

IX School of Engineering

Blake E. Cherrington, Dean

Richard J. Kee, Associate Dean for Undergraduate Programs

Donald L. Moon, Associate Dean for Graduate Programs, Research,
and Information Technology

Carol M. Shaw, Associate Dean and Director of the Center for Competitive Change

Antionette Letavec, 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 so 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 providing a broad view of the technical and social problems that confront society. Additionally, all school of Engineering programs provide excellent background for other career areas.

As an educational unit of a private university, the School of Engineering strongly emphasizes the advising of students so that they may achieve their educational objectives within the engineering program. Each student is assigned a faculty advisor. Academic advising begins before the students begin their formal course work and continues as they progress toward their objectives.

The broader responsibilities of the engineering profession demand that the professional education of an engineer include a significant component of humanities, ethics, and social science studies so 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. The engineering programs are described beginning on page 369, and the engineering technology programs are described beginning on pages 394.

OPTIONAL COOPERATIVE EDUCATION

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. 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. See also Chapter X.

UNDERGRADUATE ENGINEERING PROGRAMS

The engineering program in each of the fields of chemical, civil, computer, 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, and engineering fundamentals. All of the programs

permit additional specialization (as an overload) in 16 minors and in two concentrations in areas such as aerospace engineering, computer engineering, engineering mechanics, computer systems, structures, and industrial engineering in the School of Engineering and in other areas such as music, languages, and political science in other units of the University. Although emphasis is on fundamental theories, continued attention is paid to the solution of practical problems which the student will encounter in the practice of engineering.

The programs in chemical engineering, civil engineering, electrical engineering, and mechanical engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

The programs in electronic, industrial, manufacturing, and mechanical engineering technology are accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

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 Sinclair Community College.

MINORS IN ENGINEERING

The student majoring in chemical, civil, computer, 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 sub-area 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 at least 12 semester hours of work. It can be composed of any number of 1- to 4-semester-hour courses selected from the approved list of minor areas of study, which currently include the following:

Aerospace Engineering

Bio-Engineering¹

Chemical Processing

Computer Systems

Design and Manufacturing Engineering

Dynamic Analysis of Mechanical Systems

Energy Conversion

Engineering Management

Engineering Mechanics

Environmental Engineering

Materials Engineering

Mechanics of Engineering Systems

Signals and Systems

Structures

Thermal Engineering

Water Resources Engineering

¹Although 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.

A 12-semester-hour concentration in computer engineering is available to electrical engineering undergraduates. An 18-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 their sophomore year. The minor or concentration is designated 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 (4) taking the prescribed courses as part of the first year.

REQUIRED FIRST-YEAR PROGRAM¹

<i>Dept.</i>	<i>No.</i>	<i>Courses</i>	<i>Semester Hours</i>
—	—	First-Year Student Orientation	1
CHM	123	General Chemistry	3
CPS	—	Programming ¹	0-4
EGR	100	Enrichment Workshop	0
EGR	101	Introduction to Engineering Design	3
ENG	101-102 or 114 or 198	English Composition I, II	3 or 6
HST	101 or 102 or 198	History of Western Civilization ²	3
MTH	168-169	Analytic Geometry and Calculus I, II	8
PHL	103	Introduction to Philosophy ²	3
PHY	206	General Physics I ³	3
REL	103	Introduction to Religion	3
—	—	Basic Science Laboratory ⁴	1
Total first-year requirements			31-35

¹Chemical, mechanical and civil engineering students are not required to take any programming course in the first-year. Computer engineering students must take CPS 150 in the second semester; electrical engineering students must take CPS 130 in the second semester; mechanical engineering students take MEE 104L in the second semester of the first year.

²Chemical engineering students must take CHM 124 and CHM 124L in the second semester and postpone one of the three Humanities Base courses until the third semester.

³Computer engineering students postpone this requirement until the third semester.

⁴Chemical, civil, and mechanical engineering students must take CHM 123L; Computer Engineering students postpone this requirement until the third semester and take PHY 210L; and electrical engineering students may take either CHM 123L or PHY 210L.

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 degrees Bachelor of Chemical, Civil, Electrical, or Mechanical Engineering, Bachelor of Science in Computer Engineering, and Bachelor of Science in Engineering Technology are conferred at commencement if the general requirements of Chapter V have been fulfilled as well as those listed below:

1. All prescribed courses outlined in the respective curricula must have been passed with grades of D or better and the student must obtain a minimum grade point average of 2.000 for the prescribed courses. 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 grade-point average in all courses which have an engineering prefix must be at least 2.0 (C average).
4. The student must have attended the School of Engineering at the University of Dayton during their 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	137
Bachelor of Civil Engineering	137
Bachelor of Electrical Engineering	134
Bachelor of Mechanical Engineering	133
Bachelor of Science in Computer Engineering	132

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

Bachelor of Science in Engineering Technology	
Computer Engineering Technology Major	126
Electronic Engineering Technology Major	126
Industrial Engineering Technology Major	129
Manufacturing Engineering Technology Major	131
Mechanical Engineering Technology Major	131

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

The School of Engineering offers a combined 5-year program leading to both a bachelor's degree in a departmental major (chemical, civil, computer, electrical, or mechanical engineering) and a master's degree. Physics majors (College of Arts and Sciences) may also participate. The program is designed for the qualified student who wishes to pursue either greater specialization in a major area or to complement the undergraduate program with a related graduate-level concentration. Most students who select the program have received some advanced placement upon entry to engineering at the first-year level or take occasional summer courses.

The formal request for entrance into this program is made before the first semester of the student's junior year. Admission requirements include a minimum cumulative grade point average of 3.00 and permission from the chairperson of the department corresponding to the student's undergraduate major. Selection of the graduate (master's) program area is indicated below:

Undergraduate Program Chemical Engineering

Civil Engineering

Computer Engineering

Electrical Engineering

Mechanical Engineering

Physics

Graduate Program Selections

Aerospace Engineering
Chemical Engineering
Engineering Management
Management Science
Materials Engineering

Civil Engineering
Engineering Management
Management Science
Materials Engineering

Electrical Engineering
Engineering Management
Management Science
Materials Engineering

Aerospace Engineering
Electrical Engineering
Electro-Optics
Engineering Management
Management Science
Materials Engineering

Aerospace Engineering
Engineering Management
Management Science
Materials Engineering
Mechanical Engineering

Materials Engineering

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

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

5-YEAR BACHELOR'S-MASTER'S PROGRAM

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



CHEMICAL ENGINEERING (CME)

Chemical engineering applies the principles of the physical sciences, economics, and human relations to design, build, and supervise facilities that convert raw materials into useful products and services.

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. The second part of the curriculum offers a balance between classroom and laboratory experience in stressing chemical engineering topics such as transport phenomena, thermodynamics, kinetics and reactor design, separation processes, fluid flow and heat transfer operations, process control, and process design. The development of design tools is integrated throughout the curriculum. The curriculum allows concentrations in emerging technologies such as environmental engineering and materials engineering.

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

BACHELOR OF CHEMICAL ENGINEERING (CME)¹

<i>Dept.</i>	<i>No.</i>	<i>Course</i>	<i>1st Term²</i>	<i>2nd Term</i>
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 I, II	3-3-4	3-3-4
MTH	218	Analytic Geometry and Calculus III	4-0-4	
MTH	219	Applied Differential Equations		3-0-3
—	—	Engineering Elective ³		4-0-4
PHY	207	General Physics II	3-0-3	
—	—	General Education requirements ⁴	3-0-3	3-0-3
			17	17
Junior Year				
CME	311	Chemical Engineering Thermodynamics	4-0-4	
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	
CME	365	Separation Processes		3-0-3
CHM	—	Physical Chemistry Elective ⁵		3-3-4
CHM	—	Chemistry Elective ⁶	3-3-4	
—	—	Technical Elective ⁶		3-0-3
CMM	—	Communication	3-0-3	
—	—	General Education requirement ⁴		3-0-3
			17	17

Senior Year				
CME	406	Chemical Reaction Kinetics and Engineering	3-0-3	
CME	408	Chemical Engineering Seminar	1-0-0	1-0-0
CME	465	Flow and Heat Transfer Processes	3-0-3	
CME	466L	Chemical Engineering Operations Laboratory	0-5-2	3-0-3
CME	430-431	Chemical Engineering Design I, II	3-0-3	
CME	452	Process Control	3-0-3	
CME	453L	Process Control Laboratory		0-5-2
—	—	Chemical Engineering Elective ⁵		3-0-3
—	—	Technical Elective ⁵		3-0-3
—	—	General Education requirements ⁴	3-0-3	6-0-6
			17	17

¹All engineering, mathematics and science courses must be taken for grading option 1.

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

³Select from list of approved engineering courses.

⁴See 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.

⁵Select from CHM 303 and 303L or CHM 304 and 304L.

⁶Select courses from list approved by the Department of Chemical and Materials Engineering.

FACULTY

Tony E. Saliba, *Chairperson, Department of Chemical and Materials Engineering*

Professors Emeriti: Snide, Lu

Professors: Eylon, Flach, Lee, Myers, T. Saliba, Sandhu

Associate Professor: Ciric

Assistant Professor: Wilkens

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. Introduction to the University first-year experience. 1 sem. hr.

CME 203. MATERIAL AND ENERGY BALANCES: Introductory course on the application of mass and energy conservation laws to solve problems typically encountered in chemical process industries. Prerequisites: CHM 123, MTH 168.

3 sem. hrs.

CME 204. EXPERIMENTAL METHODS IN CHEMICAL ENGINEERING: Introduction to experimental methods, instrumentation, digital data acquisition, data analysis, and report writing. Use of digital computer is emphasized. Prerequisites: CME 203; CHM 124L, EGR 101.

3 sem. hrs.

CME 311. CHEMICAL ENGINEERING THERMODYNAMICS: Development of the fundamental principles of thermodynamics, particularly with respect to chemical engineering processes. Prerequisites: CME 203, MTH 218.

4 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 203; 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. 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. 1 sem. hr.

CME 365. SEPARATION TECHNIQUES: Distillation, evaporation, extraction, adsorption, drying, and filtration. Prerequisites: CME 311, 324. 3 sem. hrs.

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. Prerequisites: MTH 219, CME 204. 3 sem. hrs.

CME 406. CHEMICAL REACTION KINETICS AND ENGINEERING: Chemical kinetics, ideal reactor analysis and design, and heterogeneous catalysis. First term, each year. Prerequisite: CME 311. 3 sem. hrs.

CME 408. SEMINAR: Presentation of lectures on contemporary chemical engineering subjects by students, faculty, and engineers in active practice. Registration required of senior students only. No credit

CME 409. INTRODUCTION TO POLYMER ENGINEERING: Introduction to the chemistry, structure, and properties of polymers; polymer synthesis and processing. Prerequisites: CME 311, CHM 314. 3 sem. hrs.

CME 430. CHEMICAL ENGINEERING DESIGN I: Study of the principles of process development, plant design, and economics. First term, each year. Prerequisite: CME 203. 3 sem. hrs.

CME 431. CHEMICAL ENGINEERING DESIGN II: Application of the principles of process development, plant design, and economics. Second term, each year. Prerequisites: CME 430, 406, 465, 365. 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. First term, each year. Prerequisite: CME 381. 3 sem. hrs.

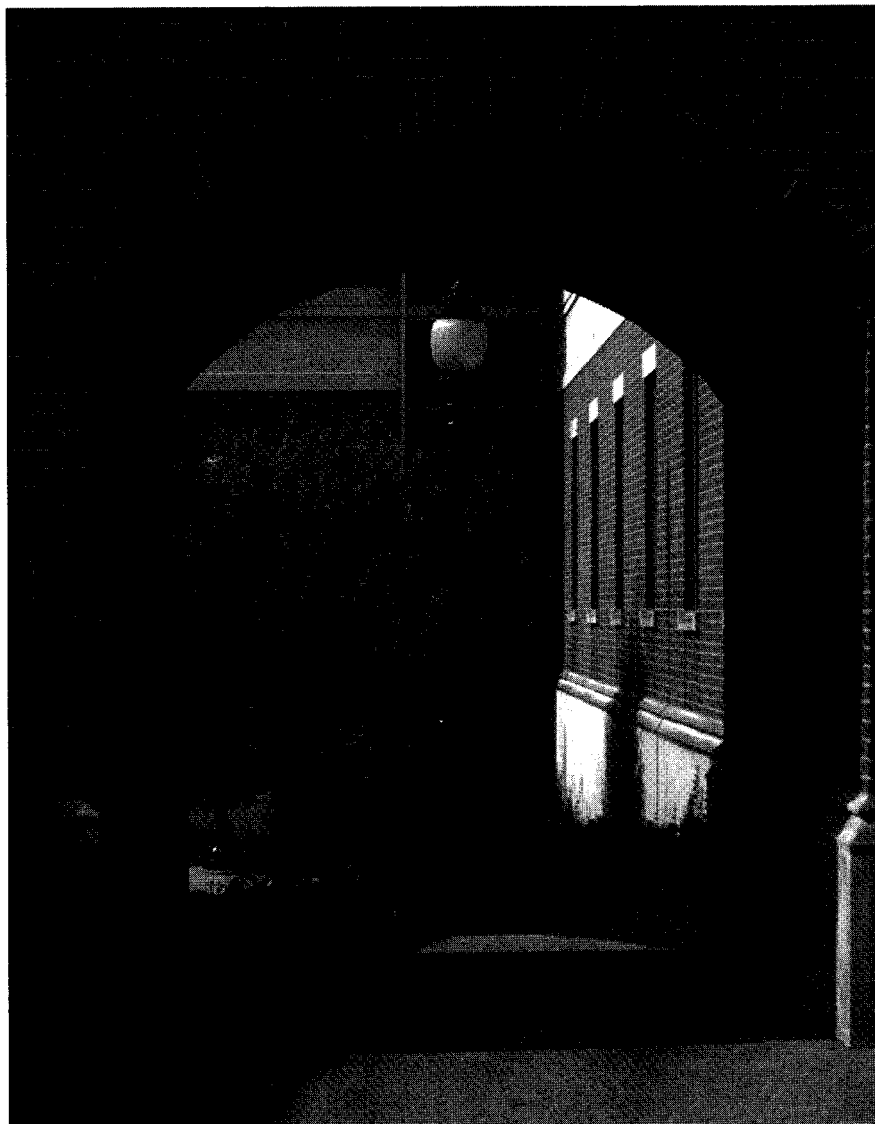
CME 453L. PROCESS CONTROL LABORATORY: Project-oriented study of process dynamics and control using computer-based data acquisition and control systems. Second term, each year. Prerequisites: CME 466L, 452. 2 sem. hrs.

CME 465. FLUID FLOW AND HEAT TRANSFER PROCESSES: Fluid mechanics, transportation and metering of fluids, agitation and mixing, heat transfer and its applications. First term, each year. Prerequisites: CME 311, 324. 3 sem. hrs.

CME 466L. CHEMICAL ENGINEERING OPERATIONS LABORATORY: Study of the equipment and utilization of various chemical engineering processes. First term, each year. Prerequisite: CME 365. Corequisite: CME 465. 2 sem. hrs.

CME 490/590. INTRODUCTION TO BIOENGINEERING I: Overview of Biomedical Engineering, Transport Phenomena in Physiological Systems, Kinetic and Reactor Modeling for Physiological Systems. Overview of Biochemical Engineering, Bioreactors, Bioseparation Processes. First term, each year. Prerequisites: CHM 420 or 451, CME 325 and 365. Corequisite: CME 406 or consent of instructor. *3 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)

The Department of Civil and Environmental Engineering and Engineering Mechanics offers a Bachelor of Civil Engineering with sufficient elective courses to obtain a concentration in construction, environmental engineering, structures, water resources, or other related areas such as geotechnical and transportation. The mission is to graduate broadly educated, technically competent individuals prepared for professional careers or for advanced studies.

Civil engineering is the profession in which a knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgment 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 engineering, hydraulics, and geotechnics. Their broad education however, 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 educational objectives of the Civil Engineering Program are:

- Provide an educational experience that offers graduates a high level of professional competence
- Provide an environment conducive to scholarship and critical thinking
- Provide opportunities for the development of leadership and team-building skills
- Develop problem-solving and decision making competence
- Promote contemporary and practice-oriented methods for solving engineering problems
- Integrate opportunities to develop communication and interpersonal skills throughout the curriculum
- Provide integration of experimental analysis and design as related to civil engineering
- Promote multidisciplinary and interdisciplinary concepts
- Promote awareness of professional ethics, social impacts and contemporary practice issues
- Promote a commitment to service and life-long learning.

Before enrolling in any engineering, chemistry, geology, mathematics, or physics course required by the Civil Engineering Program, a grade of C or better must be earned in all of the prerequisites courses for students majoring in civil engineering. Also, courses designated CIE or EGM may be repeated only once by students majoring in civil engineering.

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	2nd Term	3rd Term
Sophomore Year					
CIE	213	Surveying	2-0-2		
CIE	221L	Civil Computation Laboratory	2-2-2		
CHM	124	General Chemistry II	3-0-3		
EGM	210	Mechanics I	3-0-3		
MTH	218	Analytic Geometry and Calculus III	4-0-4		
PHY	207	General Physics II	3-0-3		
CIE	408	Seminar	1-0-0	1-0-0	
CIE	214	Highway Geometrics		2-0-2	
EGM	220	Dynamics		3-0-3	
EGM	330	Mechanics II		3-0-3	
MTH	219	Applied Differential Equations		3-0-3	
CMM	—	Communication ²		3-0-3	
—	—	General Education requirement ²		3-0-3	
CIE	215L	Surveying Field Practice			3-0-3
			17	17	3
Junior Year					
CIE	313	Hydraulics	3-3-4		
CIE	318	Analysis of Structures	4-0-4		
CIE	320	Civil Engineering Analysis	3-0-3		
GEO	218	Engineering Geology	3-0-3		
PHL	316	Engineering Ethics	3-0-3		
CIE	408	Seminar	1-0-0	1-0-0	
CIE	310L	Civil Engineering Laboratory		0-3-1	
CIE	312	Soil Mechanics		3-3-4	
CIE	333	Water Resources Engineering		3-0-3	
—	—	Technical elective ³		3-0-3	
—	—	General Education requirement ²		6-0-6	
			17	17	
Senior Year					
CIE	403	Transportation Engineering	3-0-3		
CIE	411	Design of Steel Structures	3-0-3		
CIE	412	Design of Concrete Structures	3-0-3		
CIE	420	Engineering Economics	1-0-1		
CIE	434	Water & Wastewater Engineering	3-3-4		
CIE	—	Civil engineering electives ^{3,4}	3-0-3	6-0-6	
CIE	408	Seminar	1-0-0	1-0-0	
CIE	450	Civil Engineering Design ⁵		3-0-3	
HST	343	History of Civil Engineering		3-0-3	
—	—	Technical elective ³		3-0-3	
			17	15	

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

²See 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.

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

⁴May be used to concentrate studies in the areas of Environmental, Construction, Structures, Soils, Transportation, and Water Resources Engineering.

⁵Admittance into CIE 450 requires successful completion of all required engineering courses with an average academic unit GPA of no less than 2.0, or the approval of the chair.

FACULTY

Joseph E. Saliba, *Chairperson*

Professors Emeriti: Payne, Thomson

Distinguished Service Professor: Ryckman

Professors: Bogner, Phillips, J. Saliba, Whitney

Associate Professors: Safferman, Zoghi

Assistant Professors: Farhey, Chowdhury

Lecturers: Al-Akkad, Chase

Adjunct Assistant Professors: Donaldson, McCrate, 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.

1 sem. hr.

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

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. Second term, each year. Prerequisite: CIE 213.

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. Summer, each year. Prerequisite: CIE 214.

3 sem. hrs.

CIE 221L. CIVIL COMPUTATION LABORATORY: Civil engineering applications of minicomputers and microcomputers. Introduction to computer-aided drafting and fundamentals of civil engineering graphics. Word processing, spreadsheet, database applications, and mathematical application tools. Corequisite: EGM 210.

2 sem. hrs.

CIE 310L. CIVIL ENGINEERING LABORATORY: Experiments and studies relating the engineering properties of certain building materials to their fundamental nature and composition. Second term, each year. Prerequisite: EGM 330.

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. Second term, each year. Prerequisites: CIE 313, EGM 330, GEO 218. Corequisite: CIE 312L.

3 sem. hrs.

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

1 sem. hr.

CIE 313. HYDRAULICS: Principles of liquid statics and fluid flow including similitude, measuring devices, channel and pipe flow, turbines, and pumps. First term, each year. Corequisites: CIE 313L, EGM 220.

3 sem. hrs.

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

CIE 318. ANALYSIS OF STRUCTURES: Modern and traditional methods for analyzing truss, beam, and frame structures. Modern matrix and computer methods emphasized to prepare students to solve comprehensive civil engineering structures. Topics include: element stiffness matrices and load vectors, assembly of global stiffness and load, construction of structural models, interpretation of computer results. Traditional hand-solution methods emphasized also to provide students with reliable methods for verifying the accuracy of computer model predictions. Topics include: shear and bending moment diagrams, influence lines, virtual work, slope deflection, moment distribution, shear center, unsymmetrical bending. First term each year. Prerequisite: EGM 330. *4 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. First term, each year. Prerequisites: EGM 220, 330; MTH 219. *3 sem. hrs.*

CIE 333. WATER RESOURCES ENGINEERING: Integrated study of the principles of water movement and management. Focus areas include hydrology, water distribution, waste water collection and storm water management. Second term, each year. Prerequisites: CIE 313, 313L. *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; technologies for solving 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. Design of pavement structures and drainage systems. Prerequisites: CIE 310L, 313. Corequisite: CIE 420. *3 sem. hrs.*

CIE 408. SEMINAR: Practice in the presentation and discussion of papers; lectures by staff and prominent engineers. Attendance required of all civil engineering sophomores, juniors, and 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, 318. *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, 318. *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 contracts and bonds and legal aspects of contracting. Departmental elective. Corequisite: CIE 403. 3 sem. hrs.

CIE 422. DESIGN AND CONSTRUCTION PROJECT MANAGEMENT: Fundamentals of project management as they relate to the design and construction professional, and the application of project management techniques to the design and construction of major projects. Prerequisite: CIE 421. 3 sem. hrs.

CIE 434. WATER & WASTEWATER ENGINEERING: Problems of water pollution; development and design of public water supply and waste water disposal systems; legal, political, ethical, and moral considerations. First term, each year. Prerequisite: CHM 124. 3 sem. hrs.

CIE 434L. WATER & WASTEWATER ENGINEERING LABORATORY: Laboratory exercises, demonstrations, and design problems associated with water and wastewater engineering. Corequisite: CIE 434. 1 sem. hr.

CIE 441. INTRODUCTION TO HYDROLOGY: Detailed study of the hydrologic cycle including precipitation, precipitation losses, and rainfall/runoff processes. Concepts relating to streamflow, urban drainage, river and reservoir routing, hydrologic measurement, subsurface flow, and water quality are also addressed. Unit hydrograph theory, watershed modeling, and analysis and design of drainage structures. Prerequisites: CIE 312, 313. 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. 3 sem. hrs.

CIE 463. HAZARDOUS WASTE TREATMENT: The fundamental principles of the design and operation of hazardous waste remediation processes. Characterizing contaminated sites and conducting treatability studies for the selection of the most appropriate remediation strategy. 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: CIE 320. 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.

ELECTRICAL & COMPUTER ENGINEERING (ECE)

The Department of Electrical and Computer Engineering offers two undergraduate programs leading to Bachelor of Electrical Engineering and Bachelor of Science in Computer Engineering. The Bachelor of Electrical Engineering degree program also allows the opportunity to take sufficient elective courses to obtain a concentration in computer engineering or enhanced knowledge in several specific areas. The department offers master's and doctoral degrees in electrical engineering and is closely coupled to the graduate program in electro-optics where both master's and doctoral degrees are offered.

Electrical engineering is an exciting field within the engineering discipline. It offers the opportunity to enter some of the most rewarding and challenging careers available. The explosion of capabilities in the computer, communication, automotive, and aerospace industries has resulted from advances in the electronics field. Electrical engineers are equipped to enter this dynamic arena as well as equally challenging and rewarding careers in the fields of electro-optics, computer engineering, signal processing, biomedicine and many more. Electrical engineers work in all phases of technological programs. They are involved from the conception of the basic ideas through design, fabrication, verification, manufacturing, and marketing of the final product.

Computer engineering represents perhaps the most sought-after professional component of an engineering team which develops the technological possibilities inherent in the design, construction, and operation of computer systems. The computer engineer performs a wide variety of tasks involving hardware, software, peripherals, computer-controlled systems, and hardware-software integration.

Both electrical engineering and computer engineering are broad-based engineering disciplines that provide for a wide range of career choices within the engineering field as well as providing an excellent basis for careers in such diverse areas as business, law, and medicine.

The electrical engineering curriculum is designed to provide an understanding of basic electrical engineering principles with emphasis on the development of problem solving skills. An extensive laboratory experience is integrated with the classroom work to assure that the student develops a working knowledge of the fundamentals. Upper level courses integrate the knowledge base with current technology and computational tools resulting in a graduate capable of making a contribution to the engineering profession by either entering the work force or pursuing a graduate education.

BACHELOR OF ELECTRICAL ENGINEERING (ELE)

Dept.	No.	Course	1st Term ¹	2nd Term
Sophomore Year				
ECE	201	Circuit Analysis	4-0-4	
ECE	201L	Circuit Analysis Laboratory	0-2-1	
ECE	211	Probability	1-0-1	
MTH	218	Analytic Geometry and Calculus III	4-0-4	
EGM	213	Statics and Mechanics of Materials	4-0-4	
PHY	207-208	General Physics II & III	3-0-3	3-0-3
ECE	202	Signals and Systems		4-0-4
ECE	202L	Signals and Systems Laboratory		0-2-1

ECE	215	Introduction to Digital Systems	3-0-3
MTH	219	Applied Differential Equations	3-0-3
CMM	—	Communication	3-0-3
			<hr/>
			17
			<hr/>
Junior Year			17
ECE	301	Electronic Devices	3-0-3
ECE	301L	Electronic Devices Laboratory	0-2-1
ECE	334	Discrete Signals and Systems	3-0-3
ECE	332	Electromagnetics	3-0-3
ECE	315	Random Variables	1-0-1
ECE	316	Random Processes	1-0-1
—	—	General Education requirements ²	6-0-6
ECE	333	Applied Electromagnetics	3-0-3
ECE	302	Electronic Systems	3-0-3
ECE	302L	Electronic Systems Laboratory	0-2-1
ECE	314	Fundamentals of Computer Architecture	3-0-3
—	—	Mathematics Elective ³	3-0-3
			<hr/>
			17
			<hr/>
Senior Year			17
ECE	401	Communication Systems	3-0-3
ECE	401L	Communication Systems Laboratory	0-2-1
ECE	414	Electro-Mechanical Devices	3-0-3
—	—	Technical Elective ³	6-0-6
—	—	General Education requirements ³	3-0-3
ECE	415	Control Systems	3-0-3
—	—	Engineering Thermodynamics Elective ³	3-0-3
ISE	401	Engineering Economics	1-0-1
			<hr/>
			16
			<hr/>
			16

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

²See General Education requirements, Chapter V.

³Select from list approved by the Department of Electrical and Computer Engineering.

The computer engineering curriculum is designed to provide an understanding of basic computer engineering principles with emphasis on the development of problem solving skills. The software aspects of computer engineering are introduced in the first year, while hardware and hardware-software integration topics are emphasized starting in the sophomore year. An extensive hands-on laboratory experience is integrated with the classroom work to assure that the student develops a working knowledge of the fundamentals.

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING (CPE)

Dept.	No.	Course	1st Term ¹	2nd Term
Sophomore Year				
ECE	201	Circuit Analysis	4-0-4	
ECE	201L	Circuit Analysis Laboratory	0-2-1	
CPS	151	Algorithms & Programming II	3-1-4	
PHY	210L	General Physics Laboratory 1	0-2-1	
MTH	218	Analytic Geometry & Calculus III	4-0-4	
PHY	206-207	General Physics I, II	3-0-3	3-0-3

MTH	219	Applied Differential Equation		3-0-3
ECE	202	Signals & Systems		4-0-4
ECE	202L	Signals & Systems Laboratory		0-2-1
ECE	215	Introduction to Digital Systems		3-0-3
CPS	341	Discrete Structures		3-0-3
			17	17
Junior Year				
EGM	213	Statics and Mechanics of Materials	4-0-4	
PHL	319	Information Ethics	3-0-3	
CPS	350	Data Structures and Algorithms	3-0-3	
ECE	314	Fundamentals of Computer Architecture	3-0-3	
ECE	301	Electronics Devices	3-0-3	
ECE	301L	Electronics Devices Laboratory	0-2-1	
ECE	302	Electronic Systems		3-0-3
ECE	302L	Electronic Systems Laboratory		0-2-1
ECE	211	Probability		1-0-1
CMM		Communication		3-0-3
CPS	346	Operating Systems I		3-0-3
MTH	302	Linear Algebra & Matrices		3-0-3
—	—	Technical Elective ³		3-0-3
			17	17
Senior Year				
ECE	449	Computer Systems Engineering	3-0-3	
CPS	418	Software Engineering	3-0-3	
CPS	444	Systems Programming	3-0-3	
—	—	General Education requirement ²	6-0-6	6-0-6
ECE	444	Advanced Digital Design		3-0-3
—	—	Technical Elective ³		6-0-6
			15	15

¹For example: 3-0-3 means 3 class hrs., 0 laboratory hrs., 3 sem. hrs. credit

²See General Education Requirements, Chapter V. Consult advisor.

³Select from list approved by the Department of Electrical and Computer Engineering.

FACULTY

Partha P. Banerjee, *Chairperson*

Distinguished Service Professor: Schmidt

Professors Emeriti: Evers, Kee, Rogers, Williamson

Professors: Moon, Pasala, Thiele, Scarpino

Associate Professors: Duncan, Hardie, Penno, Westerkamp

Assistant Professors: Daniels, Ordonez, Smari, Subramanyam

Adjunct Professors: Barnard, Berrera, Gauder, Looms, Mayhan, Pierson, Riechers, Repperger

COURSES OF INSTRUCTION

ECE 101. INTRODUCTION TO ELECTRICAL AND COMPUTER ENGINEERING: Introduction to electrical and computer engineering faculty, facilities, and curriculum. Career opportunities in electrical and computer engineering and areas of specialization are discussed. *1 sem. hr.*

ECE 201. CIRCUIT ANALYSIS: Principles of linear circuit analysis and problem solving techniques associated with circuits containing both passive and active components. Analysis of both transient and steady-state behavior of circuits with D.C. and sinusoidal excitation. Prerequisite: MTH 168. Corequisite: ECE 201L. 4 sem. hrs.

ECE 201L. CIRCUIT ANALYSIS LABORATORY: Laboratory course stressing experimental techniques, laboratory reporting, safety, and instrumentation. Experimental investigation of basic steady-state and transient circuits. Corequisite: ECE 201. 1 sem. hr.

ECE 202. SIGNALS AND SYSTEMS: Mathematical framework associated with the analysis of linear systems including signal representation by orthogonal functions, convolution, Fourier and Laplace analysis, and frequency response of circuits and systems. Prerequisites: ECE 201, MTH 218. Corequisite: ECE 202L. 4 sem. hrs.

ECE 202L. SIGNALS AND SYSTEMS LABORATORY: Laboratory investigation of signals and systems including signal decomposition, system impulse response, convolution, frequency analysis of systems, and filter design and realization. Corequisite: ECE 202. 1 sem. hr.

ECE 211. PROBABILITY: Study of axiomatic probability, set theory, derived probability relationships, conditional probability, statistical independence, total probability and Bayes' Theorem, and counting techniques. Prerequisite: MTH 168. 1 sem. hr.

ECE 215. INTRODUCTION TO DIGITAL SYSTEMS: Introduction to binary systems, logic circuits, Boolean algebra, simplification methods, combinational circuits and networks, programmable logic devices, flip flops, registers, counters, memory elements, and analysis and design of sequential circuits. Prerequisite: ECE 201. 3 sem. hrs.

ECE 301. ELECTRONIC DEVICES: Study of the terminal characteristics of electronic devices and basic single stage amplifier configurations using bipolar junction transistors and field-effect transistors. Analysis of the devices includes a qualitative physical description, volt-ampere curves, and the development of small- and large-signal equivalent circuit models. Prerequisites: ECE 202, 202L. Corequisite: ECE 301L. 3 sem. hrs.

ECE 301L. ELECTRONIC DEVICES LABORATORY: Laboratory investigation of electronic devices: diodes, bipolar junction transistors, field-effect transistors and operational amplifiers. Corequisite: ECE 301. 1 sem. hr.

ECE 302. ELECTRONIC SYSTEMS: Study of cascaded amplifiers, feedback amplifiers, linear integrated circuits, and oscillators including steady state analysis and analysis of frequency response. Prerequisite: ECE 301. Corequisite: ECE 302L. 3 sem. hrs.

ECE 302L. ELECTRONIC SYSTEMS LABORATORY: Design, construction and verification of multistage feedback amplifiers, passive and active filters, and oscillators. Corequisite: ECE 302. 1 sem. hr.

ECE 314. FUNDAMENTALS OF COMPUTER ARCHITECTURE: Study of computer systems organization, representation of data and instructions, instruction set architecture, processor unit and control unit, high- to low-level language mapping, system simulation and implementation, applications and practical problems. Prerequisite: ECE 215. 3 sem. hrs.

ECE 315. RANDOM VARIABLES: Common random variables and their distribution functions, transformations of random variables, moments, computer generation of random variables, bivariate random variables, conditional distribution functions, statis-

tically independent random variables, averages of functions of two random variables, transformation of pairs of random variables, the Central Limit Theorem, and the Weak Law of Large Numbers. Prerequisites: ECE 211, MTH 218. 1 sem. hr.

ECE 316. RANDOM PROCESSES: Statistical descriptions of random processes, autocorrelation function properties, power spectral density, cross correlation and covariance, random processes through linear and nonlinear systems, white noise, linear regression, and engineering decision strategies. Prerequisites: ECE 202, 315. 1 sem. hr.

ECE 323. BASIC ELECTRONIC CIRCUITS: Analysis and design of passive and active electrical and electronic circuits using time-domain and frequency-domain methods. Includes amplifiers, switches, and other types of electronic circuits. Lectures will be reinforced with practical and computer exercises. For chemical, civil, environmental and mechanical engineering students. Prerequisites: MTH 218, PHY 207. 4 sem. hrs.

ECE 332. ELECTROMAGNETICS: Study of vector calculus, electro- and magneto-statics, Maxwell's equations, and electromagnetic plane waves and their reflection and transmission from discontinuities. Prerequisites: PHY 207, MTH 219, ECE 202. 3 sem. hrs.

ECE 333. APPLIED ELECTROMAGNETICS: Electromagnetic theory applied to problems in the areas of waveguides, radiation, electro-optics and electromagnetic interference and electromagnetic compatibility. Prerequisite: ECE 332. 3 sem. hrs.

ECE 334. DISCRETE SIGNALS AND SYSTEMS: Introduction to discrete signals and systems including sampling and reconstruction of continuous signals, digital filters, frequency analysis, the Z-transform, and the discrete Fourier transform. Prerequisites: ECE 202, 215. 3 sem. hrs.

ECE 401. COMMUNICATION SYSTEMS: Study of amplitude, angle, pulse, and digital communication systems including generation, detection, and analysis of modulated signals and power, bandwidth, and noise considerations. Prerequisites: ECE 316, 302, and 334 or equivalent. Corequisite: ECE 401L. 3 sem. hrs.

ECE 401L. COMMUNICATION SYSTEMS LABORATORY: Design, fabrication, and laboratory investigation of modulators, detectors, filters, and associated communication components and systems. Corequisite: ECE 401. 3 sem. hrs.

ECE 414. ELECTRO-MECHANICAL DEVICES: Properties and theory of electro-mechanical devices: nonlinear electromagnetic actuators; rotating machine analysis; field and circuit concepts; rotating fields; direct current, synchronous, and induction machines; special-purpose machines; and fractional horsepower machines. Prerequisites: ECE 202, 333. 3 sem. hrs.

ECE 415. CONTROL SYSTEMS: Study of mathematical models for feedback control systems. Performance and stability analysis. Design topics include pole-placement, root locus, and frequency domain design techniques. Prerequisite: ECE 202. 3 sem. hrs.

ECE 440. PHYSICAL ELECTRONICS: Introduction to wave mechanics, electron ballistics, theory of metals and semiconductors, electron emission, space charge flow, and modern electron devices. Prerequisites: MTH 219, PHY 203. 3 sem. hrs.

ECE 441. INTEGRATED CIRCUIT ELECTRONICS: Integrated circuit design, construction and verification including the study of biasing, multistage differential and analog power amplification, and computer assisted design tools for "on-chip" design and layout. Prerequisite: ECE 302. 3 sem. hrs.

ECE 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 from ELF through optical frequencies. Topics include propagation, radiation, interactions with matter, guided waves, and antenna fundamentals. Prerequisite: ECE 333. *3 sem. hrs.*

ECE 443. INTRODUCTION TO ELECTRO-OPTICS: Introductory overview of electro-optics starting with Maxwell's equations and leading to lasers, holography, and other timely applications. Prerequisite: ECE 332. *3 sem. hrs.*

ECE 444. ADVANCED DIGITAL DESIGN: Systems approach to digital design including: structured top-down development process using simple and complex logic modules from various logic families; practical aspects of the design, construction, and verification of digital subsystems; application of microcomputer and/or controller as a flexible logic device; real-time embedded systems design; and the use of HDL tools and simulation. Prerequisite: ECE 314. Additional prerequisite for ELE program: ECE 334 or equivalent. *3 sem. hrs.*

ECE 445. SIGNAL PROCESSING: Study of 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: ECE 334 or equivalent. *3 sem. hrs.*

ECE 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. Prerequisite: ECE 302. Additional prerequisite for ELE program: ECE 334 or equivalent. *3 sem. hrs.*

ECE 447. DIGITAL CONTROL SYSTEMS: Analysis and synthesis of feedback control systems including digital compensators. Topics include performance and stability analysis, regulator and servomechanism design using time and frequency domain methods, and digital implementation case studies. Prerequisites: ECE 415, and 334 or equivalent. *3 sem. hrs.*

ECE 448. FIBER OPTIC COMMUNICATIONS: General light guidance principles; ray optics; dispersion; single mode, multimode, and graded index fibers; basic laser and LED source principles; photodetectors; error probability in digital optical systems; rise time analysis; loss budget analysis; local area networks and long haul communication links. Prerequisite: ECE 333. Corequisite: ECE 401. *3 sem. hrs.*

ECE 449. COMPUTER SYSTEMS ENGINEERING: An introduction to advanced computer architecture and computer systems design. Topics include: exploration of principle architecture features of modern computers, pipelining, memory hierarchy, I/O devices, interconnection networks, introduction to parallel and multiprocessor systems, and the use of hardware description languages (HDLs) in system implementation. Prerequisites: ECE 314 and CPS 346, or permission of instructor. *3 sem. hrs.*

ECE 450L. PROJECTS LABORATORY: Project-oriented laboratory applying engineering skills in the design, development, and demonstration of electrical and electronic systems. Prerequisite: permission of the project advisor. *1-3 sem. hrs.*

ECE 499. SPECIAL PROBLEMS IN ELECTRICAL AND COMPUTER ENGINEERING: Particular assignments to be arranged and approved by the department chairperson. *1-6 sem. hrs.*

MECHANICAL ENGINEERING (MEE)

Mechanical engineers apply the principles of the physical sciences, mathematics, economics, and human relations to conceive, design, and analyze a wide variety of products and systems. They may also direct their manufacture, distribution, and operation. Mechanical engineers can be employed in governmental organizations and a diversity of industries including automotive, aerospace, biomedical, textiles, raw materials production, and energy conversion. Job functions range from research, development, design, analysis, production, sales, consulting, and management. Many find that a mechanical engineering education is an excellent preparation for careers in law and medicine.

The curriculum in mechanical engineering serves as a broad-based education for positions in these diverse fields or for graduate study leading to advanced degrees. The first part of the mechanical engineering curriculum provides a firm foundation in mathematics, physics, chemistry, computer-aided drawing and conceptual design, and the humanities. The second part of the curriculum provides the engineering science fundamentals and laboratory experiences necessary for testing, design, as well as continued learning in the humanities, arts and social sciences. The final part of the curriculum emphasizes synthesis of knowledge through major design projects sponsored by regional industries. The curriculum includes sufficient elective courses to permit a concentration in aerospace or minors in several other areas, including digital systems and controls, design, thermal systems, and manufacturing. As well, open electives can be used to take courses in any field including language, business, and the sciences.

The overall educational experience has been designed to develop graduates who have the skills, knowledge, and ethical background to learn, lead, and serve within their profession and society. Specifically, this means that graduates will: have the ability to apply knowledge of mathematics, science, and engineering fundamentals; will have the ability to use techniques, skills and modern engineering tools necessary for engineering practice; will have the ability to design and conduct experiments, and analyze and interpret data; will have the ability to design components, systems and/or processes; will be able to independently identify, formulate and solve engineering problems; will have the ability to function effectively on engineering teams; will be able to communicate their ideas/solutions effectively to both technical and non-technical people; will have the broad education necessary to understand the social, environmental and economic impact of engineering solutions in a global context; will exhibit a commitment to ethical behavior, leadership and service within their profession; will have knowledge of and be able to think critically about contemporary issues; and will continue their personal and professional development by engaging in lifelong learning.

BACHELOR OF MECHANICAL ENGINEERING (MEE)

Dept.	No.	Course	1st Term ¹	2nd Term
Sophomore Year				
CMM	—	Communication ²	3-0-3	
EGM	210	Mechanics I	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
MTH	219	Applied Differential Equations		3-0-3
MEE	227L	Computer Graphics II		0-3-1
MEE	301	Thermodynamics I		3-0-3
EGM	220	Dynamics		3-0-3
EGM	330	Mechanics II		3-0-3
			16	16
Junior Year				
MEE	308	Fluid Mechanics	3-0-3	
MEE	314	Computational Methods	3-0-3	
MEE	312	Engineering Materials I	3-3-4	
MEE	321	Theory of Machines	3-0-3	
ECE	323	Basic Electronic Circuits	3-3-4	
MEE	414B	Seminar	1-0-0	1-0-0
—	—	General Education requirement ²		3-0-3
—	—	Open Elective ³		3-0-3
MEE	341	Engineering Experimentation		1-4-3
MEE	344	Manufacturing Processes		2-3-3
MEE	410	Heat Transfer		3-0-3
			17	15
Senior Year				
MEE	427	Mechanical Design	3-3-4	
MEE	439	Dynamic Systems and Controls	4-0-4	
—	—	Open Elective	3-0-3	
—	—	Ethics Elective (PHL 316 or REL 369)	3-0-3	
MEE	—	Mechanical Engineering Electives	3-0-3	3-0-3
MEE	414A	Seminar	1-0-0	1-0-1
MEE	432	Engineering Systems Design		2-6-4
MEE	460	Engineering Analysis		3-0-3
—	—	General Education requirement ²		3-0-3
—	—	General Education requirement ²		3-0-3
			17	17

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

²See 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.

³Students opting to receive a Bachelor of Mechanical Engineering degree with an Aerospace Concentration must take MEE 401, Aerodynamics, MEE 418, Gas Dynamics, MEE 408, Aerospace Performance and Controls, MEE 413, Propulsion, and MEE 409, Aerospace Structures in place of MEE 344, the two Mechanical engineering electives, and the two open electives. Also, MEE 460 may be replaced with an approved Feedback Control course.

FACULTY

Kevin P. Hallinan, *Chairperson*

Professors Emeriti: Boehman, Chuang, Eastep, Minardi, Wurst

Professors: Ballal, Brockman, Doepker, Doyle, Eimermacher, Hallinan, Jain, Sargent, Schauer

Associate Professors: Brar, Endres, Ervin, Kashani, Kissock, Petrykowski, Zabarnick

Assistant Professors: Bailey, Murray

Adjunct Professor: Shine

Adjunct Associate Professor: Ostdiek

Adjunct Assistant Professors: Benintendi, Cambreros, Coalson, Pratt, Price, Sanders

COURSES OF INSTRUCTION

MEE 101. INTRODUCTION TO MECHANICAL ENGINEERING: Weekly meeting of first-semester, first-year mechanical engineering students. Orientation and selected topics. 1 sem. hr.

MEE 104L. COMPUTER GRAPHICS I: Fundamentals of engineering graphics and the part that graphical communication plays in engineering. Introduction to computer aided design (CAD). 1 sem. hr.

MEE 227L. COMPUTER GRAPHICS II: Advanced engineering graphics and graphical communication in engineering; introduction to project design. Prerequisite: MEE 104L. 1 sem. hr.

MEE 301. THERMODYNAMICS I: An introductory course in engineering thermodynamics. Context and concepts of thermodynamics. Properties of pure substances and equations of state. First and second laws of thermodynamics with applications to heat engines, refrigeration cycles, and other energy systems. Introduction to gas mixtures. Corequisite: MTH 218. 3 sem. hrs.

MEE 302. THERMODYNAMICS II: Gas and two-phase heating, cooling, power cycles. Gas mixtures and air conditioning. First and second law analysis of reacting systems. Chemical equilibrium. High velocity nozzle and diffuser flow. Prerequisite: MEE 301. 3 sem. hrs.

MEE 308. FLUID MECHANICS: An introductory course in fluid mechanics. Fundamental concepts including continuity, momentum, and energy relations. Control volume analysis and differential formulations. Internal and external flows in laminar and turbulent regimes. One-dimensional compressible flows. Prerequisites: MEE 301, MTH 219. 3 sem. hrs.

MEE 312/312L. ENGINEERING MATERIALS I/MATERIALS LABORATORY: Atomic structure and bonding. Crystal structure of solids. Physical properties of solids. Strengthening methods in solids. Ferrous and non-ferrous metallurgy. Corequisite: EGM 330. 4 sem. hrs.

MEE 313. ENGINEERING MATERIALS II: Ceramic, polymeric and composite materials. Electrical, magnetic, optical, and thermal properties of materials. Corrosion. Prerequisite: MEE 312. 3 sem. hrs.

MEE 314. COMPUTATIONAL METHODS: Detailed introduction to solving engineering problems through programming in the Matlab technical computing software package. Fundamentals of algorithms, including iterative processes, arrays and logic operations. Graphing of 2D and 3D functions. Graphical user interfaces. Focus on engineering applications that utilize the mathematical techniques of linear algebra, statistics and numerical methods. Corequisite: MTH 219. 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: EGM 202, MTH 219. Corequisite: EGM 330. 3 sem. hrs.

MEE 321. THEORY OF MACHINES: Applications and design of mechanisms; use of graphical and analytical techniques for the kinematic and dynamic analysis and synthesis of machines. Analysis and design of cams, gears and gear trains. Balancing of rotating masses. Prerequisite: EGM 220. 3 sem. hrs.

MEE 341. ENGINEERING EXPERIMENTATION: Basic sensors and instrumentation, design of experiments, data acquisition and processing, and uncertainty and statistical analysis of data. Measurement of strain, motion, pressure, temperature, flow and sound. Measurement applications to engineering phenomena or systems. Course will utilize a mix of lecture, laboratory experiments and demonstrations. Also a term project to provide design for experiment experience. Corequisites: EGM 330, MEE 308, ECE 323. 3 sem. hrs.

MEE 344. MANUFACTURING PROCESSES: Casting processes including casting defects and design of castings; metal working processes such as extrusion, forging, rolling and wire drawing; sheet metal forming; welding processes; powder metallurgy and design principles for P/M parts, metal removal processes; forming and shaping plastics and composite materials; rapid prototyping. Design principles for manufacturability. Includes laboratory. Prerequisite: MEE 312. 3 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 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 and dynamic stability and control in all three axes. Prerequisites: MEE 401, EGM 220. 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 330. 3 sem. hrs.

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

MEE 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. 3 sem. hrs.

MEE 414A. SEMINAR: Presentations on contemporary mechanical engineering subjects by students, faculty, and engineers in active practice; student involvement in professional and service activities. 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; student involvement in professional and service activities. 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. Prerequisite: MEE 308. *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. Prerequisite: MEE 341. *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. Prerequisite: MEE 341. *3 sem. hrs.*

MEE 425. AEROSPACE DESIGN: Design project in which teams of students synthesize an engineering solution to a complex aerospace related problem through the integration of mechanical and aerospace engineering principles. Prerequisites: MEE 408, 409, 413 or permission of instructor. *4 sem. hrs.*

MEE 427. MECHANICAL DESIGN I: Three hours lecture and three hours lab per week. Stress and deflection analysis of machine components; theories of failure; fatigue failure of metals. Design and analysis of mechanical components such as gears, shafts, bearings and springs. Design projects and problems applying principles covered in lecture. Solution of complex problems with emphasis on synthesis and design of mechanical systems. Prerequisites: EGM 330; MEE 321. *4 sem. hrs.*

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. Contemporary design methods and issues associated with the product development cycle. Prerequisite: MEE 427. *3 sem. hrs.*

MEE 432. ENGINEERING SYSTEMS DESIGN: Two hours lecture and six hours of lab per week. Focus of the lab and lecture on a design project. Detailed evaluation of the Product Realization Process (PRP), including specifications, conceptual designs, and detailed designs. Study of project management including project tracking methods,

cost estimating, overhead, direct labor, time value of money and depreciation. Analysis of design criteria for safety, environmental and sociological impact. Culminates in a comprehensive written report and oral presentation. Prerequisite: MEE 427.

4 sem. hrs.

MEE 434. MECHATRONICS: Emphasis on the integration of sensors, micro-controllers, electromechanical actuators, and control theory in a 'smart' system for a semester long design project. Topics include: sensor signal processing, electromechanical actuator fundamentals, interfacing of sensors and actuators to micro-controllers, digital logic, and programming of micro-controllers, programmable logic controllers and programmable logic devices. Equal mix of lecture and laboratory. Prerequisite: ECE 323. 3 sem. hrs.

MEE 435. FEEDBACK CONTROL SYSTEMS: Analyses of automatic feedback control systems using time domain solutions, Laplace transforms, block diagrams, transfer functions, characteristic equations, stability criteria, and control actions. System performance based on Nyquist, Bode and root-locus with system compensation. Prerequisites: MTH 219, EGM 220. 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. Prerequisite: MEE 321. 3 sem. hrs.

MEE 439. DYNAMIC SYSTEMS AND CONTROLS: Dynamic systems modeling with special emphasis on mechanical systems (one and two degrees of freedom). Covers both transfer function and state space modeling techniques. Analogues drawn between mechanical, electrical, fluid, and thermal physical domains. System nonlinearities and model linearization methods are discussed. Analytical solutions of linear ordinary differential equations using Laplace transformation and state space theory. Feedback control theory, including root locus and frequency response techniques. Prerequisites: MTH 219, EGM 220. 4 sem. hrs.

MEE 460. ENGINEERING ANALYSIS: Case study approach to engineering problem solving. Emphasis on breaking down problems to tractable parts, modeling physical systems and selection of solution techniques. Problems related to thermal, fluid, structural, and dynamic systems. Problems typically involve solution of ordinary and partial differential equations, Fourier analysis of periodic behavior, simulation, optimization and/or statistical analysis. Analytical and numerical solution techniques, with an emphasis on selecting the most appropriate technique and understanding the limitations of the analysis. Prerequisites: ECE 323, MEE 312, MEE 410. 3 sem. hrs.

MEE 471. DESIGN OF THERMAL SYSTEMS: This course integrates thermodynamics, heat transfer, engineering economics, and simulation and optimization techniques in a design framework. Topics include design methodology, exergy analysis, heat exchanger networks, thermal-system simulation and optimization techniques. 3 sem. hrs.

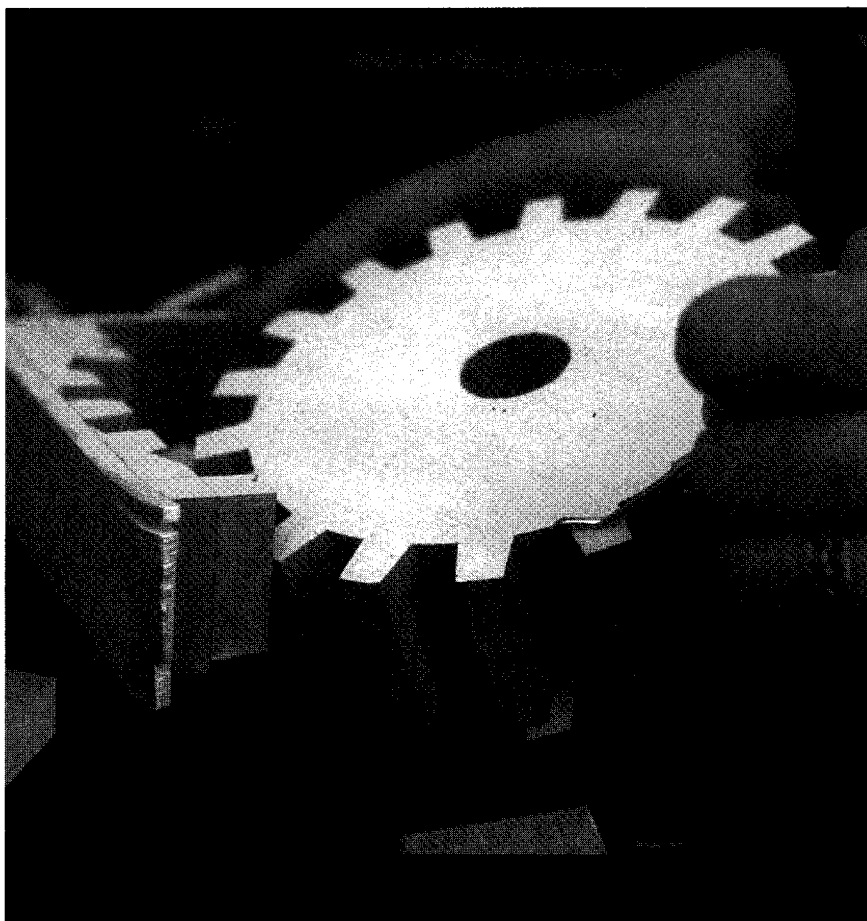
MEE 472. DESIGN FOR ENVIRONMENT: Emphasis on design for environment over the life cycle of a product or process, including consideration of the mining, processing, manufacturing, use, and post-life stages. Course provides knowledge and experience in invention for the purpose of clean design, life cycle assessment strategies to estimate the

environmental impact of products and processes, and cleaner manufacturing practices. Course includes major design project. 3 sem. hrs.

MEE 473. RENEWABLE ENERGY SYSTEMS: Introduction to the impact of energy on the economy and environment. Engineering models of solar thermal and photovoltaic systems. Introduction to wind power. Fuel cells and renewable sources of hydrogen. 3 sem. hrs.

MEE 499. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING: Particular assignments to be arranged and approved by department 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 100. ENRICHMENT WORKSHOP: A workshop structured to provide collaborative learning of engineering calculus facilitated with upper-class engineering students. Required course both semesters for first-year engineering students. *No credit*

EGR 101. INTRODUCTION TO ENGINEERING DESIGN: A team taught integrated introduction to engineering design. Emphasizes problem-solving skills, team work, multi-disciplinary approaches to engineering projects and problems, experiential hands-on experience, and structural programming. *3 sem. hrs.*

EGR 102. SEMINAR FOR UNDECLARED STUDENTS: A seminar to acquaint the student with the University and the departments of the School of Engineering. Academic policies, academic planning, registration procedures, counseling and career placement services, and assistance in selecting a major. *1 sem. hr.*

EGR 320. SYSTEMS DESIGN—HONORS: Interdisciplinary 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 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.*

COURSES OF INSTRUCTION—EGM

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

EGM 210. MECHANICS I: An integrated presentation of the principles of statics and strength of materials. Force/moment systems, free body diagrams, equilibrium of particles and rigid bodies; axial stress, strain and deformation; stress/strain diagrams, isotropic and orthotropic materials properties, generalized Hooker's law; centroid, center of gravity, center of mass; second moments of areas; distributed loads, fluid pressure; analysis of trusses, frames and machines; friction. Corequisite: MTH 169. *3 sem. hrs.*

EGM 213. STATICS AND MECHANICS OF MATERIALS: The principles of mechanics, force systems, resultants and equilibrium, centroids and center of gravity and moment of inertia, application to mechanics and frames. Also the study of stresses, strains, and deflections under different loading conditions for beams and columns. Not for CIE and MEE majors. *4 sem. hrs.*

EGM 220. 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 210. 3 sem. hrs.

EGM 330. MECHANICS II: An integrated presentation of the principles of statics and strength of materials. Torsion, power transmission; shear force and bending moment diagrams; normal and shear stresses in beams; beam deflections; analysis of stress and strain, Mohr's circle, determination of stresses with strain gage rosettes; thin walled pressure vessels; stresses from combined axial, torsional, flexural loads, buckling of columns; asymmetric beam bending. Prerequisites: EGM 220, MTH 169. 3 sem. hrs.

EGM 331. 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. First and second terms each year. Prerequisite: EGM 330. 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 330, MTH 219. 3 sem. hrs.

EGM 499. SPECIAL PROBLEMS IN ENGINEERING MECHANICS: Particular assignments 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. Special emphasis is given to the area of Contract Law due to the important and pervasive interaction that it has with engineering project work. Legal Method and the court system are introduced. Product liability and business relationships are discussed. 3 sem. hrs.

ISE 369. PROBABILITY AND STATISTICS FOR ENGINEERS: Conceptual and hands-on development of probability and statistics with software exercises. Probability problems, random variables, moments, distributions, data description and analysis, estimation (bootstrap), hypothesis testing, regression, analysis of variance, and non-parametrics. Prerequisite: MTH 218. 3 sem. hrs.

ISE 401. ECONOMIC DECISION ANALYSIS FOR ENGINEERS: Introduction to the models and methods of engineering economic decision analysis. Fundamental economic concepts, cost estimates, time value of money, comparison of alternatives, before- and after-tax analysis, decision making under risk and uncertainty, break-even analysis, and linear programming models. Prerequisite: MTH 218. 1-3 sem. hrs.

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

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

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

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

ISE 452. DETERMINISTIC OPERATIONS RESEARCH: Introductory course covers deterministic methods for optimization, with a focus on mathematical programming (linear, nonlinear, and integer programming) and network methods. Prerequisites: MTH 368 or ISE 369; CPS 132. 3 sem. hrs.

ISE 453. PROBABILISTIC OPERATIONS RESEARCH: This is an introductory course covering probabilistic methods for modeling and analyzing the performance of complex systems. Topics include Markov chains, queueing, forecasting, discrete event simulation, and inventory modeling. Prerequisites: MTH 368 or ISE 369; CPS 132. 3 sem. hrs.

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. Prerequisites: MTH 368 or ISE 369; CPS 132. 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. Prerequisite: ENI 455. 3 sem. hrs.

ENGINEERING TECHNOLOGY

The School of Engineering also offers a Bachelor of Science in Engineering Technology. The programs in which the degree is offered are computer engineering technology, electronic engineering technology, industrial engineering technology, manufacturing engineering technology and mechanical engineering technology. The engineering technologist is usually involved in the design, performance evaluation, service and sales of products, equipment, and manufacturing systems or the management of these activities. The management of process operations and plant facilities are also important career paths.

The engineering technology programs provide: (1) specialized technical courses that emphasize rational thinking and the application of engineering and scientific principles to the practical solution of technological problems; (2) courses in applied mathematics and science sufficient to support the technical courses and to prepare the student for future growth; and (3) education to prepare students to communicate intelligently and to take places in society as responsible, humane, complete professionals.

TRANSFER STUDENTS

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.

MINORS IN ENGINEERING TECHNOLOGY

Students majoring in any engineering technology program may earn a minor in another engineering technology program by completing 12 approved semester hours of work in the second discipline. Courses already required in the student's program may not be counted in the minor. The director of the program in which the minor is to be earned is responsible for approving the list of courses for the minor. Non-engineering technology majors may earn a minor in an engineering technology discipline.

ENGINEERING TECHNOLOGY FIRST-YEAR REQUIREMENTS

Students selecting any of the five engineering technology majors should take the courses prescribed for the first year as listed in the individual curricula later in this section of the *Bulletin*. Undeclared engineering technology students should follow the first-year schedule listed below.

FIRST YEAR PROGRAM—UNDECLARED ENGINEERING
TECHNOLOGY STUDENTS

<i>Dept.</i>	<i>No.</i>	<i>Courses</i>	<i>Semester Hours</i>
MTH	106	Introductory Mathematics for Engineering Technology	3-0-3
MTH	137	Calculus I with Review	4-0-4
SET	153L	Technical Computation Laboratory	3-3-1
CHM	123	General Chemistry	3-3-4
ENG	101-102	English Composition I, II	6-0-6
REL	103	Introduction to Religion	3-0-3
PHL	103	Introduction to Philosophy	3-0-3
HST	101 or 102	History of Western Civilization I or II	3-0-3
CMM	110	Small Group Communication	3-0-3
CMM	111 or 112	Informative Speaking or Persuasive Speaking.....	1-0-1
SET	100	First Year Seminar	1-0-1
ECT	110	Electrical Circuits I	3-0-3
SET	101	Enrichment Workshop	1-0-0
Total first-year requirements			33



ECT

ELECTRONIC AND COMPUTER ENGINEERING TECHNOLOGY (ECT)

The Electronic (EET) and Computer (CET) Engineering Technology Programs prepare students for careers in the electronics and computer fields respectively. The EET curriculum, while including a strong emphasis on computers, centers on applied engineering topics in circuit analysis, electronic design, communications, digital circuits, microprocessors and instrumentation. The CET curriculum targets the field of electronics towards computer hardware with a strong emphasis on the integration of hardware and software. The graduate of both programs is prepared to work in industry at a variety of tasks including analog and digital design, microprocessor hardware and software applications, electronic controls, automation, engineering sales and support, product design and development, and electronic communications. The curricula provide the strong foundation in the basic principles necessary to support any future career studies or development as dictated by changing technology or career roles.

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

Dept.	No.	Course	1st Term ¹	2nd Term
First Year				
SET	100	Engineering Technology First-Year Seminar	1-0-1	
PHL	103	Introduction to Philosophy ²	3-0-3	
MTH	106	Mathematics for Engineering Technology	3-0-3	
SET	153L	Technical Computation	0-3-1	
SET	101	Enrichment Workshop	1-0-0	1-0-0
ECT	110-120	Electrical Circuits I, II	3-0-3	3-3-4
ENG	101-102	College Composition I, II	3-0-3	3-0-3
HST	101/102	History of Western Civilization		3-0-3
MTH	137	Calculus I With Review		4-0-4
REL	103	Introduction to Religion ²		3-0-3
			14	17
Sophomore Year				
ECT	223L	Schematics and Diagrams	0-3-1	
CMM	—	Communication	3-0-3	
ECT	206	Electron Devices I	3-3-4	
ECT	224	Digital Computer Fundamentals	3-3-4	
MTH	138	Calculus I With Review	4-0-4	
ECT	306	Electron Devices II		3-3-4
ECT	357	Microprocessors I		3-3-4
MFG	431	Controls for Industrial Automation		3-0-3
IET	323	Project Management		3-0-3
MTH	149	Calculus II		3-0-3
			16	17
Junior Year				
ECT	208	Electronic Instrumentation	1-0-1	
ECT	361	Programming Structures	3-0-3	
ECT	464	Programmable Logic Controllers	3-0-3	

MTH	207	Introduction to Statistics	3-0-3	
MFG	108L	Manufacturing Processes Laboratory	0-3-1	
PHY	201	General Physics	3-2-4	
CHM	123	General Chemistry		3-3-4
ECT	328	Electronic Communications		3-3-4
MCT	220	Statics and Dynamics		3-0-3
MFG	426	Automated Manufacturing Systems and CIM		3-0-3
—	—	General Education Requirement ²		3-0-3
			15	17
Senior Year				
ECT	462	Telecommunications	3-0-3	
SET	499	Senior Seminar	1-0-1	
—	—	General Education Requirements ²	6-0-6	6-0-6
—	—	Technical Electives	6-0-6	6-0-6
ECT	490	Senior Project		1-3-2
			16	14

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

²See General Education requirements, Chapter V. Some General Education courses are specified in the program (e.g., PHY 201); others are to be chosen from the listing of approved courses.

BACHELOR OF SCIENCE WITH A MAJOR IN COMPUTER ENGINEERING TECHNOLOGY (CET)

Dept.	No.	Course	1st Term ¹	2nd Term
First Year				
SET	100	Engineering Technology First-Year Seminar	1-0-1	
PHL	103	Introduction to Philosophy ²	3-0-3	
MTH	106	Mathematics for Engineering Technology	3-0-3	
SET	153L	Technical Computation	0-3-1	
SET	101	Enrichment Workshop	1-0-0	1-0-0
ECT	110-120	Electrical Circuits I, II	3-0-3	3-3-4
ENG	101-102	College Composition I, II	3-0-3	3-0-3
HST	101/102	History of Western Civilization		3-0-3
MTH	137	Calculus I With Review		4-0-4
REL	103	Introduction to Religion ²		3-0-3
			14	17
Sophomore Year				
ECT	223L	Schematics and Diagrams	0-3-1	
CMM	—	Communication	3-0-3	
ECT	206	Electron Devices I	3-3-4	
ECT	224	Digital Computer Fundamentals	3-3-4	
MTH	138	Calculus I With Review	4-0-4	
—	—	General Education Requirements ²		3-0-3
ECT	357	Microprocessors I		3-3-4
MFG	431	Controls for Industrial Automation		3-0-3
IET	323	Project Management		3-0-3
MTH	149	Calculus II		3-0-3
			16	16

Junior Year				
ECT	358	Microprocessors II	3-3-4	
ECT	464	Programmable Logic Controllers	3-0-3	
ECT	361	Programming Structures	3-0-3	
MTH	207	Introduction to Statistics	3-0-3	
PHY	201	General Physics	3-2-4	
CHM	123	General Chemistry		3-3-4
ECT	465	Digital Data Communications		3-0-3
ECT	466	Microcomputer Architecture		3-0-3
ECT	362	Computer Operating Systems		3-0-3
MCT	220	Statics and Dynamics		3-0-3
			17	16
Senior Year				
ECT	459	Microprocessor Systems Design	3-0-3	
SET	499	Senior Seminar	1-0-1	
—	—	General Education Requirements ²	6-0-6	6-0-6
—	—	Technical Electives	6-0-6	6-0-6
ECT	490	Senior Project		1-3-2
			16	14

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

²See General Education requirements, Chapter V. Some General Education courses are specified in the program (e.g., PHY 201); others are to be chosen from the listing of approved courses.

FACULTY

Scott Segalewitz, *Chairperson of Department of Engineering Technology*

Scott Segalewitz, *Program Coordinator*

Professors Emeriti: Hazen, Rooney

Professor: Hanneman

Associate Professors: Ismail, Segalewitz

Assistant Professor: Globig

COURSES OF INSTRUCTION

ECT 110. ELECTRICAL CIRCUITS I: Practical concepts of DC and AC circuits: current, voltage, resistance, power, series and parallel circuits, capacitance, magnetic circuits, and inductance. 3 sem. hrs.

ECT 120. ELECTRICAL CIRCUITS II: Practical concepts of DC and AC circuits: reactance, impedance, phase, circuit analysis, power factor, resonance, filters, transformers, and polyphase circuits. Circuit calculations using vectors and complex algebra. Prerequisite: ECT 110. 3 sem. hrs.

ECT 120L. ELECTRICAL CIRCUITS LABORATORY: Experiments in basic DC and AC circuits to accompany ECT 120. Three laboratory hours a week. Prerequisite: ECT 110. 1 sem. hr.

ECT 206. ELECTRON DEVICES I: Fundamentals of semiconductor diodes, transistors (bipolar and field effect), amplifiers, biasing and small signal analysis. Prerequisite: ECT 120. 3 sem. hrs.

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

ECT 208. ELECTRONIC INSTRUMENTATION: Study of modern cathode ray oscilloscopes and other instrumentation including control and transfer of data using a bus system. Prerequisite: ECT 120. 1 sem. hr.

ECT 223L. SCHEMATICS AND DIAGRAMS: Procedures, standards and symbols used on electronic circuit diagrams. Introduction to schematic capture using a CAD system. Three hours of laboratory a week. Prerequisite: ECT 120. 1 sem. hr.

ECT 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: ECT 110. 3 sem. hrs.

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

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

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

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

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

ECT 357. MICROPROCESSORS I: Study of microprocessor architecture, hardware, software, and application. Prerequisite: ECT 224. Corequisite: ECT 357L. 3 sem. hrs.

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

ECT 358. MICROPROCESSORS II: Study of microprocessor architecture, hardware, software, and application. Prerequisite: ECT 357. Corequisite: ECT 358L. 3 sem. hrs.

ECT 358L. MICROPROCESSORS II LABORATORY: To accompany ECT 358. Emphasis on microcomputer programming. Three hours of laboratory a week. Prerequisite: ECT 357. 1 sem. hr.

ECT 361. PROGRAMMING STRUCTURES: The study of programming language concepts. Emphasis on the C language and its application to microcomputer hardware and software development. Visual Basic will also be introduced. Prerequisite: SET 153L. 3 sem. hrs.

ECT 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: ECT 357.

3 sem. hrs.

ECT 400. SELECTED TOPICS: Investigation and discussion of current technical topics in electronic and computer engineering technology. May be taken more than once. Prerequisite: Permission of department chairperson.

1-4 sem. hrs.

ECT 427. PULSE AND DIGITAL CIRCUITS: Design and analysis of circuits relating to computers and digital control. Topics include integrators, differentiators, multivibrators, flip-flops, time-base generators, and programmable logic devices (PLD's). Laplace transform analysis is utilized. Prerequisites: ECT 206, 224.

3 sem. hrs.

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

3 sem. hrs.

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

3 sem. hrs.

ECT 452. FEEDBACK CONTROLS: Study of signal flow, circuit stability. Nyquist criteria, Bode plots, oscillators, amplifiers, and electromechanical devices. Prerequisite: ECT 306.

3 sem. hrs.

ECT 453. ANTENNAS: Study of basic antenna types and their application to arrays and other systems. Prerequisite: ECT 328.

3 sem. hrs.

ECT 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.

ECT 459. MICROPROCESSOR SYSTEMS DESIGN: Introduction to industrial design procedures for microprocessor-based control systems. Emphasis on the integration of microcomputer hardware and software. Prerequisite: ECT 357.

3 sem. hrs.

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

3 sem. hrs.

ECT 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: ECT 120.

3 sem. hrs.

ECT 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: ECT 357.

3 sem. hrs.

ECT 463. ELECTRONIC CAD: Methods and techniques utilizing computer-aided design in electronic design, layout, and evaluation. Prerequisites: ECT 206, 223L. Corequisite: ECT 463L.

2 sem. hrs.

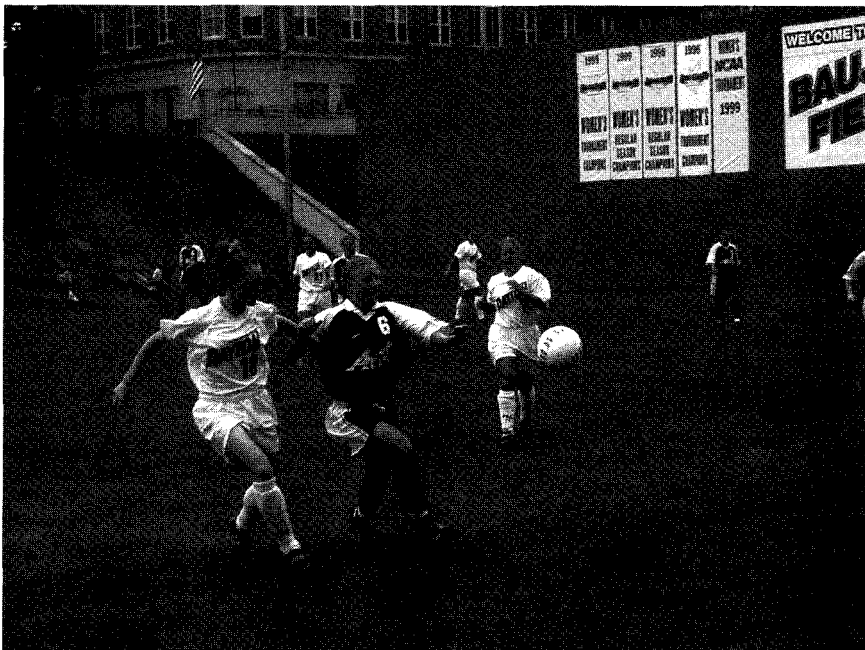
ECT 463L. ELECTRONIC CAD LABORATORY: To accompany ECT 463. Three laboratory hours a week. *1 sem. hr.*

ECT 464. PROGRAMMABLE LOGIC CONTROLLERS: Study of Programmable Logic Controllers (PLC's) and their applications in manufacturing. Topics include PLC architecture, programming, program documentation, system monitoring, automated manufacturing systems, and man-machine-interfacing software. Prerequisite: MFG 431. *3 sem. hrs.*

ECT 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: ECT 357 or equivalent. *3 sem. hrs.*

ECT 466. MICROCOMPUTER ARCHITECTURE: To develop an understanding of the basic hardware and software architecture of an industry standard microcomputer such as the IBM-PC series. To become familiar with the various terms and concepts used in the PC industry. To research current and future developments in PC hardware and software. Prerequisite: ECT 357 or equivalent. *3 sem. hrs.*

ECT 490. SENIOR PROJECT: The design, construction and presentation of an original project. The project may be individual or part of an interdisciplinary engineering technology team project. Prerequisite: Senior status. *2 sem. hrs.*



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 manufacturing, and service organizations such as health care, banking, transportation, food service, and government. Graduates may be involved in the economic selection and location of equipment, the planning of work methods and expected output, and scheduling and controlling the flow of materials. The curriculum emphasizes courses in time and motion study, production planning and control, facilities layout, economic analysis, statistical process control, labor and wage administration, and mathematical decision making.

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

<i>Dept.</i>	<i>No.</i>	<i>Course</i>	<i>1st Term¹</i>	<i>2nd Term</i>
First Year				
SET	100	Engineering Technology First-Year Seminar	1-0-1	
MTH	106	Mathematics for Engineering Technology	3-0-3	
MFG	108L	Manufacturing Processes Laboratory	0-3-1	
MCT	110L	Technical Drawing and CAD	0-6-2	
CHM	123	General Chemistry	3-3-4	
REL	103	Introduction to Religion ²	3-0-3	
SET	101	Enrichment Workshop	1-0-0	1-0-0
ENG	101-102 or 114 or 198	College Composition I, II ²	3-0-3	3-0-3
MTH	207	Introduction to Statistics		3-0-3
SET	153L	Technical Computation		0-3-1
IET	230	Work Measurement		3-3-4
HST	101/102	History of Western Civilization ²		3-0-3
PHL	103	Introduction to Philosophy ²		3-0-3
			17	17
Sophomore Year				
MFG	206L	Dimensional Metrology	0-3-1	
IET	318	Statistical Process Control	3-0-3	
PHY	201	General Physics	3-2-4	
MFG	204	Industrial Materials and Processes	3-3-4	
MTH	137-8	Calculus I with Review	4-0-4	4-0-4
MCT	220	Statics and Dynamics		3-0-3
IET	420	Industrial & Environmental Safety	3-0-3	
CMM	—	Communication		3-0-3
IET	323	Project Management		3-0-3
			16	16
Junior Year				
IET	332	Facilities Layout	3-0-3	
IET	308	Production Management Methods	3-0-3	
IET	317	Industrial Economic Analysis	3-0-3	
MCT	313	Industrial Mechanisms	3-0-3	
—	—	General Education Requirement	3-0-3	3-0-3
—	—	Technical Electives		6-0-6
IET	418	Cost Estimating		3-0-3

ECT	361	Programming Structures		3-0-3
SET	499	Seminar		1-0-1
			15	16
Senior Year				
IET	316	Quantitative Methods	3-0-3	
IET	420	Industrial & Environmental Safety	3-0-3	
—	—	General Education Requirements	3-0-3	6-0-6
—	—	Technical Electives	6-0-6	3-0-3
IET	425	Elements of Cost Control		3-0-3
ECT	110	Electrical Circuits I		3-0-3
IET	490	Senior Project		1-3-2
			15	17

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

²See General Education requirements, Chapter V. Some General Education courses are specified in the program (e.g., PHY 201); others are to be chosen from the listing of approved courses.

FACULTY

Scott Segalewitz, *Chairperson of the Department of Engineering Technology*

Charlie P. Edmonson, *Program Coordinator*

Professors Emeriti: Courtright, McGraw

Professors: Summers, Untener

Associate Professor: Edmonson

Assistant Professors: Blust, Globig

COURSES OF INSTRUCTION

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. Prerequisite: MTH 106. Corequisites: IET 230L, SET 153L. *3 sem. hrs.*

IET 230L. WORK MEASUREMENT LABORATORY: The application of real-world time-and-motion-study techniques such as flow process, man-machine, and operation process charts. Calculations for time standards, production efficiency, line balance, cost reduction, manpower, and equipment. A written and oral report on a team project. Three hours of laboratory each week. Prerequisite: MTH 106. Corequisites: IET 230, SET 153L. *1 sem. hr.*

IET 308. PRODUCTION MANAGEMENT METHODS: Study of the principles and current practices of optimizing production using Lean Manufacturing concepts. Just-in-time, Kaizen, set-up reduction, small lot production, pull systems, focused factories, standard operations, total productive maintenance, and defect-free manufacturing. *3 sem. hrs.*

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 queuing theory. Prerequisites: MTH 207, SET 153L. 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, annual worth, and rate of return methods. Study of simple and compound interest. Prerequisites: MTH 106, SET 153L. 3 sem. hrs.

IET 318. STATISTICAL PROCESS CONTROL: Statistics and probability theory applied to produce control charts (\bar{x} , 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: MTH 207, SET 153L. 3 sem. hrs.

IET 319. QUALITY IMPROVEMENT METHODS: Study of problem-solving methodologies and techniques. Team development. Students will learn to use Pareto diagrams, force field analysis, cause and effect diagrams, process mapping, and other problem-solving tools. Quality costs, product liability, and ethics are also covered. Prerequisites: IET 318, SET 153L. 3 sem. hrs.

IET 320. QUALITY ASSURANCE TECHNIQUES: Students will be exposed to a variety of current quality assurance topics that companies use to improve quality, increase productivity, and reduce costs. Topics include: total preventive maintenance, quality function deployment, reliability engineering, design of experiments, and Taguchi methods. Prerequisites: IET 318, MTH 207, SET 153L. 3 sem. hrs.

IET 321. QUALITY MANAGEMENT: Provides students with an understanding of managing a total quality environment to improve quality, increase productivity and reduce costs. An introduction to Deming, Juran, and others. Total Quality Management implementation strategies, requirements of ISO 9000, QS 9000, and the Malcolm Baldrige award will be covered. Prerequisites: IET 318, MTH 207, SET 153L. 3 sem. hrs.

IET 322. 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, work stations, and other environmental features. Written and oral projects. Prerequisite: Junior or senior status. 3 sem. hrs.

IET 323. 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. Prerequisite: SET 153L. 3 sem. hrs.

IET 332. 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. 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 415. MANAGEMENT OF TECHNICAL ORGANIZATIONS: Study of the structure of industrial and service organizations; study of the duties and responsibilities of a manager or supervisor in a technical organization in developing an effective project or production team. Study of labor administration; labor legislation and current labor practices.

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 types of costs, ethics, budgets, and profit. Semester team and individual projects, written and oral. Prerequisites: MTH 106, 207; SET 153L.

3 sem. hrs.

IET 420. INDUSTRIAL AND ENVIRONMENTAL SAFETY: Application of safety techniques and principles to identify and correct unsafe situations and practices. Study of system safety, failure modes and effects analysis, fault tree analysis, fault tree analysis, preliminary hazard analysis, hazardous materials and practices, OSHA, health and personal protection.

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.

IET 420. INDUSTRIAL AND ENVIRONMENTAL SAFETY: Application of safety techniques and principles to identify and correct unsafe situations and practices. Study of system safety, failure modes and effects analysis, fault tree analysis, preliminary hazard analysis, hazardous materials and practices, OSHA, health and personal protection.

3 sem. hrs.

IET 425. 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 financial and cost accounting including balance sheets, income statements, change of financial condition, ratio analysis, and Activity-Based Costing. Prerequisites: SET 153L, MTH 106.

3 sem. hrs.

IET 490. SENIOR PROJECT: Application of IET principles to a real world project using student teams for analysis and productivity improvement. Students will manage a project, applying planning, scheduling, monitoring, and control techniques. Oral and written project proposals, status updates, and final reports presented by teams and students to the management of the sponsoring organizations. Prerequisite: senior status.

2 sem. hrs.

MANUFACTURING ENGINEERING TECHNOLOGY (MFG)

The Manufacturing Engineering Technology Program prepares graduates for professional careers in technical and management positions in a broad range of industries such as those producing automobiles or consumer goods; the metals, paper, or food process industries; the plastics, metal and wood parts fabricating industries; and those which produce manufacturing machinery. Career opportunities in manufacturing engineering include: facilities, manufacturing automation, and tooling design; plant, quality, and process capability engineering; manufacturing supervision, and technical sales.

The curriculum is highly interdisciplinary since the manufacturing professional must possess extensive technical skills and excellent humanistic skills in communications, computers, teamwork, information technology, globalism and multiculturalism. The technical courses emphasize engineering materials and manufacturing processes; mechanical and fluid power automation; electronic controls; computer integrated manufacturing; manufacturing planning and control; extensive laboratory experiences; the technical sciences and applied mathematics from college algebra, probability, statistics, calculus, and linear programming. The curriculum contains strong components from the humanities, social sciences, and communications. The technical electives allow the student versatility in developing technical breadth or depth. The program is designed to prepare the graduates for challenging careers in manufacturing and a base for a variety of continued study.

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

<i>Dept.</i>	<i>No.</i>	<i>Course</i>	<i>1st Term¹</i>	<i>2nd Term</i>
First-Year				
SET	100	Engineering Technology First Year Seminar	1-0-1	
CHM	123	General Chemistry	3-3-4	
MCT	110L	Technical Drawing and CAD	0-6-2	
MTH	106	Mathematics for Engineering Technology	3-0-3	
SET	153L	Technical Computation Laboratory	0-3-1	
REL	103	Introduction to Religion	3-0-3	
SET	101	Enrichment Workshop	1-0-0	1-0-0
ENG	101-102 or 114 or 198	College Composition I, II ²	3-0-3	3-0-3
MTH	207	Introduction to Statistics		3-0-3
MFG	108L	Manufacturing Processes Laboratory		0-3-1
MFG	204	Materials and Processes		3-3-4
ECT	110	Electrical Circuits I		3-0-3
HST	101/102	History of Western Civilization ²		3-0-3
			17	17
Sophomore Year				
PHY	201	General Physics	3-2-4	
CMM	—	Communication	3-0-3	

MFG	206L	Dimensional Metrology	0-3-1	
PHL	103	Introduction to Philosophy	3-0-3	
MTH	137-8	Calculus I with Review	4-0-4	4-0-4
MFG	240	Manufacturing Design		3-0-3
ECT	120	Electrical Circuits II		3-3-4
MCT	220	Statics and Dynamics		3-0-3
IET	318	Statistical Process Control		3-0-3
			15	17
Junior Year				
MFG	434	Computer Numerical Control	3-0-3	
MCT	221	Strength of Materials	3-0-3	
MCT	231	Fluid Mechanics	3-0-3	
MCT	313	Industrial Mechanisms	3-0-3	
IET	308	Production Management Methods	3-0-3	
MCT	336	Fluid Power		3-3-4
MFG	426	Automated Manufacturing Systems and CIM		3-0-3
MFG	431	Controls for Industrial Automation		3-0-3
IET	323	Project Management		3-0-3
—	—	General Education Requirement ²		3-0-3
SET	499	Seminar		1-0-1
			15	17
Senior Year				
MCT	333L	Mechanical Measurements	0-3-1	
IET	316	Quantitative Methods	3-0-3	
IET	317	Industrial Economic Analysis	3-0-3	
ECT	464	Programmable Logic Controllers	3-0-3	
—	—	General Education Requirements ²	3-0-3	9-0-9
—	—	Technical Electives	3-0-3	6-0-6
MFG	490	Senior Project		1-3-2
			16	17

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

²See General Education requirements, Chapter V. Some General Education courses are specified in the program (e.g., PHY 201); others are to be chosen from the listing of approved courses.

FACULTY

Scott Segalewitz, *Chairperson of the Department of Engineering Technology*

Robert L. Wolff, *Program Coordinator*

Professor Emeritus: Simon

Professors: Summers, Wolff, Untener

Assistant Professors: Blust, Dorner

Adjunct 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. MATERIALS AND PROCESSES: Chemical and physical properties of metals, ceramics, and polymers; casting processes; powdered metallurgy; metal forming; plastics processes. Oral and written presentation of a team case study. Prerequisite: SET 153L. Corequisite: MFG 204L. *3 sem. hrs.*

MFG 204L. MATERIALS AND PROCESSES LABORATORY: Tensile and compressive testing of metals and non-metals using modern universal testing instrument; impact testing-Charpy and Izod; hardness testing-Rockwell, Brinell, Shore durometer; heat-treating-annealing, hardening, tempering; hardenability curves determination; plastics materials processing; cold forming; visits to local industries. Three hours of laboratory a week. Prerequisite: SET 153L. Corequisite: MFG 204. *1 sem. hr.*

MFG 206L. DIMENSIONAL METROLOGY: Theory and practice of precision measurement including the surface plate, angle and sine plates; surface texture and roundness; optical microscope and profile projector; mechanical and electronic gages; co-ordinate measuring machine; length standards and height gages; fixed and functional gages; sources of measurement error; introduction to Geometric Dimensioning and Tolerancing. Three hours of laboratory a week. Prerequisites: MTH 106, MCT 110L. *1 sem. hr.*

MFG 240. MANUFACTURING DESIGN: Manufacturing planning; advanced Geometric Dimensioning and Tolerancing using ANSI 14.5m-1994; paper gaging; process planning; advanced cutting tools; workholders; power presses-blanking, forming, draw dies, fine blanking; group technology, gage, jig and fixture design. 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 coordinator. *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 153L; MCT 220, 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, and material handling. Team project to plan, design, and make an oral presentation of a proposal for a complete manufacturing cell. Prerequisites: ECT 110, SET 153L. *3 sem. hrs.*

MFG 431. CONTROLS FOR INDUSTRIAL AUTOMATION: Topics include: fundamentals of digital logic, pneumatic power, electromechanical sensors and actuators, pneumatic and electrical control circuit analysis and design, industry safety and design standards, concepts of mechatronics, programmable logic controllers, and networking communications. Includes lab experiences. Prerequisites: ECT 120, SET 153L. *3 sem. hrs.*

MFG 432. MATERIALS AND PROCESSES-PLASTICS AND COMPOSITES: Introduction to the more common plastics and composite engineering materials and their properties. Study of processes including extrusion, injection molding, blow molding, compression and transfer molding, and forming. Topics on part and tooling design. Prerequisites: MFG 204, CHM 123. *3 sem. hrs.*

MFG 434. COMPUTER NUMERICAL CONTROL: CNC programming of turning center and machining center; 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 products in extensive CNC lab facility. Prerequisites: MTH 137, SET 153L, MFG 108L, MCT 110L. *3 sem. hrs.*

MFG 435. ADVANCED NUMERICAL CONTROL: Instruction in the programming of complex, multi-axis CNC machines. Extended parametric programming. Programming language techniques. Prerequisite: MFG 434. *3 sem. hrs.*

MFG 490. SENIOR 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, technical reports, and presentations. Prerequisite: MFG senior status. *2 sem. hrs.*



MCT

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, thermodynamics, 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.

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

Dept.	No.	Course	1st Term ¹	2nd Term
First-Year				
SET	100	Engineering Technology First Year Seminar	1-0-1	
MTH	106	Mathematics for Engineering Technology	3-0-3	
MCT	110L	Technical Drawing and CAD	0-6-2	
SET	153L	Technical Computation Laboratory	0-3-1	
REL	103	Introduction to Religion ²	3-0-3	
ENG	101-102	College Composition I, II ²	3-0-3	3-0-3
PHY	201-202	General Physics	3-2-4	3-2-4
SET	101	Enrichment Workshop	1-0-0	1-0-0
MTH	137	Calculus I with Review		4-0-4
MCT	111L	Introduction to Design		0-6-2
MFG	108L	Manufacturing Processes Laboratory		0-3-1
HST	101/102	History of Western Civilization ²		3-0-3
			17	17
Sophomore Year				
MCT	220	Statics and Dynamics	3-0-3	
MCT	231	Fluid Mechanics	3-0-3	
MFG	204	Industrial Materials and Processes	3-3-4	
PHL	103	Introduction to Philosophy ²	3-0-3	
MTH	138	Calculus I with Review	4-0-4	
CMM	—	Communication ²		3-0-3
MTH	149	Calculus II		3-0-3
CHM	123	General Chemistry		3-3-4
ECT	110	Electrical Circuits I		3-0-3
MCT	221	Strength of Materials		3-0-3
MFG	206L	Dimensional Metrology		0-3-1
			17	17

Junior Year				
MTH	207	Introduction to Statistics	3-0-3	
ECT	120	Electrical Circuits II	3-3-4	
MCT	313	Industrial Mechanisms	3-0-3	
MCT	336	Fluid Power	3-3-4	
IET	323	Project Management	3-0-3	
SET	499	Seminar		1-0-1
MCT	317	Machine Dynamics		3-0-3
MCT	330	Design of Machine Elements		3-0-3
MFG	240	Manufacturing Design		3-0-3
—	—	Technical Elective		3-0-3
—	—	General Education Requirement ²		3-0-3
			17	16
Senior Year				
MCT	342	Thermodynamics	3-0-3	
MCT	333L	Mechanical Measurements	0-3-1	
—	—	Technical Electives	6-0-6	6-0-6
—	—	General Education requirements ²	6-0-6	6-0-6
MCT	490	Mechanical Engineering Technology Senior Project		1-3-2
			16	14

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

²See General Education Requirements, Chapter V. Some general education courses are specified in the program (e.g., PHY 201); others are to be chosen from the listing of approved courses.

FACULTY

Scott Segalewitz, *Chairperson of Department of Engineering Technology*

David H. Myszka, *Program Coordinator*

Professor Emeritus: Mott

Professors: Untener, Wolff

Associate Professors: Edmonson, Myszka

Assistant Professors: Blust, Globig

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 111L. INTRODUCTION TO DESIGN: Advanced topics of Computer Aided Design using three-dimensional, parametric, solid modeling software. Laboratory assignments involving the CAD software are completed through a series of individual and team design projects. Introduction to design requirements, conceptualization, and design decisions. Computer drafting topics such as ANSI Y 14.5M-1994 geometric dimensioning and tolerancing standards, weld symbols, machining and surface finish symbols. Blueprint reading. Prerequisite: MCT 110L. *2 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. Prerequisite: SET 153L. Corequisite: MTH 137. *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: MFG 204, 204L; MCT 220; SET 153L; MTH 137. *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: SET 153L, MTH 106. *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, 220, SET 153L. Corequisite: MTH 137. *3 sem. hrs.*

MCT 317. MACHINE DYNAMICS: Principles of applied engineering mechanics as they relate to machines; static force analysis in both 2 and 3 dimensional systems, kinetics of machine components by the methods of force-mass-acceleration, work-energy, and impulse-momentum; machine balancing; introduction to mechanical vibrations. Prerequisite: MCT 313. *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 110L, 221, SET 153L. *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: ENG 102, ECT 120L, MCT 221. *1 sem. hr.*

MCT 336. FLUID POWER: Study of hydraulic and pneumatic fluid power components and systems 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 compo-

nents and systems. Library research project. Prerequisites: MCT 221, 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 153L, MTH 138. *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. PRODUCT DEVELOPMENT: Synthesis of mechanical devices and systems. Emphasis on the integration of various machine elements into a single unit. Activities include design, scheduling, budgeting, purchasing, fabrication, assembly and performance testing of an original team project. 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 153L. *3 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 153L. *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 317, SET 153L. *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: ECT 120L, SET 153L. Corequisite: MCT 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.*

MCT 446. APPLIED FINITE ELEMENT MODELING: Introduction to the fundamentals of structural finite element modeling. Geometry creation, element types, material specification, problem solution and results postprocessing. A focus is placed on modeling techniques using commercially available software. Prerequisites: SET 153L, MCT 221. *3 sem. hrs.*

MCT 490. MECHANICAL ENGINEERING TECHNOLOGY SENIOR PROJECT: 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. Prerequisites: MCT 317, 330. *2 sem. hrs.*



ENGINEERING TECHNOLOGY SERVICE COURSES (SET)

FACULTY

Scott Segalewitz, *Chairperson of Department of Engineering Technology*

COURSES OF INSTRUCTION

SET 100. ENGINEERING TECHNOLOGY FIRST YEAR SEMINAR: A seminar for all engineering technology majors. Introduction to the University of Dayton, the School of Engineering, Engineering Technology, engineering technology programs and careers. Academic policies, academic planning, registration procedures, counseling and career placement services. *1 sem. hr.*

SET 101. ENRICHMENT WORKSHOP: A workshop structured to provide collaborative learning for first year Engineering Technology students. Work will focus on math, chemistry and other first year courses. Taken both semesters first year. *No credit*

SET 153L. TECHNICAL COMPUTATION LABORATORY: Introduction to technical computation. Use of personal computers, text processors, computer programming using QBASIC, and spreadsheets. Programming logic, file management, use of internet and engineering network. *1 sem. hr.*

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