		3-0-3
—	—	Engineering or science elective[3]		3-0-3
—	—	General education requirement[2]		3-0-3
			15	16

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

[2]See General Education Requirements, Chapter V. Some general education requirements are specified in the program (e.g., GEO 218); others are to be chosen from the listing of approved courses. Consult advisor.

[3]Select from list approved by the Department of Civil Engineering and Engineering Mechanics.

FACULTY

Fred K. Bogner, *Chairperson, Department of Civil Engineering and Engineering Mechanics*
Distinguished Service Professor: Ryckman
Professors: Bogner, Thomson
Associate Professors: Payne, Phillips, J. Saliba, G. Shaw
Assistant Professor: Zoghi
Lecturer: Al-Akkad
Adjunct Professor: Sack

COURSES OF INSTRUCTION

CIE 101. INTRODUCTION TO CIVIL ENGINEERING: Introduction to the civil engineering faculty, facilities, and curriculum; to the career opportunities offered by the civil engineering profession; and to the areas of specialization within civil engineering. *No credit*

CIE 213. SURVEYING: Theory of measurements, computation, and instrumentation. Boundary and construction surveys, triangulation, and level net adjustments. Corequisite: MTH 168. First term, each year. *2 sem. hrs.*

CIE 214. HIGHWAY GEOMETRICS: Study of circular and spiral curves, vertical curves, grade lines, earthwork and mass diagram, slope and grade stakes, and contour grading. Prerequisite: CIE 213. Second term, each year. *2 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 214. Summer, each year. *3 sem. hrs.*

CIE 220L. CIVIL COMPUTATION LABORATORY: Civil engineering applications of minicomputers and microcomputers. Basic and FORTRAN programming of statics, calculus, and physics problems. Word processing, spreadsheet, and database applications. Corequisite: EGM 201. *1 sem. hr.*

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. Prerequisites: CIE 313, GEO 218. Corequisite: CIE 312L. 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 202. 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 316. ANALYSIS OF DETERMINATE STRUCTURES: Elastic analysis of statically determinate structures; deflections; moment-area theorems; conjugate-beam; virtual work; influence lines; shear center; unsymmetric bending; stresses and strains at a point; theories of failure. Prerequisite: EGM 303. First term, each year. *3 sem. hrs.*

CIE 317. ANALYSIS OF INDETERMINATE STRUCTURES: Elastic analysis of statically indeterminate structures; virtual work; Castigliano's theorems; slope deflection and moment distribution; development of stiffness matrices for use in computer analysis; influence lines, column analogy, limit analysis. Prerequisite: CIE 316. Second term, each year. *3 sem. hrs.*

CIE 320. CIVIL ENGINEERING ANALYSIS: Mathematical modeling and numerical solution of civil engineering problems: basic concepts of probability with emphasis on applications to structures, transportation, and hydraulics problems; application of numerical computational methods in civil engineering problems. Prerequisites: EGM 202, 303; MTH 219. First term, each year. *3 sem. hrs.*

CIE 333. WATER AND WASTE WATER COLLECTION AND DISTRIBUTION: 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 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 411. DESIGN OF STEEL STRUCTURES: Design and behavior of structural steel connections, columns, beams, and beams subjected to tension, compression, bending, shear, torsion, and composite action. Prerequisites: CIE 310L, 317. *3 sem. hrs.*

CIE 412. DESIGN OF CONCRETE STRUCTURES: Design and behavior of reinforced concrete slabs, beams, columns, walls, and footings subjected to tension, compression, bending, shear, and torsion. Prerequisites: CIE 310L, 317. *3 sem. hrs.*

CIE 420. ENGINEERING ECONOMICS: Basic principles and techniques of economic analysis of engineering projects. Prerequisite: MTH 169. *1 sem. hr.*

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. WATER AND WASTE WATER TREATMENT PROCESSES: Problems of air, water, and land pollution; development and design of public water supply and waste water disposal systems; legal, political, ethical, and moral considerations. Prerequisites: CHM 124, CIE 333. First term, each year. *3 sem. hrs.*

CIE 450. CIVIL ENGINEERING DESIGN: Group design of complete projects, drawing on the knowledge acquired in a spectrum of civil engineering subjects. Prerequisites: CIE 312, 403, 411, 412, 420, 434. *3 sem. hrs.*

CIE 470. CIE COMPUTER APPLICATIONS: Applications of mainframe, mini, and micro computers to the solution of selected civil engineering problems, including data analysis, plotting, optimization, and simulation. Prerequisite: FORTRAN. *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.

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.

The curriculum of the Department of Electrical Engineering includes computer hardware and software courses as electives. Sufficient electives are available to permit a computer engineering concentration as part of the Bachelor of Electrical Engineering.

PROGRAM EN3: BACHELOR OF ELECTRICAL ENGINEERING (ELE)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Sophomore Year		
EGM	201	Statics	3-0-3	
MTH	218	Analytic Geometry and Calculus III	4-0-4	
—	—	General education requirement[2]	3-0-3	
PHY	207-208	General Physics II, III	3-0-3	3-0-3
ELE	231-232	Circuit Theory I, II	3-0-3	3-0-3
ELE	233	Field Theory I		3-0-3
ELE	235	Digital System Design		3-0-3
EGM	202	Dynamics		3-0-3
MTH	219	Applied Differential Equations		3-0-3
			16	18
		Junior Year		
ELE	331	Linear Systems	3-0-3	
ELE	333	Field Theory II	3-0-3	
ELE	335L	Electrical Devices Laboratory	0-2-1	
—	—	General education requirements[2]	6-0-6	
ELE	312-313	Electronics I, II	3-0-3	3-0-3
ELE	314	Fundamentals of Computer Architecture		3-0-3
ELE	336L	Computer Applications Laboratory		0-2-1
ELE	338L	Electronic Devices Laboratory		0-2-1
ELE	340	Probability and Discrete Systems		3-0-3
MTH	—	Mathematics elective[3]		3-0-3
—	—	Technical elective[3]		3-0-3
			16	17
		Senior Year		
ELE	413	Communication Engineering	3-0-3	
ELE	431	Energy Conversion	3-0-3	
ELE	435L	Electronic Systems Laboratory	0-2-1	
—	—	Engineering thermodynamics elective[3]	3-0-3	
—	—	Technical electives[3]	3-0-3	3-0-3
—	—	General education requirements[2]	3-0-3	6-0-6
ELE	432	Automatic Control Systems		3-0-3

ELE	436L	Communications Laboratory		0-2-1
ELE	437L	Energy Conversion and Control Laboratory		0-2-1
—	—	Engineering management/economics elective[3]		3-0-3
			16	17

[1]For example: 3-0-3 means 3 class hrs., 0 lab. hrs., 3 sem. hrs. credit.
[2]See General Education Requirements, Chapter V. Some general education requirements are specified in the program (e.g., PHY 208); others are to be chosen from the listing of approved courses. Consult advisor.
[3]Select from list approved by the Department of Electrical Engineering.

FACULTY

Donald L. Moon, *Chairperson*
Distinguished Service Professor: Schmidt
Professors: Moon, Rogers, Thiele
Associate Professors: Evers, Karim, Pasala, Scarpino, Westerkamp, Williamson
Assistant Professors: Daniels, Duncan, Gauder, Hoover, Kee, Penno, Tuthill
Adjunct Associate Professor: Mildrum
Adjunct Assistant Professors: Champagne, Hoeffel

COURSES OF INSTRUCTION

ELE 101. INTRODUCTION TO ELECTRICAL ENGINEERING: Introduction to electrical engineering faculty, facilities, and curriculum, to career opportunities in electrical engineering, and to its areas of specialization. *No credit*

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. Corequisite: MTH 169. *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 functions, logic circuits, Boolean algebra, combinational circuits, flip-flops, registers, counters, adders, memories. 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. Prerequisites: ELE 312, 331. *3 sem. hrs.*

ELE 314. 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: Mathematical design of passive and active electric circuits using time domain and frequency domain methods. Practical areas represented include instrumentation and power, telecommunication, and control circuits. For mechanical, civil, chemical, and advanced-standing science or engineering students. Prerequisites: MTH 218, PHY 207 or equivalent. *3 sem. hrs.*

ELE 322. BASIC ELECTRONICS: Introduction to electronics devices, circuits, and systems. Design, analysis, and applications of amplifiers and other types of electronic elements. For chemical, civil, mechanical, and advanced-standing science or engineering students. Prerequisites: ELE 232, 321 or equivalent. *3 sem. hrs.*

ELE 331. LINEAR SYSTEMS: Mathematical framework associated with analysis of linear systems. Signal representation by orthogonal functions, convolution, Fourier analysis and the Laplace transform. 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 DEVICES LABORATORY: Experimental situations stressing familiarization with electrical engineering concepts, hardware, devices, instrumentation, and techniques. Corequisite: ELE 232. *1 sem. hr.*

ELE 336L. COMPUTER APPLICATIONS LABORATORY: Experimentation using the computer as a tool for engineering design, simulation of circuits and systems, experimental control, data analysis, and report generation. Corequisite: ELE 331. *1 sem. hr.*

ELE 338L. ELECTRONIC DEVICES LABORATORY: Experiments dealing with electronic devices: diodes, bipolar junction transistors, field effect transistors and op amps. Prerequisite: ELE 312. *1 sem. hr.*

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

ELE 413. COMMUNICATION ENGINEERING: Amplitude, angle, and pulse modulation systems. Generation, detection, 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 313, 333. *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, performance characteristics, stability analysis. Prerequisite: ELE 331. Corequisite: ELE 431. *3 sem. hrs.*

ELE 435L. ELECTRONIC SYSTEMS LABORATORY: Passive and active filters, automated data collection, analysis, and electronics systems design. Prerequisites: ELE 313, 338L. *1 sem. hr.*

ELE 436L. COMMUNICATIONS LABORATORY: Modulation, detection, communication electronics, communication systems design. Prerequisites: ELE 413, 435L or permission of instructor. *1 sem. hr.*

ELE 437L. ENERGY CONVERSION AND CONTROL LABORATORY: 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. Prerequisite: ELE 431 or permission of instructor. *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. Prerequisites: MTH 219, PHY 208. *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 445. SIGNAL PROCESSING: Signal conditioning, digital signal processing, and data processing. Topics include transducers, high gain amplifier design, digital filtering, and spectrum estimation. Specialized application determined by instructor. Prerequisite: ELE 340. *3 sem. hrs.*

ELE 446. MICROELECTRONIC SYSTEMS DESIGN: Basic integrated circuit design concepts, system layout, application of design methodology, the fabrication process, manufacturing limitations of the design process, and CAD/CAE utilization to realize the design process. Departmental elective. Prerequisites: ELE 313, 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.*

MECHANICAL ENGINEERING (MEE)

The Department of Mechanical and Aerospace Engineering offers a Bachelor of Mechanical Engineering with sufficient elective courses to permit a concentration in aerospace or other specialty areas. The department offers master's and doctoral degrees in both mechanical engineering and aerospace engineering.

Mechanical engineering is an active, versatile, creative branch of engineering. Mechanical engineers conceive, design, and plan a wide variety of devices, machines, and systems and direct their manufacture, distribution, and operation. They are concerned with energy—its transformation, transmission, and utilization.

The field of mechanical engineering is so broad that several specialized branches have grown from it. Mechanical engineers engage in all the engineering functions—creative design, applied research, development, application and sales, and management. Mechanical engineering is also an excellent professional base for interdisciplinary activities.

Mechanical engineers apply scientific and engineering principles and methods to the solution of contemporary human problems. Of major current interest are the application of computer technology to manufacturing automation, of super computers to computational fluid dynamics, and of lasers to detailed flow measurement in jet engines. Because research in association with Wright-Patterson Air Force Base is a major motivation for this department, a concentration in aerospace engineering is an optional part of the mechanical engineering degree.

The mechanical engineer's widely diversified professional curriculum gives the graduate a broad base for further development. A mechanical engineering background forms the basis for training in many other fields such as law, medicine, and business management.

PROGRAM EN4: BACHELOR OF MECHANICAL ENGINEERING (MEE)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		Sophomore Year		
EGM	201	Statics	3-0-3	
MTH	218	Analytic Geometry and Calculus III	4-0-4	
MEE	227L	Computer Graphics II	0-3-1	
—	—	General education requirements[2]	6-0-6	
PHY	207-208	General Physics II, III	3-0-3	3-0-3
EGM	202	Dynamics		3-0-3
EGM	303	Strength of Materials		3-0-3
MTH	219	Applied Differential Equations		3-0-3
MEE	301	Thermodynamics I		3-0-3
MEE	340L	Engineering Experimentation Laboratory		0-4-2
			17	17
		Junior Year		
MEE	302	Thermodynamics II	3-0-3	
MEE	308	Fluid Mechanics	3-0-3	
MEE	310L	Machining Laboratory	0-3-1	
MEE	312	Engineering Materials	3-3-4	

MEE	316	Mechanical Engineering Analysis	3-0-3	
MEE	414B	Seminar	1-0-0	1-0-0
—	—	General education requirements[2]	3-0-3	3-0-3
ELE	321	Basic Electric Theory		3-0-3
MEE	313	Manufacturing Processes		2-0-2
MEE	319	Mechanical Vibrations		3-0-3
MEE	321	Theory of Machines		3-0-3
MEE	410	Heat Transfer		3-0-3
			17	17
		Senior Year		
ELE	312	Engineering Electronics I	3-0-3	
MEE	330	Engineering Economics	1-0-1	
MEE	423L	Mechanical Engineering Laboratory	0-9-3	
—	—	Design elective[3]	3-3-4	
—	—	Controls elective[4]	3-0-3	
—	—	Technical electives[5]	3-0-3	3-0-3
MEE	414	Seminar	1-0-0	1-0-1
MEE	—	Mechanical engineering electives		6-0-6
PHL	316	Engineering Ethics		3-0-3
—	—	General education requirement[2]		3-0-3
			17	16

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

[2]See General Education Requirements, Chapter V. Some general education requirements are specified in the program (e.g., PHY 208); others are to be chosen from the listing of approved courses. Consult advisor.

[3]Either MEE 427, Mechanical Design I, or MEE 425, Aerospace Design.

[4]Either MEE 435, Feedback Control Systems, or MEE 408, Aircraft Performance and Control.

[5]Technical electives to be selected from engineering, mathematics, or science.

FACULTY

John J. Schauer, *Chairperson, Department of Mechanical and Aerospace Engineering*
Professors: Boehman, Brockman, Chuang, Doyle, Eimermacher, Jain, Ray, Sargent, Schauer, VonOhain, Wurst
Associate Professors: Harmer, Petrykowski
Assistant Professors: Endres, Hallinan, Montgomery
Adjunct Professors: Shine, Weeks
Adjunct Associate Professors: Ballal, Rajendran
Adjunct Assistant Professors: Kreitzer, Wurstner

COURSES OF INSTRUCTION

MEE 101. INTRODUCTION TO MECHANICAL ENGINEERING: Weekly meeting of first-semester first-year mechanical engineering students. Presentation of mechanical engineering topics and review of several basic mathematical techniques. *No credit*

MEE 104L. COMPUTER GRAPHICS I: Fundamentals of engineering graphics and the part that graphical communication plays in engineering. *1 sem. hr.*

MEE 227L. COMPUTER GRAPHICS II: Advanced engineering graphics and graphical communication in engineering; introduction to computer-aided design. Prerequisite: MEE 104L. *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 310L. MACHINING LABORATORY: Study of metal removal processes and machine tools such as lathes, grinders, milling machines, shapers, and planers; theory and practice of precision dimensional metrology. Three hours of laboratory. Prerequisites: CHM 123, MEE 104L, PHY 206. *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. Prerequisites: PHY 208, MEE 310L, EGM 303, or permission of instructor. Corequisite: MEE 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 310L, 312. *2 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 202, or CIE 320. 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, flywheels, gears, gear trains, and differentials. Prerequisite: EGM 301. *3 sem. hrs.*

MEE 330. ENGINEERING ECONOMICS: Basic principles and techniques of economic analysis of engineering projects. Prerequisite: MTH 169. *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 102, PHY 207. Corequisite: MTH 219. *2 sem. hrs.*

MEE 401. AERODYNAMICS: Fundamentals of steady incompressible, inviscid aerodynamic flows over wings. Emphasis on force and moment determination for air foil and finite wings. Prerequisite: MEE 308. *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 MCT 232. *3 sem. hrs.*

MEE 408. AIRCRAFT PERFORMANCE AND CONTROL: Elementary development of aircraft equations of motion; performance in level flight; climbing and descending performance; turning performance, takeoff and landing performance; static stability and control in all three axes. Prerequisite: MEE 401. *3 sem. hrs.*

MEE 409. AEROSPACE STRUCTURES: Structural properties of wing and fuselage sections. Nonsymmetrical bending of skin-stringer wing sections. Shear stresses in thin-walled and skin-stringer multiple-celled sections. Deflection by energy methods. Introduction to finite element stiffness method. Prerequisite: EGM 303. *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. Prerequisites: MEE 308, 316. *3 sem. hrs.*

MEE 413. PROPULSION: Principles of propulsive devices, aerothermodynamics, diffuser and nozzle flow, energy transfer in turbo-machinery; turbojet, turbo-fan, prop-fan engines; turbo-prop and turboshaft engines. RAM and SCRAM jet analysis and a brief introduction to related materials and air frame-propulsion interaction. Prerequisite: MEE 418. *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. Prerequisite: MEE 301 or permission of instructor. *3 sem. hrs.*

MEE 418. GAS DYNAMICS: Application of the basic thermodynamic and fluid motion laws to the solution of engineering problems in fluid mechanics. Use of differential and integral equations for internal and external flow of compressible fluids with friction and heat transfer. Isentropic flow; adiabatic flow; normal and oblique shocks; Prandtl-Meyer flow; 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 management concepts. 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 presentation of studies in power generation, heat transfer, and fluid dynamic systems. Prerequisites: MEE 302, 308, 340L, 410 *3 sem. hrs.*

MEE 424L. AEROSPACE ENGINEERING LABORATORY: Analysis, modeling, testing, and oral and written presentation of studies in aerodynamics; propulsion, heat transfer, and controls. Three-hour laboratory session and three-hour out-of-class group session each week. Prerequisites: MEE 302, 308, 340L, 410. *3 sem. hrs.*

MEE 425. AEROSPACE DESIGN: Preliminary design of aircraft, including layout, weight and size estimates, wing section and planform selection, determination of configuration aerodynamics, engine and inlet sizing, corrections to propulsion data, refined fuel estimates, weight and balance, stability and control, and performance determination. Prerequisites: MEE 408, 409, 413. Corequisite: MEE 425L. *3 sem. hrs.*

MEE 425L. AEROSPACE DESIGN LABORATORY: Laboratory to accompany MEE 425. Prerequisites: MEE 408, 409, 413. Corequisite: MEE 425. *1 sem. hr.*

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, journal and ball bearings, belts, brakes, and clutches; principles of fracture mechanics; failure analysis; machinery construction principles. 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. Corequisite: MEE 428. *1 sem. hr.*

MEE 435. FEEDBACK CONTROL SYSTEMS: Analyses of automatic feedback control systems using time domain solutions, Laplace transforms, block diagrams, transfer functions, characteristic functions, stability criteria, and control actions. System performance based on Nyquist, Bode, and root-locus with system compensation. 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. Vehicle simulation. Analog computation. Prerequisite: MEE 308 or permission of instructor. *3 sem. hrs.*

MEE 438. ROBOTICS AND FLEXIBLE MANUFACTURING: Overview of industrial robots; physical configuration, operation, and programming of robots; actuators, drive mechanisms, sensors, vision systems, controls, and control methods for robots; economic considerations; and automated factory concept. Prerequisites: MEE 313, 321, 435. *3 sem. hrs.*

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

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

SERVICE (EGR, EGM, ISE) AND INTERDISCIPLINARY (ENI) COURSES FOR ENGINEERING

COURSES OF INSTRUCTION—EGR

EGR 102. SEMINAR FOR UNDECLARED STUDENTS: A seminar to acquaint the student with the University and the departments of the School of Engineering. *No credit*

*EGR 201. TECHNOLOGY AND THE ENGINEERING METHOD: Survey of the fields of engineering and their tasks and tools. Development of simplified engineering skills with application to case problems. Review of contemporary technology. Exposure to an engineering design and laboratory experience. Not for engineering and/or technology majors. *3 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 backgrounds. 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 University 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.*

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*General education course. See Chapter V.

COURSES OF INSTRUCTION—EGM

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

EGM 201. STATICS: 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 169. *3 sem. hrs.*

EGM 202. 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 201. *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 stresses and strains at a point; Mohr's circle; analysis of columns. Prerequisite: EGM 201. 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.*

EGM 445. FINITE ELEMENT APPLICATIONS: Introduction to the fundamentals of the finite element method; modeling of engineering systems and elements using computer-aided engineering. Prerequisites: EGM 303, MTH 219. *3 sem. hrs.*

EGM 499. SPECIAL PROBLEMS IN ENGINEERING MECHANICS: Particular as-signments to be arranged and approved by chairperson of the department. *1-6 sem. hrs.*

COURSES OF INSTRUCTION—ISE

Industrial and systems engineering (ISE) courses are taught and administered by the Department of Engineering Management and Systems.

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 218. *3 sem. hrs.*

ISE 401. 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. Self-paced instruction. Prerequisite: MTH 218. *1-2 sem. hrs.*

ISE 402. ECONOMIC DECISION ANALYSIS FOR ENGINEERS: Introduction to the models and methods of economic decision analysis as they relate to engineering decsions. Fundamental economic concepts, cost estimates, interest and time value of money, comparison of alternatives, before- and after-tax analysis, analysis of public activities, decision making under risk and uncertainty, break-even analysis, linear programming models. Prerequisite: MTH 218. *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.*

COURSES OF INSTRUCTION—ENI

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

ENI 299. SPECIAL PROBLEMS: Special problems courses at an introductory level relative to engineering problems and activities. To be arranged and approved by the dean. *1-6 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 with emphasis on modeling of economic, industrial, urban, ecological, and world systems. *3 sem. hrs.*

ENGINEERING TECHNOLOGY

The Engineering Technology programs lead to the Bachelor of Science in Engineering Technology in any of six technical areas. The four-year programs emphasize the application of engineering principles and are designed to provide excellent preparation in the major field as well as sufficient breadth in both technical and nontechnical areas so that the graduate may work effectively with persons of varied 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. Graduates find interesting career positions involving the manufacturing of products; the management of the operation of production and materials processing systems; the sales, application, and field service of technical products and systems; and the practical design of products and machinery for industry using established procedures.

CHEMICAL PROCESS TECHNOLOGY (CPT)

Graduates of the Chemical Process Technology Program are suited for professional positions in process operations. The chemical process industries produce and distribute many key materials such as pharmaceuticals, petroleum products, paper, plastics, rubber, insecticides, fertilizers, and metals. Typical positions involve the supervision of production, the management of quality assurance, maintenance planning and control, or marketing and technical service. The program includes mathematics, basic and engineering sciences, process technology, computer programming, and general education courses. Topics in industrial engineering technology are taken as electives.

PROGRAM T1: BACHELOR OF SCIENCE WITH A MAJOR IN CHEMICAL PROCESS TECHNOLOGY (CPT)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		First Year		
CPT	125	Inorganic Chemistry	3-3-4	
MCT	110L	Technical Drawing and CAD	0-6-2	
SET	153	Technical Computation	1-0-1	
—	—	General education requirement[2]	3-0-3	
ENG	101-102	College Composition I, II	3-0-3	3-0-3
SET	112-113	Engineering Technology Mathematics I, II	4-0-4	3-0-3
CPT	212	Quantitative Analysis		2-5-4
EET	201	Fundamentals of Electronic Technology		3-0-3
HST	101 or 102	History of Western Civilization		3-0-3
			17	16
		Sophomore Year		
CPT	210	Organic Chemistry	3-3-4	
IET	215	Organization and Management	3-0-3	
MCT	220	Statics and Dynamics	3-0-3	
—	—	General education requirement[2]	3-0-3	
SET	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
MCT	231	Fluid Mechanics		3-0-3
MCT	342	Thermodynamics		3-0-3
PHY	203	Modern Technical Physics		3-2-4
SPE	101	Fundamentals of Oral Communication		3-0-3
			16	16
		Junior Year		
CPT	313	Topics in Physical Chemistry	3-0-3	
CPT	316	Analytical Instrumentation	3-3-4	
CPS	144	FORTRAN	3-0-3	
SET	306	Engineering Technology Mathematics V	3-0-3	
SET	301-302	The Technological Society I, II	3-0-3	3-0-3
SET	334	Technical Writing		2-0-2
CPT	305	Materials Science		3-0-3
MCT	221	Strength of Materials		3-0-3
—	—	General education requirement[2]		3-0-3
—	—	Technical elective		3-0-3
			16	17

		Senior Year		
CPT	215	The Chemical Industry	3-0-3	
SET	499	Seminar	1-0-1	
—	—	Technical electives	6-0-6	6-0-6
—	—	General education requirements[2]	3-0-3	3-0-3
CPT	401-402	Process Operations I, II	3-3-4	3-3-4
CPT	420	Instrumentation and Control		3-0-3
			17	16

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

[2]See General Education Requirements, Chapter V. Some general education courses are specified in the program (e.g. PHY 203); others are to be chosen from the listing of approved courses.

FACULTY

David I. Gross, *Chairperson, Department of Chemical Technology*
Professor: C. Shaw
Associate Professors: Gross, Sinha
Part-time Instructors: T. Hughes, W. Hughes, Richardson, Smith, Woods

COURSES OF INSTRUCTION

*CPT 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.*

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

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

CPT 125L. INORGANIC CHEMISTRY LABORATORY: Physicochemical measurements to accompany CPT 125. Three hours of laboratory a week. *1 sem. hr.*

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

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

CPT 212. QUANTITATIVE ANALYSIS: Fundamental principles and techniques involved in exact analysis. Theory of gravimetry, titrimetry, and colorimetry. Prerequisite: CPT 122 or 125. *2 sem. hrs.*

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

*CPT 214. GENERAL CHEMISTRY WITH CASE STUDIES: Survey of the principles of chemistry including elements, their simpler compounds, and molecular phenomena. Includes a sequence of case studies of industrial applications, their economic and environmental effects, and their impact on personal, social and environmental values. *4 sem. hrs.*

*CPT 215. THE CHEMICAL INDUSTRY—TECHNOLOGY AND ISSUES: Broad survey of the chemical process industries stressing their underlying chemistry, unit operations, and generation of by-products. Environmental concerns and key economic factors are examined as issues bearing on individual values and the ethics of industrial decisions. Prerequisite: Organic chemistry. *3 sem. hrs.*

CPT 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. *3 sem. hrs.*

CPT 313. TOPICS IN PHYSICAL CHEMISTRY: Consideration of several topics pertinent to physical chemistry: thermochemistry, states of matter, reaction kinetics, electrochemistry. Prerequisite: CPT 122 or 125. *3 sem. hrs.*

CPT 316. ANALYTICAL INSTRUMENTATION: Study of analytical instrumentation commonly available to research laboratories and process industries. Includes underlying physical principles, equipment operations, and the interpretation of spectra and other data. Prerequisites: CPT 210, 212, 212L. *3 sem. hrs.*

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

CPT 400. SELECTED CHEMICAL TOPICS: Investigation and discussion of current technical topics in chemical technology. May be taken more than once. Prerequisite: Permission of department chairperson. *3 sem. hrs.*

CPT 401. PROCESS OPERATIONS I: Study and application of the engineering principles and methods which underlie chemical process operations. Material and energy balances, fluid flow, heat transfer, evaporation, drying, and filtration. Prerequisites: MCT 231, 342, CPT 313. *3 sem. hrs.*

CPT 402. PROCESS OPERATIONS II: Continuation of CPT 401, emphasizing mass transfer operations. Humidification, distillation, liquid-liquid extraction, gas scrubbing, and adsorption. Prerequisite: CPT 401. *3 sem. hrs.*

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

CPT 420. INSTRUMENTATION AND CONTROL: Survey of devices for detecting and signaling the state of process control variables. Principles and methods of automatic process control. Control modes, controllers, feedback and feed forward operations, tuning methods, and data acquisition systems. Includes tuning exercises using computer-simulated processes. *3 sem. hrs.*

CPT 437. INTRODUCTION TO NUCLEAR TECHNOLOGY: Selected principles of physics and engineering to include nuclear phenomena, radioactivity, reactor thermodynamics, and heat power generation. Includes studies of reactor configurations, materials, fuels, shielding, safety, and security. Prerequisite: MCT 342. *3 sem. hrs.*

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

CPT 453. POLLUTION CONTROL II: Study of water pollution, its occurrence, effects, and control provisions. Examination of municipal water and wastewater practices; case study of an industrial waste point source. Prerequisite: BIO 350. *3 sem. hrs.*

CPT 454. POLLUTION CONTROL III: Study of hazardous waste management: the origin and classification of wastes, regulatory provisions, and abatement technology; toxicology, thermal conversion, and modern incineration systems. Prerequisite: CPT 125. *3 sem. hrs.*

CPT 454L. POLLUTION CONTROL LABORATORY: To accompany CPT 454. Experiments in quantitative and qualitative methods of water analysis, including biological and chemical techniques. Possible visits to municipal or water treatment facilities. No absences permitted. Prerequisite: CPT 212. *1 sem. hr.*

CPT 455. POLLUTION CONTROL IV: Continuation of CPT 454. Studies of ground water occurrence, hydrology, contaminant entry, plume propagation, quality monitoring, and remediation techniques; the technology of solid waste containment, leachate control, and drinking water protection. Prerequisite: CPT 454. *3 sem. hrs.*

CPT 462. POLYMERS: Introduction to addition, condensation, cellulosic and natural polymers, their production, processing, properties, and use. Extensive examination of plastics manufacturing operations including casting, extrusion, and composite methods. Prerequisite: CPT 122. *3 sem. hrs.*

CPT 471. BIOMEDICAL EQUIPMENT I: Fundamentals of electro-mechanical equipment and systems as used in medical facilities. Studies of physiological processes on which equipment functionality depends, electronic principles and circuitry, and practices for using the equipment for measurement, life support, and therapy. Prerequisites: BIO 152, EDD 306, EET 306. *3 sem. hrs.*

CPT 472. BIOMEDICAL EQUIPMENT II: Continuation of CPT 471, with emphasis on systems. Studies of imaging equipment such as X-ray and NMR and of nuclear and radio isotope systems. Emphasis on computers for control and data handling. Studies of safety aspects of equipment and system safety programs conducted by medical facilities. Prerequisite: CPT 471. *3 sem. hrs.*

CPT 473. BIOMECHANICS: Modeling of the human musculoskeletal system using mechanical analogies, with the goal of improving the industrial workplace. Studies of ergonomic principles, common industrial maladies, and the use of mechanics for quantitative prediction. Prerequisites: EDD 305, 306; MCT 215, 217. *3 sem. hrs.*

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*General education course. See Chapter V.

ELECTRONIC ENGINEERING TECHNOLOGY (EET)

The Department of Electronic Engineering Technology prepares students for careers in the electronics field. The curriculum includes a strong emphasis on computer engineering technology while centering on applied engineering topics in circuit analysis, electronic design, communications, digital circuits, micro-processors, and instrumentation. The graduate is prepared to work in industry at a variety of tasks including analog and digital design, microprocessor hard-ware and soft-ware applications, plant engineering, technical management, engineering sales, product design and development, and electronic communications. The curriculum provides the strong foundation in basic electronics necessary to support any future career studies or development as dictated by changing technology or career roles.

This program is accredited by The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

PROGRAM T3: BACHELOR OF SCIENCE WITH A MAJOR IN ELECTRONIC ENGINEERING TECHNOLOGY (EET)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		First Year		
EET	100	First-Year Seminar	1-0-0	
SET	153	Technical Computation	1-0-1	
—	—	General education requirement[2]	3-0-3	
ENG	101-102	College Composition I, II	3-0-3	3-0-3
SET	112-113	Engineering Technology Mathematics I, II	4-0-4	3-0-3
EET	110,120	Electrical Circuits I, II	3-3-4	3-3-4
CPT	122	General Chemistry		3-3-4
SPE	101	Fundamentals of Oral Communication		3-0-3
			15	17
		Sophomore Year		
EET	220	Electrical Circuits III	3-0-3	
EET	223	Schematics and Diagrams	0-3-1	
EET	224	Digital Computer Fundamentals	3-3-4	
EET	206, 306	Electron Devices I, II	3-3-4	3-3-4
EET	300	Electronic Engineering Technology Seminar	1-0-0	1-0-0
SET	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
EET	357	Microprocessors I		3-3-4
SET	334	Technical Writing		2-0-2
—	—	General education requirement[2]		3-0-3
			15	16
		Junior Year		
EET	208	Cathode Ray Oscilloscope	1-0-1	
EET	358	Microprocessors II	3-0-3	
CPS	144	FORTRAN	3-0-3	
MCT	220	Statics and Dynamics	3-0-3	
SET	306	Engineering Technology Mathematics V	3-0-3	
—	—	Technical electives	3-0-3	3-0-3
EET	300	Electronic Engineering Technology Seminar	1-0-0	1 -0-0
EET	328	Electronic Communications		3-3-4
IET	215	Organization and Management		3-0-3
HST	101 or 102	History of Western Civilization		3-0-3
PHY	203	Modern Technical Physics		3-2-4
			16	17

		Senior Year		
EET	427	Pulse and Digital Circuits	3-3-4	
SET	499	Seminar	1-0-1	
EET	300	Electronic Engineering Technology Seminar	1-0-0	1-0-0
EET	—	Electronic engineering technology electives	3-0-3	3-0-3
—	—	General education requirements[2]	3-0-3	6-0-6
—	—	Technical electives	3-0-3	3-0-3
SET	301-302	The Technological Society I, II	3-0-3	3-0-3
EET	430	Special Electronic Projects		1-0-1
			17	16

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

[2]See General Education Requirements, Chapter V. Some general education courses are specified in the program (e.g., PHY 203); others are to be chosen from the listing of approved courses.

FACULTY

Joseph M. Farren, *Chairperson*
Professor Emeritus: Hazen
Professors: Farren, Hanneman, Rooney
Associate Professors: Coures, Hovey, Ismail
Part-time Instructors: Surber, VanDonkelaar

COURSES OF INSTRUCTION

EET 100. FIRST-YEAR SEMINAR: Introduction to the department, its faculty, its curriculum, opportunities for graduates, and the various procedures and policies necessary for the successful student to follow. *No credit*

EET 110. ELECTRICAL CIRCUITS I: Practical concepts of DC circuits: resistance, resistivity, power, and magnetism. Circuit calculations using basic formulas. Corequisite: SET 112. *3 sem. hrs.*

EET 110L. ELECTRICAL CIRCUITS I LABORATORY: To accompany EET 110. Three hours of laboratory a week. *1 sem. hr.*

EET 120. ELECTRICAL CIRCUITS II: Practical concepts of AC circuits: capacitance, inductance, reactance, impedance, phase, and circuit analysis. Circuit calculations utilize vectors and complex quantities. Prerequisites: EET 110 or 201; SET 112. *3 sem. hrs.*

EET 120L. ELECTRICAL CIRCUITS II LABORATORY: To accompany EET 120. Three hours of laboratory a week. *1 sem. hr.*

EET 201. FUNDAMENTALS OF ELECTRONIC TECHNOLOGY: Physics of electricity, DC and AC circuit fundamentals, measurements, and electron devices for non-electronic engineering technology majors. Prerequisite: SET 112. *3 sem. hrs.*

EET 206. ELECTRON DEVICES I: Fundamentals of transistors (bipolar and field effect), vacuum tubes, gas tubes, semi-conductor diodes, and their associated circuits. Prerequisite: EET 120. Corequisite: SET 210. *3 sem. hrs.*

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

EET 208. CATHODE RAY OSCILLOSCOPE: Study of the design, operation and application of the cathode ray oscilloscope. Prerequisite: EET 120. *1 sem. hr.*

EET 220. ELECTRICAL CIRCUITS III: Topics in AC circuits including power factor correction, resonance, polyphase circuits, transformers, pulse response, and the use of ECAP and SPICE to analyze circuits. Prerequisite: EET 120. *3 sem. hrs.*

EET 223. SCHEMATICS AND DIAGRAMS: Procedures, standards, and symbols used on electronic circuit diagrams. Prerequisite: EET 120. *1 sem. hr.*

EET 224. 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). Prerequisite: EET 120. *3 sem. hrs.*

EET 224L. DIGITAL COMPUTER FUNDAMENTALS LABORATORY: To accompany EET 224. Three hours of laboratory a week. *1 sem. hr.*

EET 300. ELECTRONIC ENGINEERING TECHNOLOGY SEMINAR: Exchange of ideas in electronics, to include student lectures, guest lectures, and industrial visitations. Required of all EET students who are enrolled in or have taken EET 206. *No credit*

EET 306. ELECTRON DEVICES II: Fundamentals of integrated circuits, operational amplifiers, transistors, photoelectric devices, silicon-controlled rectifiers, and their associated circuits. Prerequisite: EET 206. Corequisite: SET 211. *3 sem. hrs.*

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

EET 307. ELECTRICAL MEASUREMENTS: Application of direct and alternating current circuit analysis to electrical measuring methods and techniques with emphasis on industrial problems and considerations. Prerequisite: EET 120. *3 sem. hrs.*

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

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

EET 357. MICROPROCESSORS I: Study of microprocessor architecture, hardware, software, and application. Prerequisite: EET 224. *3 sem. hrs.*

EET 357L. MICROPROCESSORS I LABORATORY: To accompany EET 357. Emphasis on memory design, I/O design, and software development. Three hours of laboratory a week. *1 sem. hr.*

EET 358. MICROPROCESSORS II: Studies in microprocessor software design, mass storage systems, and applications. Prerequisite: EET 357. *3 sem. hrs.*

EET 361. PROGRAMMING STRUCTURES: The study of programming language structure concepts for microcomputers. Emphasis on the C programming language and its application to software and hardware development. Topics include C operators, flow control statements, functions, pointers and arrays, I/O structures, and library routines. Prerequisite: EET 357. *3 sem. hrs.*

EET 362. CONCEPTS AND APPLICATIONS OF COMPUTER OPERATING SYSTEMS: Introduction to the fundamentals and applications of computer operating systems and the interaction of hardware and software. Operating systems for large-scale, mini-, and microcomputers introduced through case studies. Prerequisite: EET 357. *3 sem. hrs.*

EET 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.*

EET 427. PULSE AND DIGITAL CIRCUITS: Design and analysis of circuits relating to computers and communications. Topics include integrators, differentiators, blocking oscillators, multivibrators, flip-flops, and time-base generators. Laplace transform analysis utilized. Prerequisites: EET 220, 224; SET 306. *3 sem. hrs.*

EET 427L. PULSE AND DIGITAL CIRCUITS LABORATORY: To accompany EET 427. Three hours of laboratory a week. *1 sem. hr.*

EET 430. SPECIAL ELECTRONIC PROJECTS: Laboratory work and reading associated with a phase of electricity selected by the student and approved by department chairperson. Prerequisite: EET 306. *1 sem. hr.*

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

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

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

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

EET 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.*

EET 459. MICROPROCESSOR SYSTEMS DESIGN: Introduction to industrial design procedures for microprocessor-based control systems. Emphasis on the integration of microcomputer hardware and software. Prerequisite: EET 358. *3 sem. hrs.*

EET 460. ADVANCED MICROPROCESSOR SYSTEMS: Study of advanced microprocessor families and their applications to systems, including single and multi-processor design. Prerequisite: EET 357. *3 sem. hrs.*

EET 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: EET 120 or 201. *3 sem. hrs.*

EET 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: EET 328, 328L. *3 sem. hrs.*

EET 463. ELECTRONIC CAD: Methods and techniques utilizing computer-aided design in electronic design, layout, and evaluation. Prerequisites: EET 206, 223. Corequisite: EET 463L. *2 sem. hrs.*

EET 463L. ELECTRONIC CAD LABORATORY: To accompany EET 463. Three laboratory hours a week. *1 sem. hr.*

EET 464. MICROCONTROLLERS AND PLC'S: Study of various microcontrollers and their incorporation into control applications. Interfacing, bus structures, interrupts, and instruction sets; operation and application of programmable logic conrollers. Prerequisite: EET 357. *3 sem. hrs.*

EET 465. DIGITAL DATA COMMUNICATIONS: Study of the techniques for transmission of messages between digital electronic devices separated by short and long distances. Various data formats used along with hardware, codes, and I/O devices. Prerequisite: EET 357. *3 sem. hrs.*

ENVIRONMENTAL ENGINEERING TECHNOLOGY (EVT)

The Environmental Engineering Technology Program is offered and administered by the Department of Chemical Technology. Graduates of the program are prepared for responsibilities in both the private and public sectors wherein the effects and control of pollution are of major concern. Typical professional positions include the oversight of waste treatment operations, the supervision of pollution abatement programs, and the management of regulatory implementation. The study program includes mathematics, basic and engineering sciences, and pollution control technology.

PROGRAM T4: BACHELOR OF SCIENCE WITH A MAJOR IN ENVIRONMENTAL ENGINEERING TECHNOLOGY (EVT)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		First Year		
CPT	125	Inorganic Chemistry	3-3-4	
SET	153	Technical Computation	1-0-1	
MCT	110L	Technical Drawing and CAD	0-6-2	
—	—	General education requirement[2]	3-0-3	
ENG	101-102	College Composition I, II	3-0-3	3-0-3
SET	112-113	Engineering Technology Mathematics I, II	4-0-4	3-0-3
CPT	212	Quantitative Analysis		2-5-4
EET	201	Fundamentals of Electronic Technology		3-0-3
HST	101 or 102	History of Western Civilization		3-0-3
			17	16
		Sophomore Year		
BIO	151	Concepts of Biology I	3-0-3	
CPT	210	Organic Chemistry	3-3-4	
MCT	220	Statics and Dynamics	3-0-3	
—	—	General education requirement[2]	3-0-3	
SET	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
BIO	350	Applied Microbiology		3-0-3
MCT	231	Fluid Mechanics		3-0-3
PHY	203	Modern Technical Physics		3-2-4
SPE	101	Fundamentals of Oral Communication		3-0-3
			16	16
		Junior Year		
CPT	316	Analytical Instrumentation	3-3-4	
GEO	218	Engineering Geology	3-0-3	
MCT	342	Thermodynamics	3-0-3	
SET	306	Engineering Technology Mathematics V	3-0-3	
SET	301-302	The Technological Society I, II	3-0-3	3-0-3
SET	334	Technical Writing		2-0-2
CPS	144	FORTRAN		3-0-3
IET	215	Organization and Management		3-0-3
IET	318	Statistical Process Control		3-0-3
—	—	General education requirement[2]		3-0-3
			16	17

		Senior Year		
CPT	215	The Chemical Industry	3-0-3	
CPT	313	Physical Chemistry	3-0-3	
CPT	452-453	Pollution Control I, II	3-0-3	3-0-3
CPT	454-455	Pollution Control III, IV	3-3-4	3-0-3
—	—	General education requirements[2]	3-0-3	3-0-3
SET	499	Seminar		1-0-1
—	—	Technical electives		6-0-6
			16	16

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

[2]See General Education Requirements, Chapter V. Some general education courses are specified in the program (e.g., PHY 203); others are to be chosen from the listing of approved courses.

INDUSTRIAL ENGINEERING TECHNOLOGY (IET)

The Industrial Engineering Technology Program has as its objective providing specialized education to prepare students for management and technical staff positions in such areas as manufacturing, health care, banking, transportation, food service, and government. They may be involved in the economic selection and location of equipment, the planning of work methods and expected output, and the scheduling and controlling of the flow of materials. The curriculum emphasizes courses in time and motion study, production planning and control, facilities layout, economic analysis, statistical quality control, labor and wage administration, and mathematical decision making.

This program is accredited by The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

PROGRAM T5: BACHELOR OF SCIENCE WITH A MAJOR IN INDUSTRIAL ENGINEERING TECHNOLOGY (IET)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		First Year		
CPT	122	General Chemistry	3-3-4	
MCT	110L	Technical Drawing and CAD	0-6-2	
ENG	101-102	College Composition I, II	3-0-3	3-0-3
SET	112-113	Engineering Technology Mathematics I, II	4-0-4	3-0-3
—	—	General education requirements[2]	3-0-3	3-0-3
IET	215	Organization and Management		3-0-3
MFG	204	Industrial Materials and Processes		3-3-4
SET	153	Technical Computation		1-0-1
			16	17
		Sophomore Year		
CPS	144	FORTRAN	3-0-3	
IET	108	Production Methods and Controls	3-0-3	
MFG	108L	Manufacturing Processes Laboratory	0-3-1	
MCT	220	Statics and Dynamics	3-0-3	
SPE	101	Fundamentals of Oral Communication	3-0-3	
SET	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
EET	201	Fundamentals of Electronic Technology		3-0-3
HST	101 or 102	History of Western Civilization		3-0-3
IET	225	Elements of Cost Control		3-0-3
IET	230	Work Measurement		2-3-3
MFG	206L	Dimensional Metrology		0-3-1
			16	16
		Junior Year		
IET	316	Quantitative Methods in Industrial Engineering Technology	3-0-3	
IET	317	Industrial Economic Analysis	3-0-3	
IET	422	Human Factors	3-0-3	
MCT	313	Industrial Mechanisms	3-0-3	
SET	334	Technical Writing	2-0-2	
—	—	Technical elective	3-0-3	
IET	318	Statistical Process Control		3-0-3

IET	418	Cost Estimating		3-0-3
PHY	203	Modern Technical Physics		3-2-4
SET	301	The Technological Society I		3-0-3
SET	499	Seminar		1-0-1
—	—	General education requirement[2]		3-0-3
			17	17
		Senior Year		
IET	420	Industrial and Environmental Safety	3-0-3	
IET	432	Facilities Layout	2-3-3	
SET	499	Seminar	1-0-1	
—	—	General education requirements[2]	3-0-3	3-0-3
—	—	Technical electives	6-0-6	3-0-3
IET	405	Labor Administration		3-0-3
IET	421	Project Management		3-0-3
SET	302	The Technological Society II		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]See General Education Requirements, Chapter V. Some general education courses are specified in the program (e.g., PHY 203); others are to be chosen from the listing of approved courses.

FACULTY

James F. Courtright, *Program Director*
Professor Emeritus: McGraw
Professor: Courtright
Associate Professors: Simon (MFG), Summers
Assistant Professor: Sharp (MFG)

COURSES OF INSTRUCTION

IET 108. PRODUCTION METHODS AND CONTROLS: Introduction to the principles and current practices of managing the production of goods and services. Just-in-time, materials requirements planning, forecasting, bills of material, scheduling, and optimizing production. *3 sem. hrs.*

IET 215. ORGANIZATION AND MANAGEMENT: Study of the structure of industrial and service organizations; the responsibilities and duties of a manager or supervisor in developing an effective production team. Written and oral team presentations, role playing, and the application of human relations. *3 sem. hrs.*

IET 225. ELEMENTS OF COST CONTROL: Survey of the methods of breakdown and cost analysis of labor, material, and overhead used in manufacturing and service organizations. Basic cost accounting including balance sheets, income statements, change of financial condition, and ratio analysis. Prerequisites: SET 112, 153. *3 sem. hrs.*

IET 230. WORK MEASUREMENT: Fundamentals of work simplification and motion economy using the techniques of time-and-motion study. Setting of labor standards using the techniques of stop watch, pre-determined time, standard data, and work sampling. Introduction to CIM and automated manufacturing. Prerequisites: SET 112, 153. Corequisite: IET 230L. *2 sem. hrs.*

IET 230L. WORK MEASUREMENT LABORATORY: The application of real-world time-and-motion-study techniques such as flow process, man-machine, and gozinta charts. Calculations for time standards, production efficiency, line balance, cost reduction, manpower, and equipment. A written and oral report on an automated machine line; computer programs and computerized time studies. Three hours of laboratory each week. Prerequisites: SET 112, 153. Corequisite: IET 230. *1 sem. hr.*

IET 316. QUANTITATIVE METHODS IN INDUSTRIAL ENGINEERING TECHNOLOGY: Introduction of the mathematical techniques used to support decision making and managerial analysis. Probability theory, decision theory, linear programming, and queueing theory. Prerequisites: SET 113, 153. *3 sem. hrs.*

IET 317. INDUSTRIAL ECONOMIC ANALYSIS: Comparison of manufacturing or service industry projects and investments based on their economic value. Quantification of costs and benefits; analysis using present worth and annual worth methods. Study of simple and compound interest. Prerequisites: SET 153, 210. *3 sem. hrs.*

IET 318. STATISTICAL PROCESS CONTROL: Statistics and probability theory applied to produce control charts (x-bar, R, s, p, u, and c) to monitor processes. Interpretation and application of these charts. Sample size selection, reliability, pareto analysis, and modern quality management techniques. Prerequisites: SET 113, 153. *3 sem. hrs.*

IET 400. SELECTED TOPICS: A self-paced research course. Preparation of a documented written research project on an engineering technology subject. May not be taken more than once. Prerequisites: Junior or senior status; permission of program director. *3 sem. hrs.*

IET 405. LABOR ADMINISTRATION: Brief history of labor legislation and labor unions to provide an understanding of the origins of current labor practices. Case studies on current labor topics as examples of management techniques. Collective bargaining, employee rights, contracts, grievances, and arbitration. *3 sem. hrs.*

IET 415. INDUSTRIAL ENGINEERING TECHNOLOGY SEMINAR: The capstone course for the IET program. Development and management of the allocation of a company's resources: capacity, raw materials, equipment, and personnel. Computer simulation to solve product and service provision problems. Prerequisite: IET senior status. *3 sem. hrs.*

IET 418. COST ESTIMATING: Study of the fundamentals of cost estimating of labor, material, and overhead for products, projects, operations, and systems. The concepts of internal and external cost estimating, types of costs, ethics, budgets, and profit. Semester team and individual projects, written and oral. Prerequisites: SET 153, 210. *3 sem. hrs.*

IET 420. INDUSTRIAL AND ENVIRONMENTAL SAFETY: Study of practices and devices such as OSHA, Life Safety Code 101, sprinkler systems, special protection systems, hazardous materials, SARA, machine guarding, poisons, pests, construction, helicopters, the National Electric Code, health, and personal protection. Written inspection reports. *3 sem. hrs.*

IET 421. PROJECT MANAGEMENT: Study of the structure, techniques, and application of project management including mathematical models, decision making, styles of management, and communications. Analysis of and oral reports on project management problems. Semester team project with written and oral presentations. Prerequisites: SET 113, 153, 334; IET 215; SPE 101. *3 sem. hrs.*

IET 422. HUMAN FACTORS: Methods of improving the interface of humans with their physical work environment. Study of human characteristics to determine the best designs for tasks, products, workstations, and other environmental features. Written and oral projects. Prerequisite: Junior or senior status. *3 sem. hrs.*

IET 423. THE IET IN SERVICE ORGANIZATIONS: Case studies, articles, guest speakers, and projects to provide insight into how industrial engineering technology skills and training can be applied to service industries including hospitals, banks, and eating and retailing establishments. Prerequisite: IET junior status. *3 sem. hrs.*

IET 432. FACILITIES LAYOUT: Design of facilities for the most efficient flow of raw materials, work-in-process, and completed stock through a work place. Facilities layout, material handling, and warehousing in relation to trends toward reduced inventory, smaller lot sizes, and just-in-time. Prerequisites: IET 230, 230L, and IET junior status. Corequisite: IET 432L. *2 sem. hrs.*

IET 432L. FACILITIES LAYOUT LABORATORY: To accompany IET 432. Projects to investigate efficient layouts of production facilities, hospitals, libraries, warehouses, receiving docks, and other areas. Three hours of laboratory a week. Prerequisites: IET 230, 230L; IET junior status. Corequisite: IET 432. *1 sem. hr.*

MANUFACTURING ENGINEERING TECHNOLOGY (MFG)

The Manufacturing Engineering Technology Program prepares graduates for technical and management careers in many types of companies, such as those that fabricate and assemble mechanical equipment or consumer products, continuous process industries, and defense-related industries. Positions in manufacturing engineering, plant engineering, production supervision, quality assurance, methods, and tooling are appropriate for the graduate of this program. Instruction is provided in manufacturing technology; computer-aided design; automated manufacturing and computer-integrated manufacturing; the technical sciences; manufacturing planning and control; and applied mathematics including probability and statistics, calculus, and linear programming. The program contains strong components from the humanities, social sciences, and communications to help prepare the graduates for productive careers in industry.

PROGRAM T6: BACHELOR OF SCIENCE WITH A MAJOR IN MANUFACTURING ENGINEERING TECHNOLOGY (MFG)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		First Year		
CPT	122	General Chemistry	3-3-4	
MCT	110L	Technical Drawing and CAD	0-6-2	
SET	153	Technical Computation	1-0-1	
ENG	101-102	College Composition I, II	3-0-3	3-0-3
SET	112-113	Engineering Technology Mathematics I, II	4-0-4	3-0-3
—	—	General education requirements[2]	3-0-3	3-0-3
MFG	204	Materials and Processes		3-3-4
MFG	108L	Manufacturing Processes Laboratory		0-3-1
SPE	101	Fundamentals of Oral Communication		3-0-3
			17	17
		Sophomore Year		
CPS	144	FORTRAN	3-0-3	
HST	101 or 102	History of Western Civilization	3-0-3	
IET	108	Production Methods and Control	3-0-3	
MFG	206L	Dimensional Metrology	0-3-1	
MCT	220	Statics and Dynamics	3-0-3	
SET	210-111	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
EET	201	Fundamentals of Electronic Technology		3-0-3
MCT	221	Strength of Materials		3-0-3
MCT	231	Fluid Mechanics		3-0-3
MFG	240	Manufacturing Design		3-0-3
SET	334	Technical Writing		2-0-2
			16	17

		Junior Year		
IET	316	Quantitative Methods in Industrial Engineering Technology	3-0-3	
IET	318	Statistical Process Control	3-0-3	
MFG	434	Numerical Control	3-0-3	
MCT	313	Industrial Mechanisms	3-0-3	
MCT	336	Fluid Power	3-3-4	
IET	215	Organization and Management		3-0-3
MFG	426	Automated Manufacturing Systems and CIM		3-0-3
MFG	431	Controls for Industrial Automation		3-0-3
PHY	203	Modern Technical Physics		3-2-4
SET	499	Seminar		1-0-1
—	—	Technical elective		3-0-3
			16	17
		Senior Year		
MFG	450	Manufacturing Engineering Technology Project	2-0-2	
MCT	333L	Mechanical Measurements	0-3-1	
SET	301-302	The Technological Society I, II	3-0-3	3-0-3
—	—	Technical electives	3-0-3	6-0-6
—	—	General education requirements[2]	6-0-6	3-0-3
IET	317	Industrial Economic Analysis		3-0-3
			15	15

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

[2]See General Education Requirements, Chapter V. Some general education courses are specified in the program (e.g., PHY 203); others are to be chosen from the listing of approved courses.

FACULTY

Robert L. Wolff, *Program Director*
Professors: Courtright (IET), Wolff
Associate Professors: Simon, Summers (IET), Untener (MCT)
Assistant Professors: Sharp
Adjunct Associate Professor: Wendeln

COURSES OF INSTRUCTION

MFG 108L. MANUFACTURING PROCESSES LABORATORY: Application of metal-cutting theory using single- and multiple-point cutting tools, basic metal removal process of toolroom and production machines. Experience on conventional milling machines, shapers, lathes, surface grinders, and drill presses. Three hours of laboratory a week. *1 sem. hr.*

MFG 204. INDUSTRIAL MATERIALS AND PROCESSES: Chemical and physical properties of metals, ceramics, and polymers; casting processes; powdered metallurgy; metal forming; plastic processes. Oral and written presentation of a team case study. Corequisite: MFG 204L. *3 sem. hrs.*

MFG 204L. INDUSTRIAL MATERIALS AND PROCESSES LABORATORY: Destructive testing of metal using standard test instruments and procedures for tension, impact, and hardness. Heat-treatment studies including tempering, hardening, annealing, and hardenability curve determination. Hardness testing including Rockwell, Brinell, and Shore Scleroscope. Impact testing. Visits to test and metallurgical laboratories. Corequisite: MFG 204. *1 sem. hr.*

MFG 206L. DIMENSIONAL METROLOGY: Theory and practice of dimensional metrology including the surface plate, angle and sine plates, basic measuring instruments, optical microscope and profile projector, electronic gauges, co-ordinate measuring machine, fixed gauges, length standards, measurement of geometric sizes of parts, height gauges, dial indicators, study of sources of measurement error, engineering drawing interpretation. Three hours of laboratory a week. Prerequisites: SET 112, 113; MCT 110L. *1 sem. hr.*

MFG 240. MANUFACTURING DESIGN: Manufacturing planning; drawing interpretation; geometric dimensioning and tolerancing; process planning; machine tools; workholders; power presses; blanking, forming, and draw dies; fine blanking; electrical discharge machining. Prerequisites: MFG 108L, 204, 206L; MCT 110L. *3 sem. hrs.*

MFG 400. SELECTED MANUFACTURING TOPICS: Investigation and discussion of current topics in manufacturing engineering technology. May be taken more than once. Prerequisite: Permission of the program director. *1-4 sem. hrs.*

MFG 424. ROBOTICS: Study of robotics including history, robot geometry, cost justification, end-effector (types, use, and design), sensors, and programming. Application of robots in industries. Robot programming and operation projects and end-effector design projects. Prerequisites: SET 113, 153; MCT 220 or 217, 313. *3 sem. hrs.*

MFG 426. AUTOMATED MANUFACTURING SYSTEMS AND CIM: CIM systems and interrelationships; group technology, computer-aided process planning, expert systems, local area networks, automated flow lines, data collection, material handling. Team project to plan, design, and make an oral presentation of a proposal for a complete manufacturing cell. Prerequisites: MFG 108L, 204; SET 153; EET 201. *3 sem. hrs.*

MFG 431. CONTROLS FOR INDUSTRIAL AUTOMATION: Electrical motor and control types and selection, conventional machinery control input-output devices, stepper motors. Interpretation and design of conventional ladder relay logic control systems, programmable logic controller systems using manual data input and off-line computer-programming projects, and moving-part pneumatic logic systems. Prerequisites: EET 201; SET 113, 153. *3 sem. hrs.*

MFG 434. COMPUTER NUMERICAL CONTROL: CNC programming for the mill and lathe; application of CAM software to design CNC programs, edit programs, and display tool paths. Parametric part programming concepts to produce complex surfaces. Machine set-up and operation. Design, programming, and production of a product on the CNC mill and lathe. Prerequisites: SET 112, 153; MFG 108L; MCT 110L. *3 sem. hrs.*

MFG 450. MANUFACTURING ENGINEERING TECHNOLOGY PROJECT: Study and research in a specific area that integrates major elements from previous design and manufacturing process courses, culminating in individual and/or group projects and technical reports. Prerequisite: MFG senior status. *2 sem. hrs.*

MECHANICAL ENGINEERING TECHNOLOGY (MCT)

The Mechanical Engineering Technology Program emphasizes the practical application of the principles of the mechanical field. Career opportunities are in mechanical design, computer-aided design, product evaluation and development, manufacturing engineering, computer-aided manufacturing, plant engineering, technical sales, technical service, fluid power, automation, and supervision. A significant portion of the graduates are in technical management. The curriculum includes a core of technical sciences; applied courses in design, thermo-dynamics, fluid mechanics, and manufacturing; extensive laboratory experiences; and mathematics from college algebra through probability, statistics, calculus, and differential equations. Courses are required in oral and written communication, with components in the humanities and social sciences to provide insight into the impact of technology on society. Concepts from basic education are stressed in technical courses. The curriculum is broad to prepare graduates for employment and provide a foundation on which to base continued study of changing technology.

This program is accredited by The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

PROGRAM T7: BACHELOR OF SCIENCE WITH A MAJOR IN MECHANICAL ENGINEERING TECHNOLOGY (MCT)

Dept.	*No.*	*Course*	*1st Term*[1]	*2nd Term*
		First Year		
CPT	122	General Chemistry	3-3-4	
MFG	108L	Manufacturing Processes Laboratory	0-3-1	
MCT	110L	Technical Drawing and CAD	0-6-2	
ENG	101-102	College Composition I, II	3-0-3	3-0-3
SET	112-113	Engineering Technology Mathematics I, II	4-0-4	3-0-3
—	—	General education requirements[2]	3-0-3	
MFG	204	Industrial Materials and Processes		3-3-4
MCT	111	Computer Graphics		1-6-3
SET	153	Technical Computation		1-0-1
SPE	101	Fundamentals of Oral Communication		3-0-3
			17	17
		Sophomore Year		
CPS	144	FORTRAN	3-0-3	
MFG	206L	Dimensional Metrology	0-3-1	
MCT	215	Statics	3-0-3	
—	—	General education requirements[2]	3-0-3	
PHY	201-202	General Physics	3-3-4	3-3-4
SET	210-211	Engineering Technology Mathematics III, IV	3-0-3	3-0-3
MCT	217	Dynamics		3-0-3
MCT	221	Strength of Materials		3-0-3
MCT	231	Fluid Mechanics		3-0-3
			17	16

		Junior Year		
MFG	240	Manufacturing Design	3-0-3	
MCT	313	Industrial Mechanisms	3-0-3	
MCT	336	Fluid Power	3-3-4	
MCT	342	Thermodynamics	3-0-3	
SET	306	Engineering Technology Mathematics V	3-0-3	
EET	224 or 120	Digital Computer Fundamentals or Elec. Circuits II		3-0-3
HST	101 or 102	History of Western Civilization		3-0-3
MCT	330	Design of Machine Elements		3-0-3
MCT	333L	Mechanical Measurements		0-3-1
MCT	334L	Fluid and Thermal Laboratory		0-3-1
SET	334	Technical Writing		2-0-2
SET	499	Seminar		1-0-1
—	—	Technical elective		3-0-3
			16	17
		Senior Year		
IET	215	Organization & Management	3-0-3	
MCT	433	Mechanical Design	2-0-2	
MCT	—	Mechanical engineering technology electives	3-0-3	3-0-3
SET	301-302	The Technological Society I, II	3-0-3	3-0-3
—	—	General education requirements[2]	6-0-6	3-0-3
—	—	Technical electives		6-0-6
			17	15

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

[2]See General Education Requirements, Chapter V. Some general education courses are specified in the program (e.g., PHY 203); others are to be chosen from the listing of approved courses.

FACULTY

Philip E. Doepker, *Chairperson*
Professor Emeritus: Wilder
Professors: Doepker, Mott, Wolff (MFG)
Associate Professor: Untener
Assistant Professors: Myszka, Sharp (MFG)

COURSES OF INSTRUCTION

MCT 109L. INTRODUCTION TO CAD: Coordinate systems; display commands; computer generation of various geometric primitives such as points, lines, arcs, strings, text, groups, and symbols; editing and manipulating geometry; layers and layering standards; three-dimensional modeling. Three hours of laboratory a week. Prerequisite: Approval only. *1 sem. hr.*

MCT 110L. TECHNICAL DRAWING AND CAD: Technical sketching and shape description, orthographic projection theory, multi-view drawings, necessary views, sectional views, working and shop drawings, dimensioning practices, tolerancing, thread and fastener representation and nomenclature, assembly and detail drawings. Six hours of laboratory a week using conventional drafting instruments and commercial computer-aided design (CAD) software. *2 sem. hrs.*

MCT 111. COMPUTER GRAPHICS: ANSI Y14.5-1982 tolerancing and drafting standards, auxiliary views, selected topics from descriptive geometry, weld symbols, machining and surface finish symbols, blueprint reading as applied to frames, mechanical and structural components, piping and hydraulic drawings. Individual or team design projects. Prerequisite: MCT 110L. *1 sem. hr.*

MCT 111L. COMPUTER GRAPHICS LABORATORY: Laboratory assignments utilizing traditional and computer-aided design (CAD) techniques to reinforce topics from MCT 111. Advanced topics from CAD, three-dimensional solid and surface modeling. Prerequisite: MCT 110L. Corequisite: MCT 111. *2 sem. hrs.*

MCT 215. STATICS: Principles of applied engineering mechanics: force systems, free body diagrams, resultants and equilibrium in both two- and three- dimensional systems; centroids and centers of gravity; distributed load systems; application of loads to trusses, frames, machines, and beams; friction; moments of inertia of areas. Prerequisites: SET 112, 153. *3 sem. hrs.*

MCT 217. DYNAMICS: Principles of applied engineering 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; introduction to mechanical vibrations. Prerequisites: MCT 215 or 220; SET 153, 210. *3 sem. hrs.*

MCT 220. STATICS AND DYNAMICS: Study of forces on bodies at rest and in motion using Newton's three laws of motion. Vectors, force systems, components, reactions, resultants, free body diagrams, equilibrium, centroids, moment of inertia, kinetics, and kinematics. For non-MCT majors only. Prerequisites: SET 112, 153. Corequisite: SET 210. *3 sem. hrs.*

MCT 221. STRENGTH OF MATERIALS: Analysis and design of load-carrying members, considering stress, strain, and deflection. Study of direct tension, compression, and shear; torsion; shear and moment diagrams; bending; combined stress; analysis of columns; pressure vessels. Prerequisites: MCT 215 or 220; SET 153, 210. *3 sem. hrs.*

MCT 231. FLUID MECHANICS: Fluid properties, fluid statics including manometry, submerged surfaces, buoyancy and stability of floating bodies. The principles of fluid flow including Bernoulli's and energy equations, energy losses, and pump power. Analysis and design of pipe line systems and open channels; pump selection. Prerequisites: MCT 215 or 220; SET 112, 153. *3 sem. hrs.*

MCT 313. INDUSTRIAL MECHANISMS: Design and analysis of linkages and cams. Graphical solutions to kinematics problems including the concepts of instantaneous motion and relative motion. Development and analysis of motion diagrams. Study of geometric features of gears and gear transmission systems. Prerequisites: MCT 110L, 217 or 220; SET 153. Corequisite: SET 210. *3 sem. hrs.*

MCT 330. DESIGN OF MACHINE ELEMENTS: Analytical design techniques used to evaluate machine elements; stress analysis, working stress, failure theories, fatigue failure; design methods for spur gears, shafts, keys and couplings, roller and journal bearings, and springs. Original design project. Prerequisites: MCT 111, 111L, 221, 313; SET 153. *3 sem. hrs.*

MCT 333L. MECHANICAL MEASUREMENTS: Laboratory evaluations of metal fatigue, stress, strain, noise, vibration, buckling, and nondestructive examination. Utilization of power supplies, transducers, conditioners, amplifiers, recorders; computer data acquisition. Log books and written final reports. Prerequisites: EET 201; MFG 204, 204L; MCT 217, 220, 221. *1 sem. hr.*

MCT 334L. FLUID AND THERMAL LABORATORY: Experiments in fluid mechanics, thermodynamics, and energy conversion. Pressure, temperature, flow, and power measurements using mechanical devices and electronic instrumentation including transducers, sensors, and data acquisition. Prerequisites: MCT 231, 342. *1 sem. hr.*

MCT 336. FLUID POWER: Study of hydraulic and pneumatic fluid power components and systems as used in industrial, mobile, and aerospace applications; standard symbols in circuit design; circuit analysis specification for pumps, valves, cylinders, and circuits; hydraulic fluids; filtration; electric motors; system efficiencies; proportional control and electrohydraulic servo control systems; seals; fluid conductors; pneumatic components and systems. Library research project. Prerequisite: MCT 231. Corequisite: MCT 336L. *3 sem. hrs.*

MCT 336L. FLUID POWER LABORATORY: To accompany MCT 336. Evaluation of fluid power components: pressure, flow, RPM, sound level, current, voltage, power, torque, and time. Graphical design, computational analysis, assembly, and testing of typical circuits and systems. Testing of hydraulic fluids for viscosity, pour point, flash and fire point, specific gravity. Three hours of laboratory a week. *1 sem. hr.*

MCT 342. THERMODYNAMICS: Energy analysis of engineering systems using the concepts and laws of thermodynamics. The principle of the mechanical equivalent of heat, behavior of pure substances, use of thermodynamic property tables, and study of gas mixtures. Application of the Carnot cycle to both heat engines and reversed heat engines. Prerequisites: SET 153, 210. *3 sem. hrs.*

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

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

MCT 430. DESIGN OF FLUID POWER SYSTEMS: Energy efficiency; pressure drop determinations, variable volume pressure-compensated pumps, accumulators, proportional and electrohydraulic valves, cylinder design, hydraulic motor selection; circuit design, open and closed loop systems, power unit design; sizing of electric motors; use of industrial data and National Fluid Power Assn.-JIC design standards. Individual design project. Prerequisite: MCT 336. *3 sem. hrs.*

MCT 432. HEAT POWER: Applications of the principles of thermodynamic cycles. Analysis of energy transfer systems such as internal combustion and gas turbine engines. Power generation through steam cycles including reheat and regenerative cycles. Reversed heat engine cycles and vapor compression cycles used in heating and cooling. Prerequisites: MCT 342, SET 153. *3 sem. hrs.*

MCT 433. MECHANICAL DESIGN: Bringing together analytical and graphical techniques from previous courses to accomplish the design of a complete mechanism, machine, or mechanical system. Conceptual, preliminary, and final design; design criteria; decision analysis; scheduling; electric motor selection, fastening, and joining. Written and oral reports. Prerequisite: MCT 330. *2 sem. hrs.*

MCT 438. HEAT TRANSFER: The principles of conduction, convection, and thermal radiation energy transfer. Conduction through series and parallel walls, pipes, and containers. Forced and free convection through films, thermal radiation of energy between surfaces, and the overall transfer of heat. Prerequisites: MCT 231, 342; SET 153. *3 sem. hrs.*

MCT 440. APPLIED VIBRATIONS: Free and forced vibration of single degree of freedom systems with and without damping. Industrial applications including reciprocating and rotating machinery, balancing, isolation, and noise reduction. Demonstrations of vibration sensors and instrumentation. Prerequisites: MCT 217; SET 153, 306. *3 sem. hrs.*

MCT 445. EXPERIMENTAL MECHANICS: Principles of experimental stress analysis and motion measurement using strain gauges, photoelasticity, brittle coatings, accelerometers, and computerized data acquisition and analysis. Computer analysis of strain gauge rosettes to determine principal stresses. Prerequisites: EET 201, SET 153. Corequisites: MCT 330, 445L. *2 sem. hrs.*

MCT 445L. EXPERIMENTAL MECHANICS LABORATORY: Installation of strain gauge rosettes. Experiments to determine the state of strain and stress in structures using strain gauges, photoelasticity, and brittle coatings. Vibration measurement using strain gauges, accelerometers, and motion transducers. Written and oral reports. Corequisite: MCT 445. *1 sem. hr.*

ENGINEERING TECHNOLOGY SERVICE COURSES (SET)

FACULTY

Professor: Strange
Associate Professors: C. Schleppi, Staub

COURSES OF INSTRUCTION

SET 101. INDUSTRIAL MATHEMATICS: Review of introductory algebra and other selected mathematical topics. *3 sem. hrs.*

SET 112. ENGINEERING TECHNOLOGY MATHEMATICS I: Engineering technology applications of equations, functions, linear systems, exponents, radicals, logarithms, polynomials, triangle and analytic trigonometry, vectors, and complex numbers. *4 sem. hrs.*

SET 113. ENGINEERING TECHNOLOGY MATHEMATICS II: Engineering technology applications of selected topics in finite mathematics such as linear systems, matrices, sets, probability, statistics, finance, logic, and Boolean algebra. *3 sem. hrs.*

SET 153. TECHNICAL COMPUTATION: Introduction to computer programming in BASIC, including BASIC statements, input, output, looping, branching, and arrays. *1 sem. hr.*

SET 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: SET 112. *3 sem. hrs.*

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

*SET 301. THE TECHNOLOGICAL SOCIETY I: History of technology as a revolutionary social force and of the interrelationships between technology, politics, and economics. Prerequisite: HST 101 or 102. *3 sem. hrs.*

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

SET 306. ENGINEERING TECHNOLOGY MATHEMATICS V: Selected topics from ordinary differential equations including Laplace transforms for solving problems encountered in engineering technology. Prerequisite: SET 211. *3 sem. hrs.*

SET 334. TECHNICAL WRITING: Comprehensive treatment of the fundamentals of writing effective technical documentation for industry, including use of technical illustrations and tables. Prerequisite: ENG 102. *2 sem. hrs.*

SET 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.*

SET 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.*

SET 499. SEMINAR: Career planning for engineering technology majors. The job search process, resume preparation, the job interview, professional development. Required of all engineering technology majors in the junior or senior year. *1 sem. hr.*

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*General education course. See Chapter V.